



OneSky Crew Fatigue Call Analysis Through Feature Extraction

Authors: Jessica Christa Wira, Krutika Shitole, Noa Teed
Mentor: Dr. Mihhail Berezovski, ERAU
Industrial Partner: Michael Campobasso, OneSky LLC.



ABSTRACT

OneSky is a private aviation enterprise that encompasses a network of smaller aviation entities with a specific emphasis on enhancing private aviation through the development of advanced IT solutions. One of the challenges that they face is when the crews make fatigue calls. Crew fatigue calls result in disruption of scheduled flights which in turn costs money and results in damage to the company. Fatigue can also be seen as a major safety factor. To ensure flight safety and efficient flight and crew scheduling, this research will analyze the features that caused crew calling fatigue on a particular day.

INTRODUCTION

The analysis will be done based on the historical data of 1512 different crews with over 800 thousand crew trips and 258 fatigue calls from October 2018 to February 2023. Feature extraction will be used to determine the features that are most likely to cause fatigue calls in the past.

DATA DESCRIPTION

1. Crew Trip History

- Sample size: 891580 trips
- No of Crew: 1512
- Variables:
 - CrewId
 - CrewRole (P or S)
 - DepartureDateUTC
 - ArrivalDateUTC
 - DepartureTimeZone
 - ArrivalTimeZone
- Date range: 2018-10-26 to 2023-02-11
- Percentage of P role = 50.4%; S role = 49.6%
- No of Trip Time Zones: 30 zones
- Most Frequent Time Zone: -5

