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General Aviation Fatal and Non-fatal Accidents by Season

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ABSTRACT

This study examined the difference in fatal and non-fatal GA accident rates in the United States among the seasons. Accident data was from the National Transportation Safety Board (NTSB, 2022) database from 2010 to 2019. Seasonality and fatality have a significant effect on the number of GA accidents.

BACKGROUND

The general aviation (GA) industry has been impacted by the severity of harsh weather conditions experienced during the four seasons. GA accidents have a shocking safety record; approximately 94% of civil aviation fatalities arise from GA. In 2014, for instance, 1,143 GA accidents were recorded, 20% of which were very severe (Boyd, 2017).

Spring and fall do not have harsh weather conditions in most cases (Sneider et al., 2011). However, in summer, the precipitation is high in the northern parts of the U.S, and it comes with thunderstorms.

PURPOSE & RESEARCH QUESTION

The purpose of this study was to determine if there is a difference in the number of fatal and non-fatal GA accidents by season.

Is there a difference in fatal and non-fatal GA accident rates in the U.S among the seasons?

METHODS

This study used an ex post facto design. We downloaded data from the NTSB (2022) database of all GA accidents between 01-01-2010 and 12-31-2019 in the U.S. We used the calendar date to classify reports into season: Winter (NOV- JAN), Spring (FEB- APR), Summer (MAY-JUL), and Fall (AUG-OCT). We used Excel for descriptive statistics and R studio for the two-way ANOVA, Tukey's pairwise comparison, and eta squared.

RESULTS

There were 10,602 U.S. GA accidents from 2010 to 2019 from the NTSB (2022) database. We excluded three accidents because their fatalities were unknown, so we analyzed 10,599.

The Summer recorded the highest number of accidents with a total of 2965 None and 574 Fatal. The mean annual accidents by season was the lowest in the winter with 38.50 ($SD=7.85$) Fatal, and 132.4 ($SD=18.80$) None.

Figure 1: GA Accidents in The U.S. by Season : 2010- 2019.

