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Investigating aviation safety factors and proposed conceptual model for safety behaviors among Thai flight crews: A qualitative approach

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Article Info

Abstract

This study aims to answer behavioral safety questions regarding influential factors and relationship among those factors relating to Thai flight crews' safety behaviors, and the objective of this study is to develop a proposed hypotheses relating to factors affecting Thai flight crews' safety behaviors for future research. Based on a sample of 21 flight crews and executives in Thailand, the result found that influential factors relating to Thai flight crew safety behaviors were organizational safety climate, fleet safety climate, aviation safety knowledge, aviation psychological safety and flight crews' safety attitudes and personalities. Flight time was considered as a typical job experience and did not directly reflect the safety behaviors among flight crews. What reflected safety behaviors among flight crews were their own safety attitudes and personalities. Therefore, it would be proposed that organizational safety climate, fleet safety climate and flight attitudes and personalities played antecedent roles and aviation safety knowledge and aviation psychological safety played mediating roles. Future studies can possibly use the result from this study to formulate further hypotheses and apply the proposed conceptual model for quantitative analysis.

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Introduction

Air transportation is regarded as a high reliability industry. Safety has always been considered as the top priority in this business. While many parties contribute to improve aviation safety such as cabin crewmen, mechanics, engineers, ground crews and air traffic controllers, flight crews are directly responsible for the flight operation safety (Bazargan & Guzhva, 2011; Burgess et al., 2018). However, past studies indeed indicate that air transport accidents are caused by human error and flight crews are the main cause of the accidents (DaRBy, 2006; Helmreich, 1997). Although air accidents are rare, when they occur, they result in significant loss of life and assets. It is thereby crucial to attain more understanding about factors affecting flight crew safety behaviors , which are defined as the patterns carried out by a person in order to reduce or avert a dreaded disaster (Fogarty & Shaw, 2010), and what could possibly help improve their operational safety.

The causes of human behaviors can be categorized into three levels; individual, group and organization levels (Robbins & Mukerji, 1994). In the same concept derived from safety literature (Gao et al., 2016; Hedlund et al., 2016), different levels of safety-related factors have been analyzed such as individuals' safety knowledge, safety courtesy, safety compliance, attitudes and personalities While past studies indicate that several factors are associated with an improvement in safety behaviors in various contexts (Curcuruto & Griffin, 2018; Makary et al., 2006), this study focuses on the role of safety climate in both organizational and fleet levels (Brondino et al., 2013; Hofmann & Morgeson, 1999). Safety climate was defined as the shared perception among individuals of the safety practices of the organization and of the employees' behaviors. There are several domains that relate to safety climate such as safety priorities, safety commitment, personal attitudes toward safety, environmental safety, and co-worker safety interactions (Quach et al., 2021). This present research draws attention to the role of organizational safety climate (OSC) and fleet safety climate (FSC) in influencing flight crews' safety behaviors. On the organizational level, management safety policies provide an essential company-wide work environment to all employees. On the group level, fleets provide an important proximal flight environment in which flight crews reside (Karagülle, 2012). By considering a fleet level, flight crews in the same fleet are trained to fly the same types of aircraft and rely on the same procedures. Therefore, they are likely to be influenced by the safety norms in their fleets. On a personal level, flight crews also interact and share work-related information with other crewmembers within the same fleets and their behaviors are also likely to be influenced by the interactions that they have with others.

By utilizing a qualitative approach in this study, it can be anticipated that this work can possibly contribute to behavioral safety literature in several aspects. Firstly, even though previous studies have revealed the role of organization or group safety climate in other context (Bamel et al., 2020; Brondino et al., 2012), the significance of aviation fleets has not been studied. This study includes the role of fleet-level factors affecting flight crews' safety behaviors as a contribution for behavioral safety field of study. Secondly, quite a few studies have investigated how and why safety climate can have influences on flight crews' safety behaviors in aviation context. Lastly, although several past studies have quantitatively investigated the causal relationship among some of these safety-related components (Griffin & Neal, 2002; Maneechaeye et al., 2021), few studies have utilized qualitative technique to delve deeper into a richer aspect that quantitative analysis cannot find. As a contribution, this study applies the qualitative technique to deeply investigate the relationship among safety-related factors affecting Thai flight crews' safety behaviors.