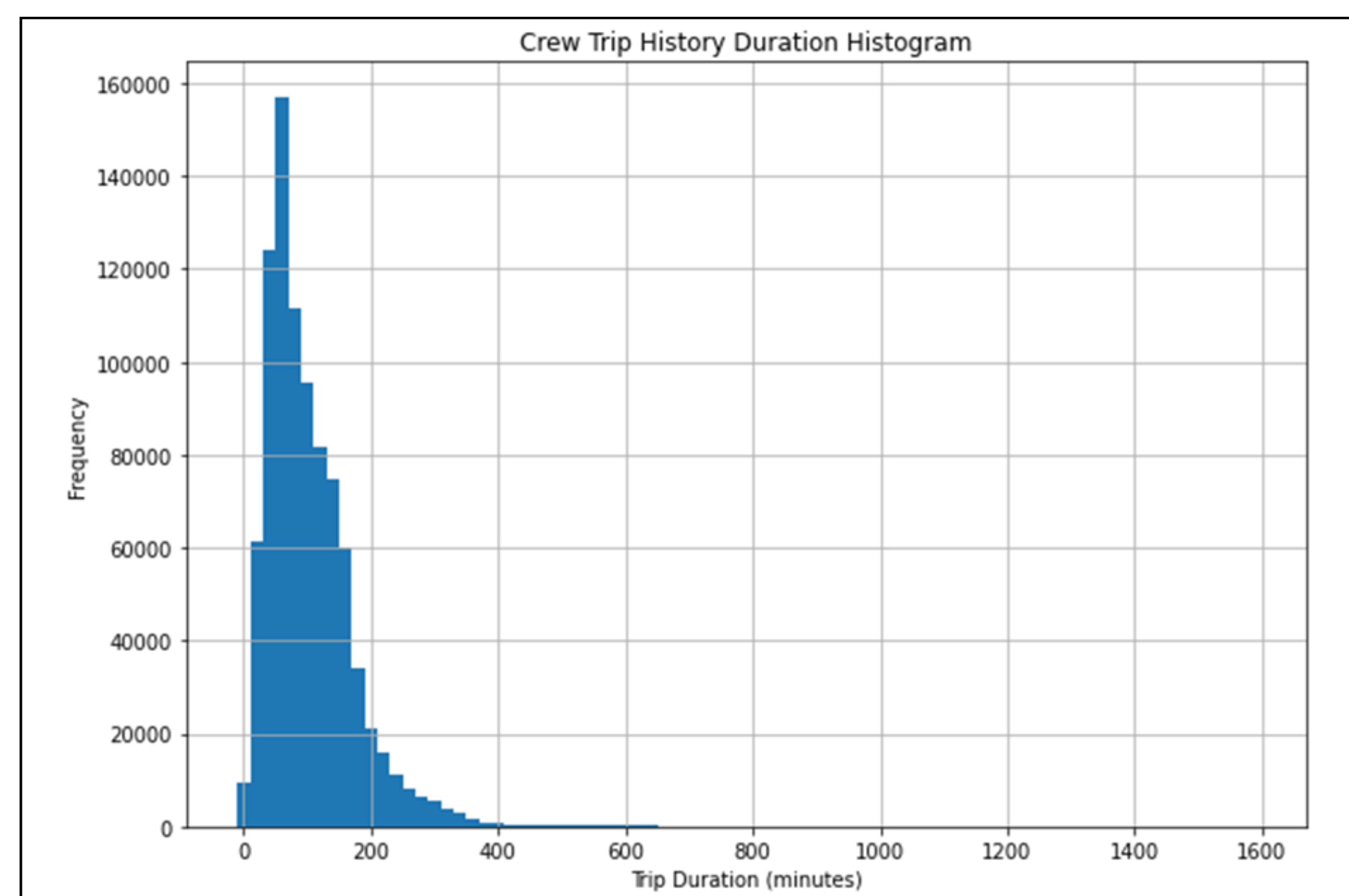


Figure 1. Data Distribution of the Crew Trip History by Duration

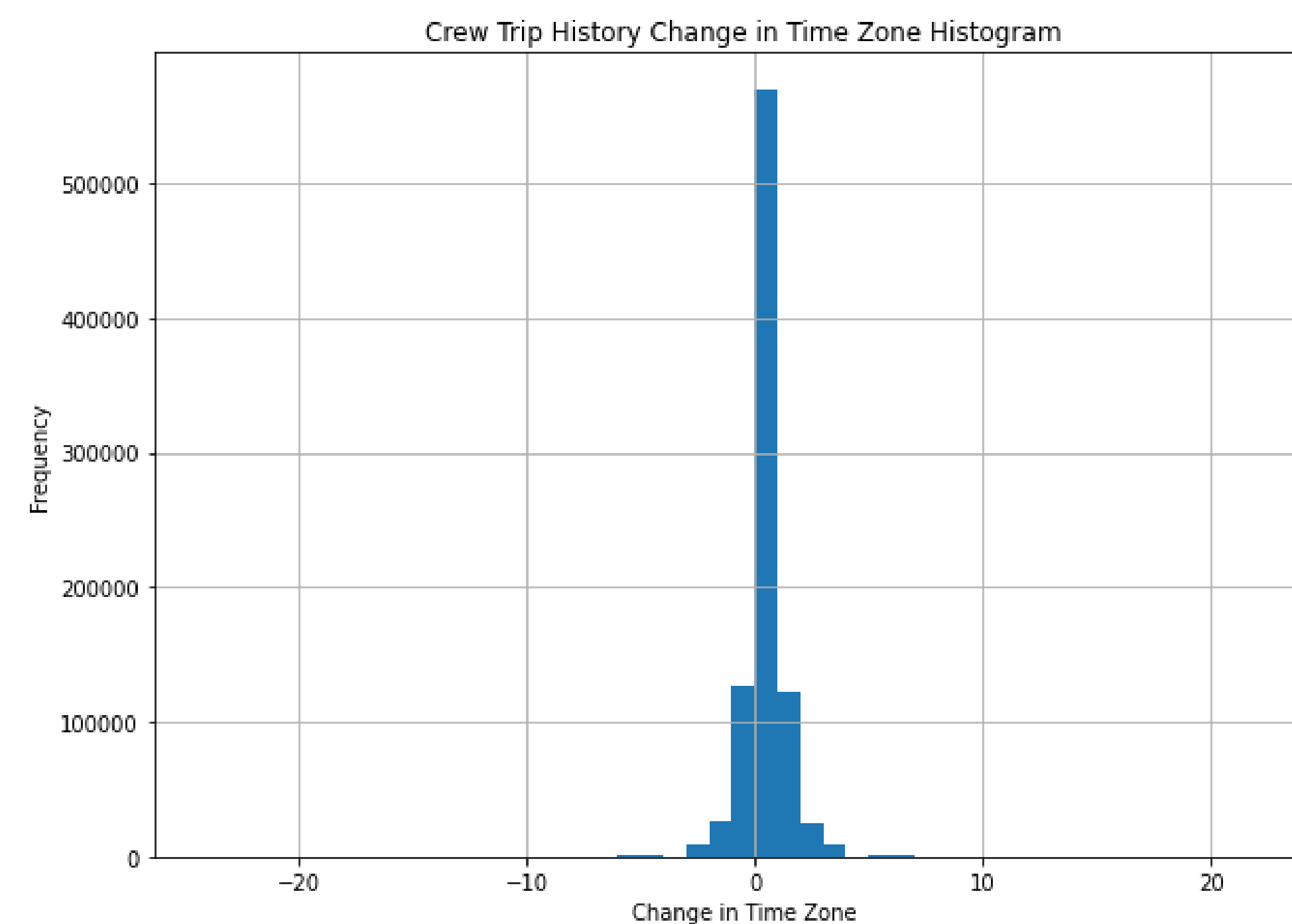


Figure 2. Data Distribution of the Crew Trip History by Change in Time Zone

2. Fatigue Call History

- Sample size: 251 calls
- No of Crew: 182
- Variables:
 - CrewId