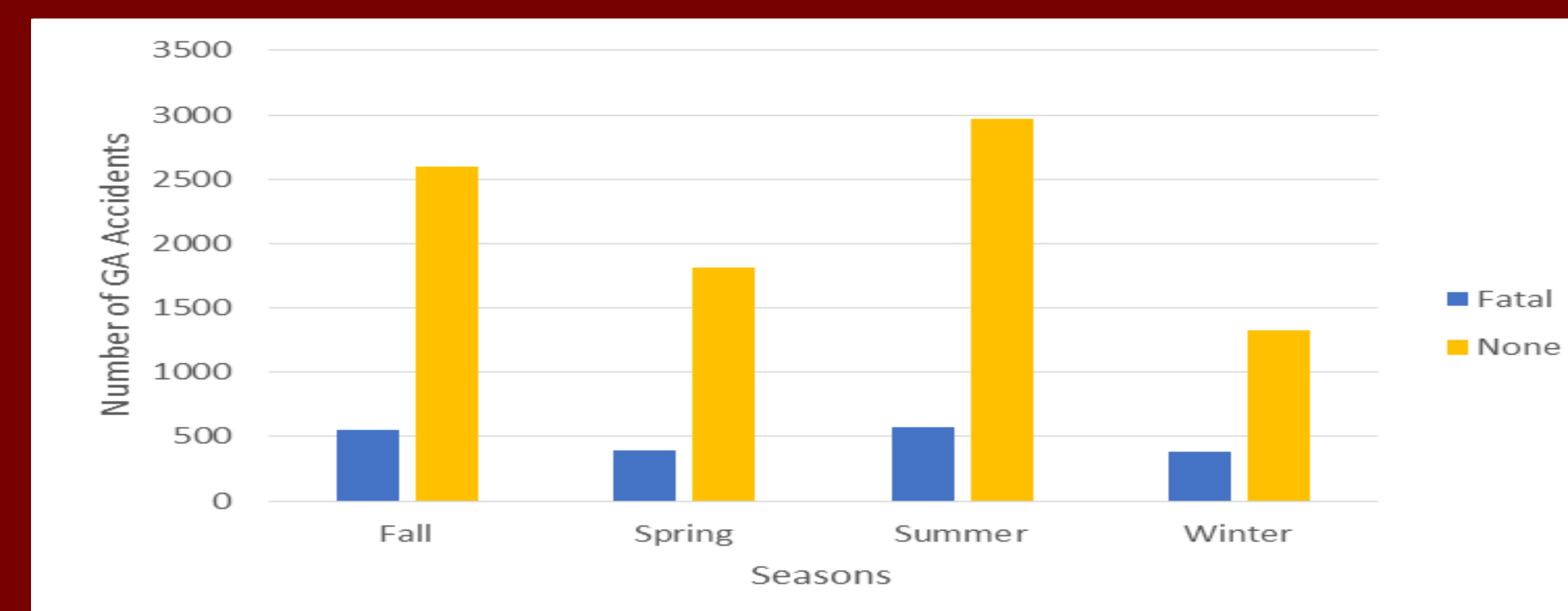
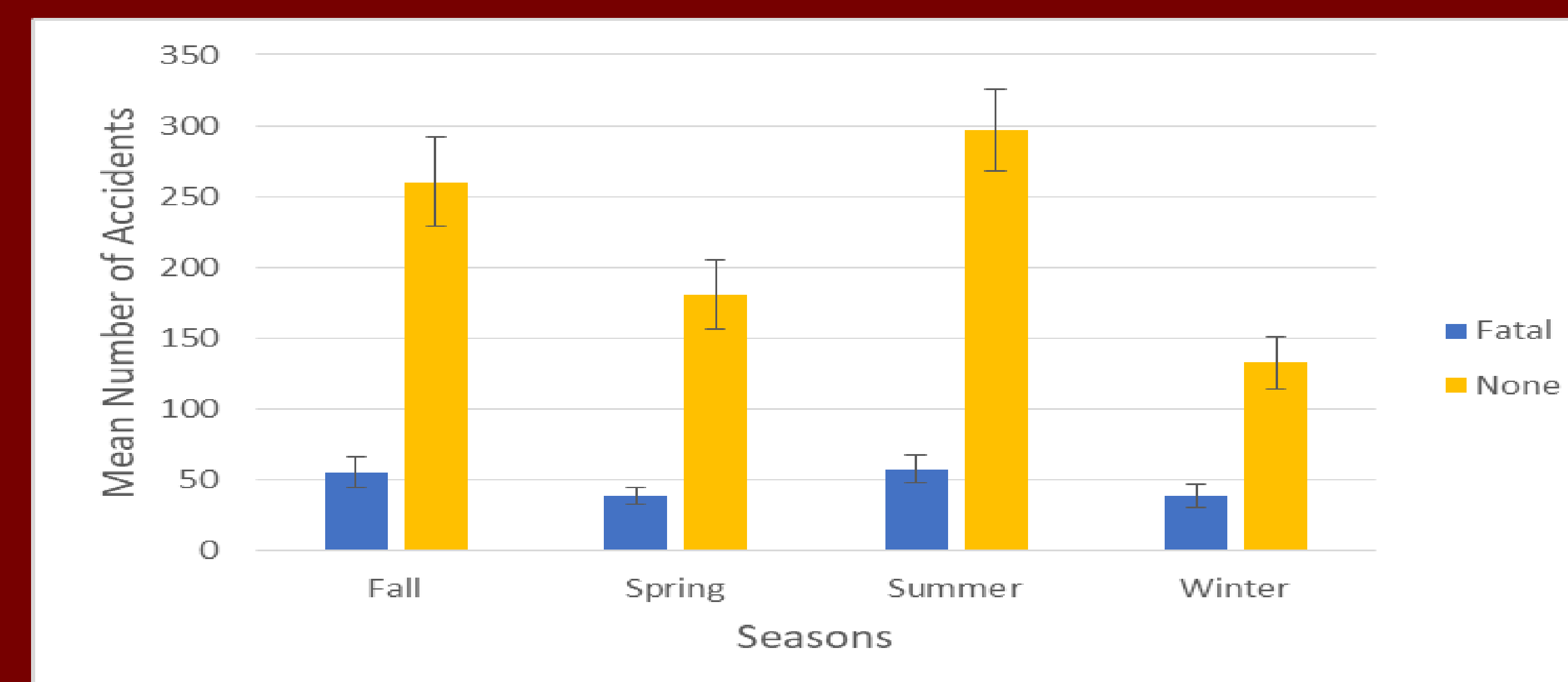


Figure 2: Mean GA Accidents by Season and Fatality.



Note: The error bars represents the standard deviation.

The two-way ANOVA revealed a statistically significant interaction between season and fatality in GA accidents, $F(3, 72) = 54.17, p < .001$. The simple effect of fatality on GA accidents was significant ($p < .001$), and the simple effect of season on GA accidents was also significant ($p < .001$). Tukey's pairwise comparison indicated statistically significant differences in GA accidents ($p < .05$), except for four pairings. The eta squared was 0.74 for fatality, 0.14 for season, and 0.08 for the interaction between season and fatality.

DISCUSSION

The data strongly supported the hypothesis because the ANOVA found a significant difference in the number of GA accidents in the U.S. by both season and fatality. Moreover, the pairwise comparison revealed a significant difference between all the season combinations except between fall and summer, and between spring and winter, whose mean differences were not significantly different. The effect size was large for season and fatality, but small for the interaction.

In all seasons there were fewer fatal accidents than non-fatal accidents. There were fewer GA accidents during the winter and fall than in summer and spring. This could be because these seasons cause cooler and denser air, which increases engine efficiency. Because of less dangerous weather conditions during these seasons, pilots have good visibility, less traffic, and less turbulence, resulting in fewer aviation accidents (Fultz & Ashley, 2016).

Pilots need to be aware that the most GA accidents occur during summer and fall, thus pilots should always be cautious during these times and conduct preflight planning carefully.

FUTURE RESEARCH

Future research could be conducted on weather-related GA accidents. Also, future research can explore what kind of accidents happen in each season.

This study involved only the airplane category. Therefore, this study can be replicated to examine all aircraft categories.

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