Literature Review

There are many elements to this study, theoretically and practically, as aviation safety covers a capacious space. Aviation is considered as one of the leading industries in risk management. Most aviation accidents are attributable to human factors such as faulty communication between crewmembers. Flight crews, like other high-reliability professionals, are carefully selected, highly trained professionals. They are educated for high level performance in high-risk work environments, are mandated to make proper decisions under pressure in limited time, and are constantly reminded that their mistakes may cost major loss of life and assets. However, air accidents and incidents still occur from time to time due to human factor limitation.

Organizational Safety Climate

Several past studies suggest that there is a positive relationship between the social environment and human behavior (Eagly & Wood, 1999; Vandsburger, 2004). This study proposes that safety climates present one such important environment that can determine flight crews' safety behaviors (Zohar, 2000; 2003). From social learning perspective (Bandura & Walters, 1977), it has been presented that human behaviors are a result of a three-way interaction among cognitive, behavioral, and environmental factors. For example, how people interpret the outcome of their own behavior informs and alters their environments and the personal factors they own which inform and change subsequent behavior. This is the concept of reciprocal determinism (Hong et al., 2016). More especially, individuals' behaviors are modified by the social environment that they reside in, and in turn are reinforced by the rewards or punishments. The influence of social environments is likely to be more powerful when those in it are perceived to be personally important to individuals such as role models or idols. For instance, if the social environment is characterized by people who place emphasis on maintaining safety in their organizations, it is likely that employees will also embrace such behaviors. Furthermore, from the motivation point

of view, the influence of the role models can help enhance one's self-efficacy in how to perform one's work as one learns from observing how others do things (Latham & Saari, 1979).

In this study, the primary focus is on safety behaviors, which can be divided into safety compliance and safety courtesy. Safety compliance refers to when individuals willingly comply with safety rules and regulations at work whereas safety courtesy refers to when individuals are willing to help each other to maintain a proper safety level at work (Dahl & Olsen, 2013). Safety courtesy also involves positive helping and participating in activities among employee about safety-related issues at work and the willingness to join a safety-related promotional program (Laurent et al., 2020). Therefore, compliance has also been viewed as a type of a task-related behavior, whereas safety courtesy has been viewed as a type of citizenship behavior that goes beyond the call of duty without any formal rewards (Daily et al., 2009).

As mentioned earlier, safety climate is an environment-level factor, which can be divided into the team and organizational levels (Morgeson & Hofmann, 1999). Safety climate could be conceptualized as an environmental factor involving perceptions of workplace safety-related attributes and the relative priority of safety at work. Fleet safety climate (FSC) is defined as the shared perceptions regarding the safety among members within the same fleets of aircraft whereas organizational safety climate (OSC) is defined as a shared perception of the organization-wide policies, procedures and practices relating to safety in the operation, which has been recognized as a reflection of the underlying safety culture (Cox & Flin, 1998). According to social learning theory, these are considered as the most essential factors in influencing safety-related behaviors (Neal & Griffin, 2006).

Fleet Safety Climate

At the fleet level, fleet safety climate can significantly shape flight crew commitment towards the safety goals of their department. Operationally, flight crews working in the same fleets of aircraft are trained to operate the mission according to the current type of aircrafts that they are assigned to fly. Within this context, they get trained to use the same standard operating procedures (SOPs) and rely on the same technical knowledge and regulations. Therefore, they are more likely influenced by the same fleets' norms and operations. Therefore, it is reasonable to assume that different fleets will have significantly different safety levels.

Organization Policies and Procedures

At the organizational level, organizational safety climate can also shape flight crew commitment towards the safety goals of their organizations as this construct is recognized as the organizations' overall emphasis on safety at work. These may include HR-related activities such as standard operating procedures, rewards, promotion, training and development, performance evaluation, communication or even punishment. For example, some airlines have a specific policy to save costs by cutting almost all contingency and extra fuel and, as a result, this will impose stringent punishments on any pilots who order such extra fuel for their flight. Extra fuel orderings are considered as the last resource for flight crew when uncertain situations arise such as midflight engine failures or any other technical malfunction that require extra sufficient fuel for returning to safe landing site (Youssef et al., 2020). Some airlines do not impose punishment on flight crew who order such fuel but also encourage them to fill up the tank when necessary to ensure a safer operation. Hence, it is reasonable to argue that there will be significant variance of safety perceptions that can be a result from the influence of organization safety policy (Sivanathan et al., 2005).