 - FatigueCallDate
- Date range: 2018-10-14 to 2023-01-30
- Max no of fatigue calls per crew per year = 4 calls
- Max no of fatigue calls per crew = 5 calls

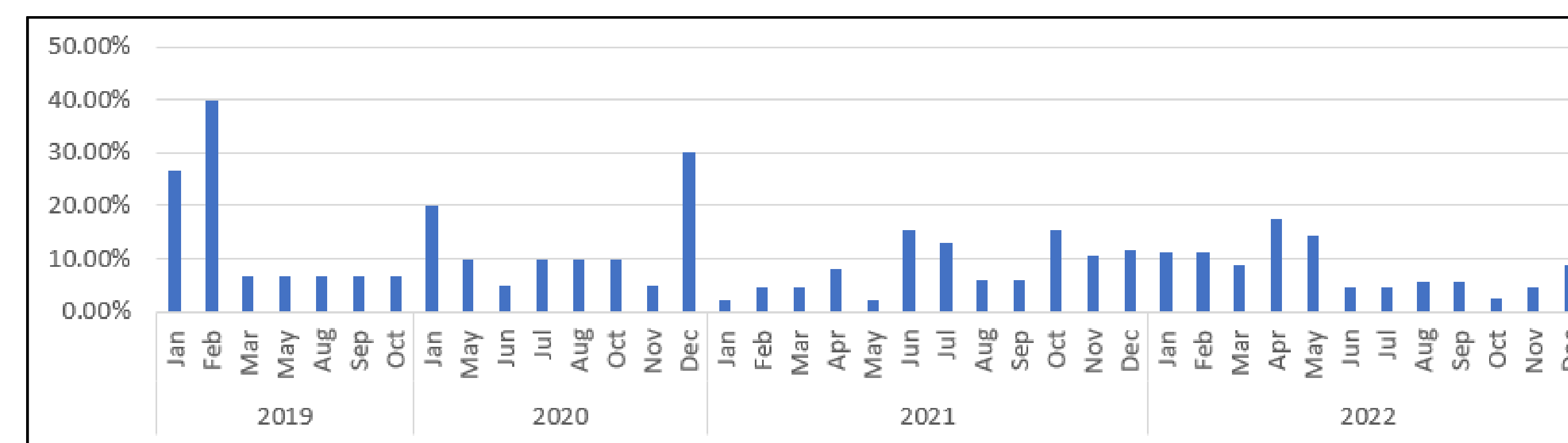


Figure 3. Distribution of Fatigue Calls Percentage by Months of Each Year.
(Absence of a month indicates no fatigue calls for that time)

