The Research of Chinese Pilots Operating Safety

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Abstract. In order to understand the factors that affect the operating safety of Chinese pilots more deeply, we designed the "Chinese pilots' operating safety questionnaire". In this study, a total of 2130 questionnaires were received, of which 2094 copies are valid. We conducted a statistical analysis of the closed questions, collected the various open answers, and compared the different insights of the pilots in the same question. Finally, we summarized the discoveries and potential problems in operation risk, fatigue risk, safety awareness, the pilot's health care and the application of new technology. Through this survey and research, we are more systematic and comprehensive understanding of the major factors affecting the pilots' operations safety, and get some management problems existing in civil aviation and airlines of China, such as the flight time limit prescribed to be fine enough, non-precision approach of training is not enough. The conclusion of the investigation is very important for improving the safety management of airlines and revising China civil aviation related safety policies and regulations.

Keywords: Pilots' operating safety · Non-precision approach · Fatigue risk · Safety awareness

1 Introduction

According to Reason's Swiss cheese model, the behavior of people is the last line of defense to prevent accident. However, human behavior is influenced by the environment, organization, management and other deeper factors. And solving these deeper problems is the fundamental of the accident prevention. In order to understand the feeling and the problems of the pilots about operating safety, improve the airlines' safety management and provide some suggestions for China civil aviation's regulations revised, we designed the "Chinese pilots' operating safety questionnaire" based on interviewing experts and reviewing extensive literature.

The questionnaire is divided into six parts, a total of 50 questions. The first part is the background information of pilots, mainly to understand the basic situation of persons participating in the survey, such as age, education, aircraft type, total flight hours and other information. The second part is the operation risk, mainly about the operation of non-precision approach and plateau, complex airport when an engine is

failure based on the statistical analysis of the China civil aviation incidents in the past five years. The third part is the flight time and fatigue risk, mainly about the pilot's flight time, workload, rest and subjective fatigue. The fourth part is the safety awareness, primarily to understand the safety situation awareness during flight operations and information reporting. The fifth part is mainly about the pilot's health care situation and suggestion. The sixth part is the application the new flight technology, mainly to understand the negative and positive impacts on flight operating safety by new equipment or systems.

We distribute the questionnaires to airlines' relevant responsible person in print and electronic version, and then the responsible persons randomly distribute the questionnaires to the pilots. After completion of the questionnaire, the pilots submit it to the responsible person of the airline, finally feedback to us. Airlines participating in the survey not only cover large and small airlines, but also include general aviation. Finally, we received a total of 2130 questionnaires were received, of which 2094 copies are valid, the effective rate is 98 %.

2   Statistical Analysis of the Questionnaires

We received 2094 valid questionnaires, conducted a statistical analysis of the closed questions, collect the various open answers, and compare the different insights of the pilots in the same question. Finally, we summarize the discoveries and potential problems in operation risk, time of flight and fatigue risk, safety awareness, the pilot's health care and the application of new technology. Statistical results of the main issues are as follows:

1. The characteristics of the pilot team. The pilots' age is concentrated in 25–34 years, accounting for 70.7 % of those surveyed; The pilots entering the domestic aviation school after graduated from the high school are the most, accounting for 39.0 percent of those surveyed; The vast majority of pilots' educational back ground surveyed is Bachelor degree accounted for 91.2 %.
2. Non-precision approach. As the Fig. 1 shows, most of the pilots' non-precision approach experience is less than 10 % of all the flight experience, accounting for 76 percent of the surveyed pilots totally.
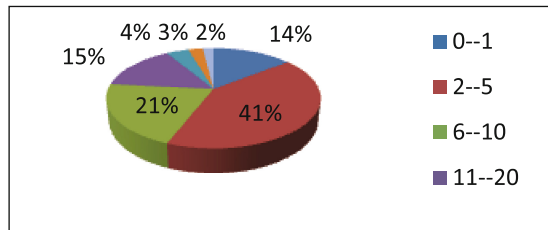

Fig. 1. The distribution of the proportion of non-precision approach in flight experience

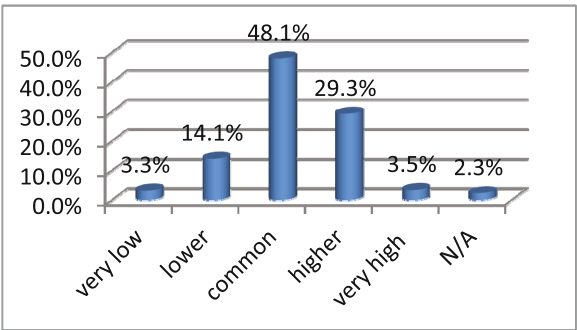As the Fig. 2 shows, 48.1 % of the pilots think the frequency of non-precision approach training is common。