Safety Culture and Safety Promotion

Apart from those environmental factors, workplace safety culture also plays an important role in the transparency of reporting hazardous events occurring at work. Flight crews need to feel that they operate in a blame-free culture to report dangerous issues that might reduce margin of safety in flight, even minor issues. Minor issues that have not been reported have the great potential in the long run to become major issues (Peltomaa, 2012). Even though flight crews are highly trained and well educated, they are still humans, and humans are subjected to error. By promoting a blame-free culture, this could encourage them to report any possible dangerous issues at work even in their flight to promote safer operation and prevent any possible future accidents that may arise from these issues.

As a behavioral safety research, this study intends to investigate the possible causal relationship underlying those safety-related issues.

Research Questions

1. What are the influential factors and indicators relating to Thai flight crews' safety behaviors?

2. What are the relationships among those factors relating to Thai flight crews' safety behaviors?

3. What can possibly be a conceptual causal relationship model relating to Thai flight crews' safety behaviors?

Research Objectives

1. To find out the influential factors and indicators relating to Thai flight crews' safety behaviors

2. To analyze the relationships among those factors relating to Thai flight crews' safety behaviors.

3. To propose a conceptual causal relationship model relating to Thai flight crews' safety behaviors.

Methodology

After defining the research question and objective and the process of literature reviews, research process is designed. Firstly, the semi-structure interviewing form is created and backed by previous studies. The semi-structure interviewing form is separated into 2 different forms according to key informants' professional background, which are operational and managerial background. Then, target key informants will be selected and appointed. The amount of information from key informants will be collected until saturated and no further implications arise.

This study employed the qualitative research design. This approach adopted the concepts and ideas from previous qualitative methodology and was congruent with the research aim, that is, to unveil the research questions (Creswell et al., 2007; Creswell & Miller, 2000). Most of the perception and impact of aviation safety will be interpreted, and as such this is an interpretive study. This research utilized individual in-depth interview to attain clarity and significance. Interviews with flight crews were conducted in-person only to ensure every essential behavioral element of informants and the instrument was semi-structured in nature, opening the room for any questions which arose from key informants.

All 21 voluntary flight crews appointed for interview session were selected by purposive sampling method. This method is following the line of reason in the determination of research key informants to obtain valid research data from the key informants that are consistent with the primary objectives of the study (Etikan et al., 2016). Consent was secured from the key informants before the qualitative research interviews commenced. Before an interview, they also attend a short briefing about the importance of the study and data collection. Key informants were selected from major airlines from both full services and low-cost carriers and helicopter services companies. Each company comprised at least 3 types of flight crew key informants, namely, were First Officer (FO), Captain (CP) and Executive (EX). The majority of key informants were male according to the nature of the aviation-related profession, which is considered as male-dominated. The inclusion criteria are Thai flight crew that currently operate a flight mission. Data were collected until saturated and until research questions were answered.

Before an interviewing session, a short briefing was conducted to ensure mutual understanding of the objective of interviewing session. The data collecting instrument used in this research was a self-developed qualitative questionnaire consisting of two primary sections. The first part elicits the key informants' demographic data and the second part was the questionnaire intending to collect data with open-ended questions. There were two separate sets of questionnaires, which were a set of questions for executive and a set of questions for flight crew. Sample questions for executive were as follow: (1) "In summary, how was the level of safety climate within your airline, and what factors could possibly promote positive safety climate within the company?"; (2) "Presently, how do your employee participate in safety activities?"; and (3) "In your point of view, how do flight times affect or not affect Thai flight crew safety performance?". Sample questions for flight crew were as follow: (1) "In your opinion, what is the most influential factor relating to positive safety performance, and what is the obstacle that acts on the safety performance of flight crew?"; (2) "Presently, do you currently participate in safety promotional campaign in your airline?"; and (3) "In your point of view, how do flight times affect or not affect Thai flight crew safety performance?".