METHODOLOGY

Using the patterns identified from the time series graph shown in Figure 3, some of the features that we analyzed includes:

- Increase in total trip duration
- Switch of crew roles (Primary or Secondary)
- Fatigue calls attributed to flying for the first time
- Combination of switch in role with total trip duration

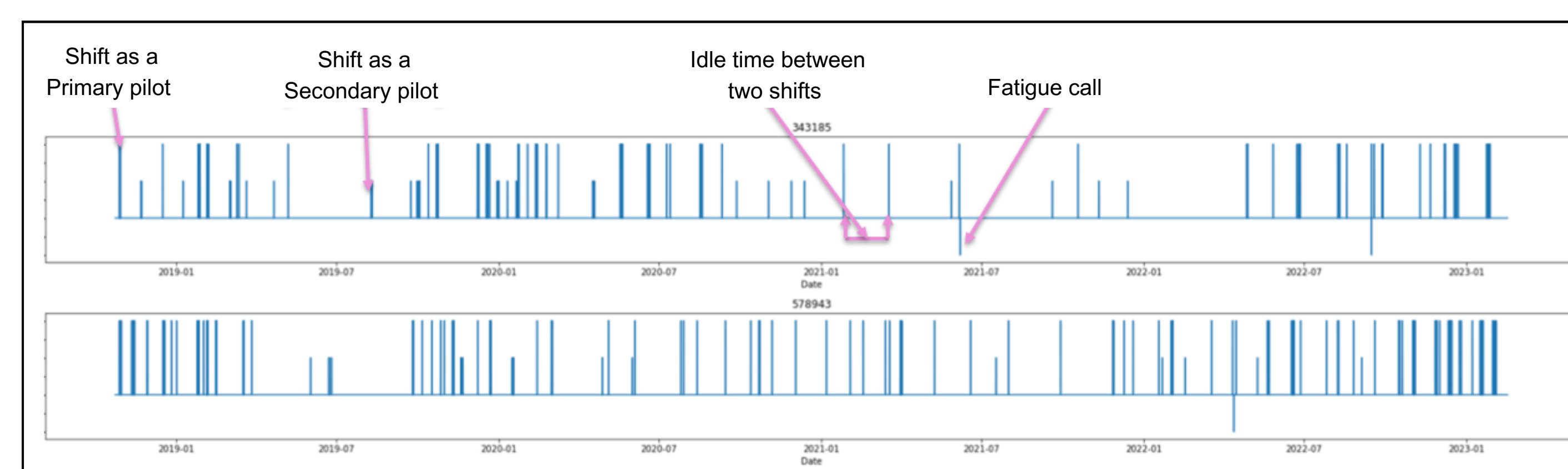


Figure 4. Time Series Graph for Pattern Visualization of Each Crew's Trip History

RESULTS

As shown in Figure 4, the increase in trip duration is found to be the most frequent pattern to calls. Therefore, we analyzed the intensity of the increase and found that the average of the increase in the duration from the previous year to the year they call fatigue, which is about 214.4% while the highest increase is 1400% and the lowest increase is about 5.2%.