Fig. 2. The distribution of the frequency of non-precision approach training. N/A represents the number of pilots with no experience of the survey item

As the Fig. 3 shows, 36.6 % of the pilots think the effect of non-precision approach training is common.
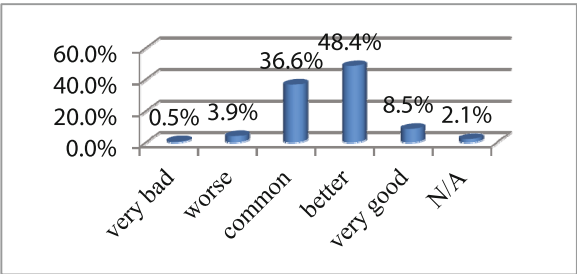

Fig. 3. The distribution of the effect of non-precision approach training

As the Table 1 shows, during non-precision approach, 6 % of the pilots admit they sometimes would violate the regulations or the operating manuals under the premise of ensuring safety.

Table 1. Possibility of violation

Whether violatethe regulations or the operating manuals	Number	Proportion(n = 2091)
Yes	130	6.2 %
No	1871	89.5 %
N/A	90	2.3 %

(1) Fatigue risk

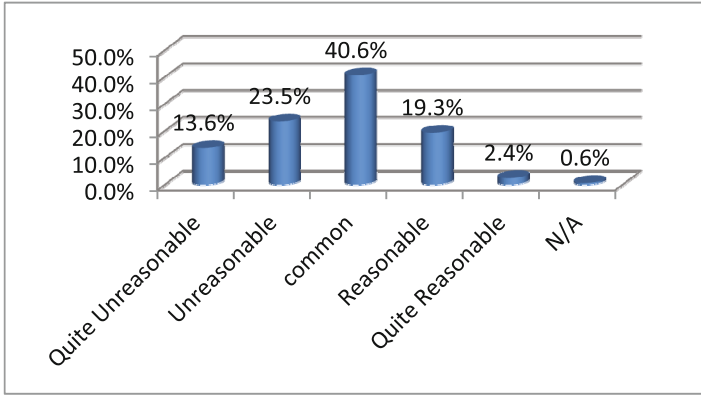As the Fig. 4 shows, 77.7 % of pilots think the scheduling system exists the irrationality on different degree.

Fig. 4. The distribution of scheduling reasonability

As the Fig. 5shows, 78.6 % of the pilots' average actual sleep time per day is about 5 h < T < 8 h in the past month.
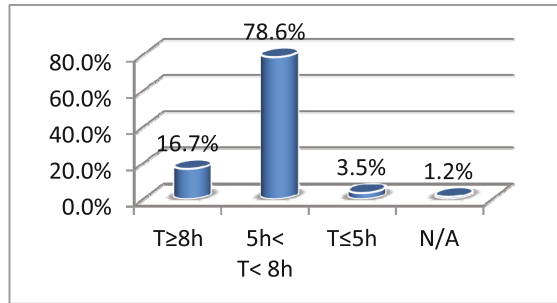

Fig. 5. The distribution of daily actual sleep time

The Fig. 6 shows that 51.1 % of pilots think their total sleep quality is just so so in the last month.

As Fig. 7 shows, 44.8 % of pilots think the complexity of mental activity of the airplane control is common. But 40.9 %of pilots think it needs more mental attention.

As the Fig. 8 shows, 64 % of the pilots have the feeling of laziness and distraction on different degree; 57.8 % of the pilots have the feeling of depression and anxiety on different degree; 53.6 % of the pilots are easy to loss temper to their colleagues, family or friends on different degree; 74.6 % of the pilots think themselves' fatigue level is above the average level.
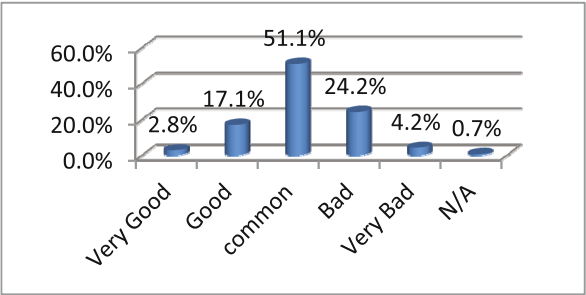
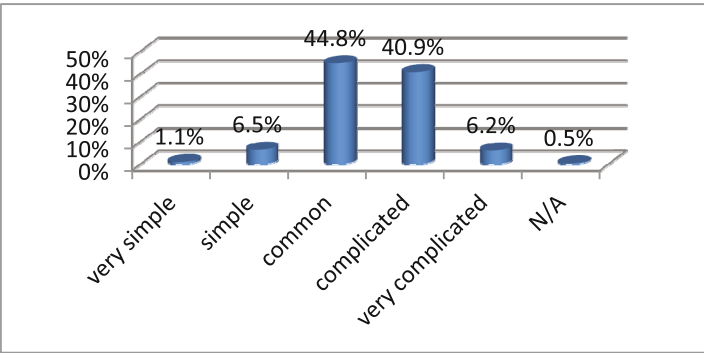**Fig. 6.** The distribution of sleep quality self-evaluated