Results and Discussion

The results of this research were organized by research objectives. The following section will be presented by specific concepts in relation to the literature, and the data will be presented in relation to research concepts and related theories.

The first step was to collect descriptive details about the flight crew to answer research questions via major concepts. These processes were collected through interview with a short warm-up introduction and briefing. As shown in Table 1, most informants were airplane pilot (85%) and male (90%). Flight crew and executives were included due to the inclusion criteria and they all volunteered for the study. All key informants were highly experienced flight crews and flight operation executives who had logged over 2,000 flight hours over their career.

Table 1 Demographics

Aircraft Type	Frequency	Percentage
Airplane Pilot (Total)	18	85
- Low-cost carriers	10	
- Full services	6	
- Chartered flight and air taxis	1	
- General aviation companies	1	
Helicopter Pilot (Total)	3	15
- Offshore support operations	2	
- Onshore flight services	1	
Total	21	100
Gender		
Male	19	90
Female	2	10
Total	21	100
Position		
First Officer	7	33.3
Captain	7	33.3
Executive	7	33.3
Total	21	100

The following section presents the significant findings of the investigation in this study. From the qualitative data analysis, challenges emerged around the aspects of aviation safety, namely, (1) factors affecting aviation safety, (2) incident and accident action plan, (3) aviation safety knowledge, (4) factors affecting aviation safety behaviors, (5) aviation safety climate, (6) aviation safety participation, and (7) attitude towards flight time.

1. Factor Affecting Aviation Safety

According to the investigation, most of the respondents pinpointed 4 major aspects affecting aviation safety, which were (1) flight crew training, (2) aircraft maintenance service quality, (3) flight operation safety standard, and (4) organizational operation safety policies and procedures.

In order to build and maintain safety within an organization, these four major variables were included into a safety equation, namely, (1) flight crew training, (2) aircraft maintenance service, (3) aviation regulator body, and (4) organizational operation safety policies and procedures. Among those factors, flight crew training was considered as the most important factor affecting aviation safety as flight crew was the position that was directly responsible for a flight operation. Adequate flight training and recurrent training should be assured so as to maintain a level of flight safety among flight crew. For instance, a respondent narrated his thought toward flight crew training,

> *"The airline will schedule a flight crew training for every pilot within the company according to*

> *a standard that is set by CAAT, but my airline always goes beyond that standard to ensure safer operation. When they pass the training as per standard, they will be scheduled for the flight operation. Moreover, if emergency situations do occur, it can be ensured that our flight crew are able to deal with it safely."*

Aircraft maintenance service quality was also important as aircraft need to be well-maintained at all time to ensure operational serviceability. If maintenance crew were well-trained and worked as per safety standard, it could be expected that aircraft would be in good shape before dispatch and flight operation safety could be anticipated. Flight operation safety standard was also considered as a factor affecting aviation safety. One respondent specifically pointed out an aspect toward aircraft maintenance service quality,

> *"All aircraft maintenance engineers (AMEs) and mechanics in our company are fully-licensed. They (AMEs) work according to aircraft maintenance standard. Aircraft that are always in good shape have a minimal chance to malfunction during flight. Engineers and mechanics can surely help pilots to ensure safer flight operation."*

In Thailand, the aviation regulator body setting up flight operation safety standard, Civil Aviation Authority of Thailand or CAAT, plays an important role in regulating and monitoring air transportation. CAAT disseminates standardized flight operation safety policy that can be applied to any air operators. This standard policy from the regulator is regarded as another essential component for aviation safety. This was reported by some respondents. For instance, a respondent recalled,

> *"Certainly, we (flight crew) need to fly according to a standard set by CAAT. The standard is there for a reason. It can make sure that every company operates within the same limits and these limits are written by blood from previous air accident victims. Thus, we must learn from this standard to ensure safer flight operation."*

Lastly, Organizational operation safety policies and procedures was another factor affecting aviation safety. Mostly, organizational operation safety policies and procedures are company-specific Operation Manual (OM) regarding flight operation adapted from CAAT standard. One of our respondents further ensured an important role of OM that could possibly promote aviation safety within his airline as he recounted,

"A safety standard set by CAAT is like a 'one-size-fits-all' policy for generic air transportation. However, our operation is more complicated than that. Relying on CAAT standard alone might not be adequate for our complex operation. Therefore, our company makes our own OM to suit the operation, and some main parts of these OMs are adapted from CAAT standard, but we make it in more detail."