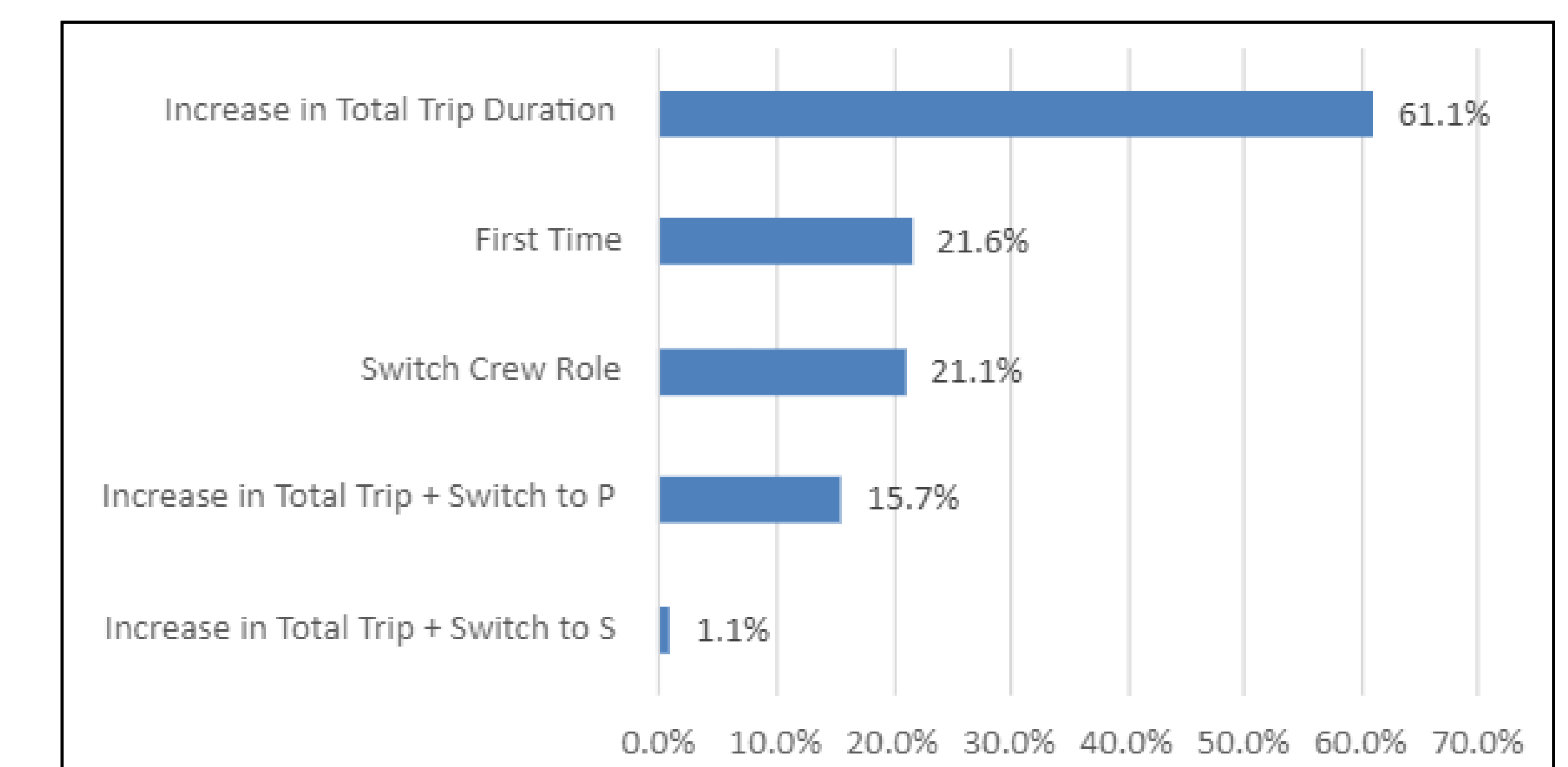


Figure 5. Feature Analysis of the Yearly Fatigue Crew Trip Frequency Table

We then analyze the data per year to obtain more accuracy. Figure 5 shows the percentage of fatigue call occurrences after the crew works for a set amount of days of shift as a primary crew (left) and secondary crew (right) in 2019. We found that the most frequent pattern of calls arise after 2 days of shift as either primary or secondary role.