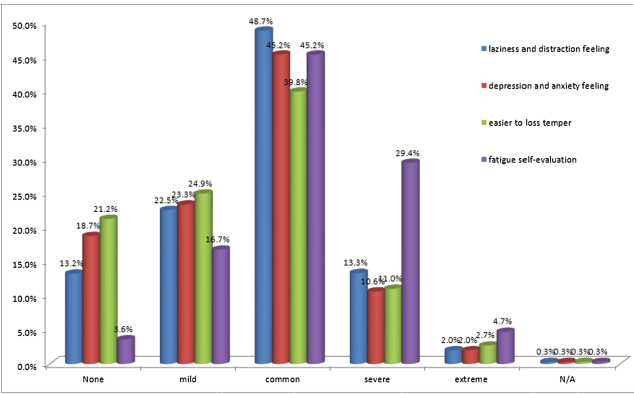**Fig. 7.** The distribution of complexity of mental activity

Fig. 8. The distribution of fatigue Self-evaluation

(2) Regulations Rationality and Safety Awareness

As the Table 2 shows, although 54.4 % of pilots think the regulations or operating manuals are suitable for operating, 35.1 % of pilots think there are some items notapplicable.

Table 2. Regulationsirrationality

Regulations Irrationality	Number	Proportion (n = 2073)
YES	727	35.1 %
NO	1127	54.4 %
N/A	219	10.5 %

As the Table 3 shows, if the pilot cannot get the ATC order for a long time, 36.2 % of pilots admit that he would change the aircraft flight status, and then seek the communication with ATC.

Table 3. The practices

Change status firstly and then Communicate with ATC	Number	Proportion (n = 2070)
YES	749	36.2 %
NO	1093	52.8 %
N/A	228	11.0 %

As the Table 4 shows, 11.7 % of pilots admit that he may violate the regulations or operation manuals under the premise of ensuring safety.

Table 4. Possibility of violation

Possibility of Violation	Number	Proportion (n = 2085)
YES	243	11.7 %
NO	1700	81.5 %
N/A	142	6.8 %

The most important factor that impacts the information reporting is "worry about being punished", accounted for 37.3 % as the Fig. 9 shows.
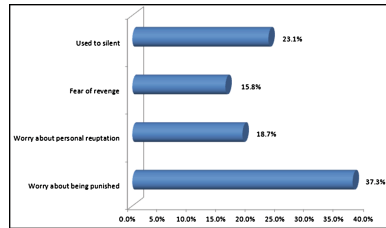
Fig. 9. The factors affect the information reporting

3   Conclusion and Recommendations

We can get the following conclusions from the questionnaire survey and give corresponding suggestion as below:

1. The pilot group of China is young, and most of them received a good education.
2. The survey results indicate that the non-precision approach happened rarely, and the rationality of the training frequency was common, and the training effect was not significant. We think it is necessary for airlines to consider in-depth study on the rationality of the non-precision approach training frequency and the training effect, and to discuss how to design or develop then on-precision approach training program, improve the rationality of the training frequency and enhance the training effect.
3. The survey results indicate that the pilot group showed a significant fatigue level. We suggest airlines and regulatory authority need to consider more about the fatigue risk on operation. It's important to develop the protection measures for individual, and methods of the fatigue risk monitoring, analysis and management for airlines.
4. The survey results indicate that the current regulations and operating manuals still have some unsuitable items, and the pilots' safety awareness needs to be improved. It's necessary to need further investigation of the applicability of regulations and operating manuals, identify the major hazards and revised timely. Also, we advised the airlines to establish reasonable rewards and punishment project, and carry out the safety culture construction to strengthen the pilots' safety awareness on obeying the rule and reporting the information.

As a first step to understand the pilots operating safety, the results obtained from the questionnaire survey are preliminary and limited. In order to gain more detailed results, we are doing more detailed investigation according to the significant problem, and combine effective interview with senior pilots in the future.

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