2. Incident and Accident Action Plan

In this aspect, most of the respondents pinpointed that incident or accident root cause investigation, 'no blame, no name' or 'blame-free' incident reporting are main keys to promote aviation safety. Oftentimes, respondents mentioned their experience toward incident and accident action plan as one respondent shared,

"One of the most important elements that could possibly promote aviation safety is blame-free reporting. It is inevitable that an unforeseen event or incident may arise during flight as such is considered as a normal aviation operation. Pilots facing emergencies during flight must report what they found and share such to everyone concerned. Specifying only the incident case, not the pilots' name, can ensure anonymity, and this will encourage them to report future incidents that may arise."

Varying reporting beliefs and 'no blame' reporting styles could result in a positive attitude toward incident reporting. For instance, a respondent recalled,

"No blame, no name reporting culture in our company is the key to promote aviation safety. Focusing on the incident case, not the flight crew, will encourage them to report what they had faced during flight, and such will let other flight crew know what was going on." In similar experience, another respondent said, "I once put an aircraft into an unusual attitude accidentally due to a conflict in air traffic and instant IMC (Instrumental Meteorological Condition). This action triggered a limit into aircraft banking turn and might have damaged the airframe. However, after that flight, my copilot and I confidently reported the situation as we know that our company will not directly punish us but will delve deep into the root cause. The report form did not require flight crew name. It required only flight number."

3. Aviation Safety Knowledge

While it is true that pilots consider their skillsets as significant source of professional assets in aviation, their aircraft technical knowledge, aviation-related knowledge and emergency procedure knowledge could also be a source of their skillsets to ensure safer operation. More often than not, a high level of aviation safety knowledge results in better and safer flight operation and perhaps could also promote better cockpit environment. One respondent voiced,

"As a pilot, a proper flying skill is mandatory, but aircraft technical knowledge along with emergency procedure knowledge will save you from any undesirable unforeseen event at work." Another respondent also recalled, "In an event of an emergency, your knowledge towards aircraft system and other things relating to the situation such as weather, traffic pattern, radio telephony and cockpit management will get you home and you are able to see your family once again."

4. Factors Affecting Aviation Safety Behaviors

Evidence from the data collected indicated two emerging factors on the opportunities that might affect aviation safety behaviors among flight crew. When asked about what might be the factors affecting aviation safety behaviors, they reported (1) flight crew knowledge, and (2) Standard Operating Procedures (SOPs).

In this regard, one respondent reported thus,

"The more knowledge pilots gain, the safer the operation they will provide. To know and to understand what you are currently doing are main factors that affect aviation safety behavior." This was further expounded by another respondent who voiced, "SOPs truly affect aviation safety behaviors. SOPs are like a map to guide a safer flight operation. Well-prepared SOPs will guide pilots into desirable flight behaviors."

One respondent broadly described that knowledge and SOPs were essential factors affecting aviation safety behaviors, *"Through pilots' individual knowledge and company flight procedures, I was given a lot of opportunities in improving myself to becoming a safer pilot. I learned new things every day and the company's SOPs helped guide me to what I should do during flight. By conforming to SOPs, it can be ascertained that this flight will go as planned safely."*

5. Aviation Safety Climate

In this matter, respondents acknowledged several factors affecting aviation safety climate in both fleet-wide and organization-wide aspects. In an organizational level, factors affecting aviation safety climate were Crew Resource Management (CRM) and safety regulation compliance. In a fleet level, the factor affecting aviation safety climate was teammate.

One of the respondents narrated factors affecting organization safety climate,

"In general, our company has a good safety climate. As far as I am concerned, safety regulation compliance among flight crew within the organization is the key promoting proper aviation safety climate. Another factor affecting positive organization safety climate is proper CRM among flight crew." A similar experience was also echoed by another respondent and summed up this way in factor affecting fleet safety climate, "Luckily, climate at my fleet is positive. In flight, I am comfortable to fly with an easy-going crew. I think that good teammate is the key to promote fleet safety climate."