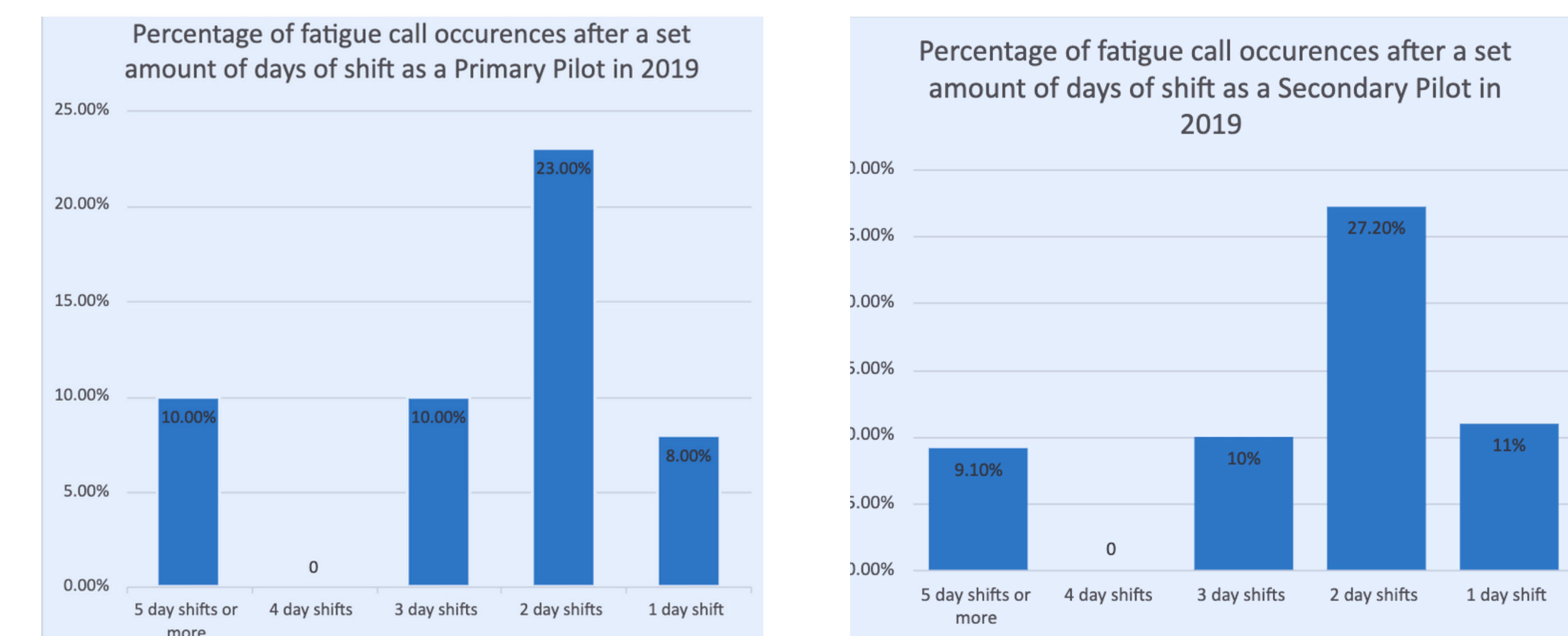


Figure 6. Occurrences of fatigue call depending on the set amount of days of shifts in 2019

FUTURE WORK

Using the data we found in this research, future work can be done to analyze the data in a smaller range of time to obtain a higher accuracy of fatigue call analysis. Furthermore, analyzing the change in time zones of the departure and arrival zone, the time of the day (day or night flight), the imte of the year (such as holiday season) can also be considered as an additional feature to be analyzed.