6. Aviation Safety Participation

Aside from aviation safety climate, another way to promote aviation safety is safety participation. Most respondents did not directly deal with safety participation program as they are not the part of the flight safety department. However, they did indirectly participate in safety campaign via safety compliance, safety reporting and knowledge sharing.

One respondent specifically pointed out an aspect of safety participation experience that was considered challenging and hinted at what makes a good safety promotional participation. She stated,

"As a line pilot, I do not have a direct responsibility to promote safety promotional program. What I can do to promote better flight safety is to conform to rules and report what I have faced during flight. I consider these as my safety participation." In a similar fashion, a respondent said, "I am a line pilot, not a flight safety officer. I follow rules and regulation in flight mission and always refresh my knowledge to ensure safe operation. As far as I am concerned, this is the way I participate in aviation safety program. Even though it might be indirect, I could possibly help promote aviation safety within the company." Another respondent voiced,

"I am just a line pilot, I always report what I have seen in flight and share it with my teammate. I am not a safety officer. This is what I do to indirectly promote flight safety."

7. Attitude towards Flight Time

According to the interview, most of the respondents pinpointed 2 major aspects about flight time and flight safety behavior relationship: (1) flight time is considered as a typical professional experience; and (2) flight time does not directly relate to flight safety behaviors, but personalities and attitudes are factors relating to flight safety behaviors among seasoned and less experienced flight crews.

One respondent specifically pinpointed an aspect about flight time considered as a normal professional experience. He voiced,

"Regarding flight time, I divide it into three parts. A low-timer will follow the rules 100%. When time passes, this guy will become a hot pilot and skip some procedures. After that, when he has found that he was lucky to get through dangerous events during his career, he will follow the rules once again." Another respondent also stated. "Flight time is considered as a work experience in other professional contexts. Low-time pilot with rich experiences on emergency situations is better than hi-time pilot with only straight and level flight experience. Therefore, flight time is not 100% directly related to flight safety. It depends upon the context."

For some, flight time does not relate to safety behavior but personalities and attitudes do. Oftentimes, high-time flight crews have conflict with their low-time copilots as they feel over-confident and sometimes skip checklists. This was reported by one respondent.

"Flight time is just a job experience. It does not indicate the safety behaviors among those hi-timers. I think attitude toward safety is the key. Some senior pilots always skip checklists as they can do it by heart. It is acceptable, but we are human and humans are subjected to error. We never know when all these cheese holes will line up. Am I right?" From the same experience, one of our respondents said, "Flight time is just a bunch of numbers in your logbook. It does not indicate how safely you fly. I think safe attitudes and positive personalities are the real factors affecting flight safety behaviors."

To summarize, according to the analysis, there are several factors affecting aviation safety including flight crew training, aircraft maintenance service quality, flight operation safety standard, and organizational operation safety policies and procedures. The most important factor is flight crew training as this can directly affect flight crews' performance on duty. For an incident and accident action plan, the 'blame-free' reporting is essential to promote operational safety as this could result in a positive attitude toward reporting. Moreover, a high degree of safety knowledge and proper standard operating procedures can be a useful source to ensure safe operation, and this can promote a positive flight environment. For safety climate concepts, from both organization and fleet level, crew resource management and safety compliance are essential keys to promote positive safety climate at work. Finally, flight times of each flight crew are considered as a professional experience and do not directly relate to safety behaviors. Instead, personalities and attitudes are factors affecting flight safety behaviors. As per the analysis, it can be concluded that antecedents of safety behaviors are safety climate, safety knowledge and psychological safety. Moreover, safety behaviors can also be moderated by safety attitudes and personalities and safety culture.

Conclusion and Recommendation

While previous studies shed light on the importance of aviation safety climate (Evans, 1999), it is quite surprising that few studies, if not none, have investigated the role of safety climate at the fleet-level perspective in a qualitative method. The goals of this study were to answer three research questions and achieve three research objectives. All questions were answered and all objectives were achieved. Influential factors relating to Thai flight crew safety behaviors, which were aviation safety compliance and aviation safety courtesy, were organizational safety climate, fleet safety climate, aviation safety knowledge, aviation psychological safety and flight crews' safety attitudes and personalities. Flight time was considered as a typical job experience in this context and did not directly reflect the safety behaviors among flight crews. What reflected safety behaviors among flight crews were their own safety attitudes and personalities. In this causal relationship, organizational safety climate fleet safety climate and flight attitudes and personalities played antecedent roles, and aviation safety knowledge and aviation psychological safety played mediating roles. The finding from this study is congruent with the result made by previous researchers (Gore et al., 2010; Sexton et al., 2006) who indicated that

there might be variation of safety perceptions among flight crews at the fleet-level aspect. Importantly, this study also responds to calls for more research on safety behavior at different levels of safety climate (Alruqi et al., 2018).

Safety climate is the shared perception among flight crew within organization or fleet relating to safety practice and regulation conformation. At organizational level, CRM and safety regulation compliance are the determinants of organizational safety climate. At fleet level, team members are the key to promote positive fleet safety climate. While past study reveals that the lack of communication between flight crews and maintenance crews is considered as the main problem in general aviation flight safety (Armentrout-Brazee et al., 2000), it is possible that solid safety climate will promote effective communication among fellow flight crews, dispatch teams, ground crews and maintenance crews, which in turn influence their positive safety behavior.

Aviation safety knowledge is defined as flight crew degree of knowledge about existing safety system procedures, guidelines, and safety standards in the organization. Aircraft technical knowledge, aviation-related knowledge and emergency procedure knowledge are the keys to promote aviation safety knowledge.

Aviation psychological safety is regarded as a shared belief that the team is safe from interpersonal risk exposure. With this, team members are certain that the teams will not punish someone for speaking out. Blame-free reporting and no-blame-no-name culture are the keys to positive aviation psychological safety.

Aviation safety compliance is defined as adhering to safety procedures and carrying out mission in a safe manner. Factors relating to aviation safety compliance are flight crew knowledge, policies and standard operating procedures.

Aviation safety courtesy is regarded as voluntary behaviors such as warning each other, consulting with each other, communicating, and interaction among flight crew for safety matters. Regulation compliance, safety reporting and knowledge sharing are the keys to promote better aviation safety courtesy. Moreover, in behavioral theory, an attitude is defined as the evaluative dimension of the performance of a behavior, and personality is defined as the coherent pattern of behavior, cognition and desire over time characterizing unique individuals.

Flight time is considered as a typical job experience and does not directly affect flight crews' safety behaviors, but safety attitudes and personalities do. High-time captains conflict with their low-time copilots as they

always feel over-confident and sometimes skip checklists while low-time copilots will always follow the rules to ensure a safe operation. According to previous study, it has been investigated that senior captains tend to have less preferable viewpoints about their organizations' safety policies and procedures (Gao et al., 2013).Therefore, it is arguable that low-time copilots facing more adverse missions might be more skillful than high-time captains flying only straight and level flight.

Another contribution from this study is to provide a proposed hypothesis (PH) for possible future studies.

Proposed Hypothesis 1: Flight Attitude and Personalities and Aviation Safety Culture and Management Commitment have a positive direct effect on Aviation Safety Compliance.

Proposed Hypothesis 2: Flight Attitude and Personalities and Aviation Safety Culture and Management Commitment have a positive direct effect on Aviation Safety Courtesy.

Proposed Hypothesis 3: Aviation Safety Knowledge plays a mediating role between Safety Climate and Safety Behaviors

Proposed Hypothesis 4: Aviation Psychological Safety plays a mediating role between Safety Climate and Safety Behaviors

The results from the qualitative analysis can be described as Table 2 shown below. This table contains proposed constructs and indicators derived from qualitative analysis and can be further investigated by future studies.

According to the proposed hypotheses and proposed constructs and indicators derived from the data analysis process, proposed conceptual model for future research opportunities is portrayed in Figure 1 shown below. The concept of this causal relationship, ranging from safety climate to safety behavior, is derived from past aviation safety-related studies (Griffin & Neal, 2000; Maneechaeye & Potipiroon, 2022; Zohar, 2010). This figure contains the proposed causal relationship among those analyzed factors in this study, and this proposed model can also be further studied by future research.
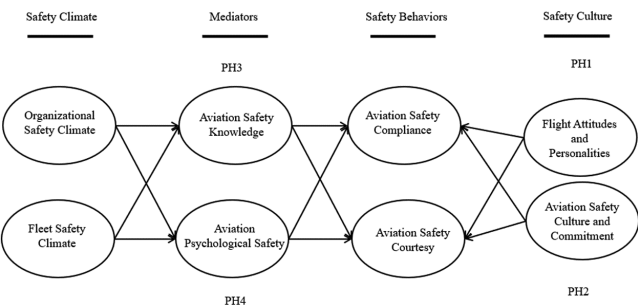

Figure 1 Proposed conceptual model

Table 2 Proposed constructs & indicators from qualitative analyses

Constructs	Indicators	Sample Questions
Organizational Safety Climate	- Safety Priority - Safety Policies and Procedures - Safety Management System	1. The organization regards safety as high priority. 2. The organization has very clear safety policies and procedures. 3. The organization has a well-established safety management system.
Fleet Safety Climate	- Attitudes toward Flight Crew - Attitudes toward Maintenance Crew - Attitudes toward Ground Crew - Crew Resource Management	1. Flight crews within my fleet help me fly safely in my mission. 2. Maintenance crews within my fleet safely prepare good aircraft for my mission. 3. Ground crews within my fleet support me well in my mission. 4. All members in my fleet work well together as per Crew Resource Management (CRM) Concept.
Aviation Safety Knowledge	- Aircraft Technical Knowledge - Aviation-Related Knowledge - Emergency Procedure Knowledge	1. I have adequate knowledge regarding aircraft technical issues. 2. I have adequate knowledge regarding flight regulations and aviation-related issues. 3. I have adequate knowledge regarding in-flight emergencies.
Aviation Psychological Safety	- Flight Crew Safety Trust – Interpersonal - Fleet-wide Safety Trust – Group - Management Safety Report Encouragement – Management - No-blame-no-name Culture – Organization	1. I always listen to and trust my crewmates when they speak out regarding safety in flight. 2. Flight crews within fleet and other fleets will not blame me when I do wrong unintentionally. 3. My chief pilot encourages their flight crews to report any safety issues at work. 4. My organization encourages no-blame-no-name safety reporting culture.
Aviation Safety Compliance	- The Use of Checklist - Regulation Compliance - Conforming to Correct Flight Procedure - Ensuring the Level of Safety at Work	1. I always use the checklist during flight mission. 2. I always follow operating manuals (OMs) in my flight mission. 3. I always use the correct safety procedures for carrying out my mission. 4. I always ensure the highest levels of safety when I carry out my mission.

Table 2 Continued

Constructs	Indicators	Sample Questions
Aviation Safety Courtesy	- Safety Encouragement - Safety Reporting - Knowledge and Experience Sharing - Stop-work Authority	1. I always encourage my crews to follow safety procedure at work. 2. I always report irregularities in my flight mission. 3. I always share knowledge and experience to other crews from my flight mission. 4. I always take action to stop safety violation to protect my crew.
Flight Attitudes and Personalities	- Situational Awareness - Aviation Safety Cautions - Regulation and Authority Acceptance - Risk Avoidance - Complacency Avoidance - Dare Admonition	1. I maintain a high level of situational awareness all times during flight. 2. I take the highest cautions during critical phrases of flight. 3. I always trust and listen to my flight crews, ATC and ground crews during my mission 4. I rarely take a risk during my flight mission. 5. I am not complacent during my flight mission. 6. When my crews do something wrong, I dare to speak out and admonish.
Aviation Safety Culture and Management Commitment	- Leadership of Top and Middle Management - Safety Commitment of Top and Middle Management - Two-way Communication between Management and Employees - Employee Participation in Safety-Related Decision Making - Safety Learning Desire - Attitude towards Blame	1. My management teams exercise proper leadership towards safety 2. My management teams have high commitment in operational safety. 3. My organization allows positive two-way communication among management and employees. 4. My organization allows employees to participate in safety-related decision making. 5. I desire to learn more about safety-related topics in operation. 6. I believe that if I do something wrong unintentionally, I will not be blamed.

Conflict of Interest

The author declares that there is no conflict of interest.

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