



Is There a Relationship Between Pilot Stress and Short- and Long- Haul Flights?

Khai Sheng Sew^(✉), Jongwoo Jung, Kin Wing Lo, Lucus Yap, and Silvia Pignata

University of South Australia, Mawson Lakes, SA 5095, Australia
sewky004@mymail.unisa.edu.au

Abstract. Past studies have been conducted to identify whether short-haul (SH) or long-haul (LH) pilots experience a higher level of stress during a single flight. An extensive literature review revealed high stress levels in both groups (i.e., LH pilots were more stressed than SH pilots, and vice versa). To investigate these mixed results, quantitative and qualitative survey data were collected from 49 international commercial airline pilots from various countries in the Asia-Pacific, Europe and in North America. The General Health Questionnaire–12 (GHQ-12) was used to measure the stress levels of pilots during the pandemic. The study found that there was no significant difference between the stress levels of SH pilots compared to the stress levels of medium-, long-, and ultra long-haul pilots. To further investigate stress levels, pilots' qualitative responses indicated that 75.5% of pilots were impacted by factors related to the COVID-19 pandemic, including increased stress associated with the uncertain future of the aviation industry, and income instability. In summary, this study aims to raise the attention of industry stakeholders such as aviation authorities and airlines of the need for targeted initiatives to support pilots who are most vulnerable to high-stress levels.

Keywords: Pilots · Stress · Short-haul or Long-haul · Covid-19

1 Introduction

As the world is continuously evolving, consumerism is on the rise. Associated with this are changes in the business models of airlines, where low-cost carriers (LCCs) have bloomed and prospered in recent years. Consequently, airlines now strive to keep their fleet in the air for as long as possible, achieving a high turnover rate and transporting more passengers for extra sales volume (Pels 2021). This growth may be negatively perceived by pilots, as higher turnover rates mean more flight legs which can lead to increased workloads and stress levels for pilots. The issue of work stress has been neglected by the aviation industry and pilots also tend to avoid the topic mainly due to concerns about medical certifications that require pilots to be both physically fit and mentally healthy, thus pilots may perceive that a slight compromise in these areas may cost them their licenses (Lollis et al. 2009). As a result, pilots may remain silent about any increases in psychological stress stemming from personal and/or work-related factors such as long flight hours or multiple flight legs in a typical working day.

The result of a reactive approach towards the mental health of pilots was sadly demonstrated by the Germanwings Flight 9525 in 2015, where the co-pilot kept his mental illness from his employer and then committed suicide using a commercial airliner filled with passengers (Bureau d'enquêtes et d'analyses pour la sécurité de l'aviation civile 2015). The incident resulted in the tragic loss of 150 lives and cost the airline more than \$300 m. Although attention focussed on the topic of pilots' mental health after the incident, there is a need for the aviation industry to take more initiatives to mitigate the issue as pilots are still reluctant to openly talk about their mental health.

1.1 Purpose and Importance

This study aims to investigate the vulnerability of certain categories of pilots (short-haul (SH) or long-haul (LH)) in experiencing higher psychological stress levels than their counterparts. The main objective of this research is to identify the potential relationship between the psychological stress levels of pilots and the number of hours they fly on a single flight. We hope to induce and spark positive actions from industry players, including civil aviation authorities and airlines, to act against this prevalent issue in order to maintain a healthy sky.

2 Literature Review

Extant research has sought to identify whether SH or LH pilots experience higher stress levels stemming from the nature of their work, with regard to flight hours. Due to mixed findings, this review seeks to paint a clearer picture on the topic. According to (Pasha and Stokes 2018), commercial airline pilots are constantly exposed to work-related stressors including, but not limited to, high workloads, disrupted circadian rhythms and the corporate instability of airlines (Little et al. 1990). As piloting a commercial aircraft is likely to be a stressful job, this review aims to identify whether SH or LH pilots experience a higher level of stress when performing their flight duties (Johnson 2019).

2.1 SH Pilots and Stress

According to research conducted by (Reis et al. 2013) the proportion of pilots experiencing mental fatigue directly related to their job was 94.1% for SH or medium-haul (MH) pilots compared to 89.3% of LH pilots. SH pilots experience a higher level of mental fatigue due to flying multiple flight legs in a typical duty day. For example, one study utilizing the NASA Task Load Index Scale demonstrated that mental and performance demands were essential components of workload during take-offs and landings (Lee and Liu 2003). This finding was supported by a study highlighting the increase in physiological activity in pilots during flights, especially during take-offs and landings where pilots' heart rates increased during landing, reaching a peak at or just before touchdown (Causse et al. 2012; Roscoe 1978). (Lee and Liu 2003) were also able to demonstrate that pilots' heart rates reached a high of 83.2 bpm during take-off and a staggering 88.6 bpm during landing. Further studies were able to demonstrate that heart rate responses in experienced pilots were influenced almost entirely by workload-related factors, not

emotional factors (Roscoe 1978). In short, SH pilots experience a high level of stress due to increased demands with repeated cycles of take-offs and landings on a typical working day.

2.2 LH Pilots and Stress

A study that utilized the biopsychosocial model of the lived experience of commercial airline pilots revealed that pilot well-being is negatively affected by the nature of their work, especially for LH pilots (Cullen et al. 2021). This finding was related to biological issues such as long, irregular, and anti-social work hours with frequent time-zone changes, accompanied by circadian rhythm disruptions (Cullen et al. 2021). On top of these stressors, having to fly across multiple time zones has been shown to cause the human body to release stress hormones, leading pilots to experience high levels of stress on a LH flight (Bidaisee et al. 2019).

In addition, research conducted by (Guy 2006) recognized that workers who undertake shift work complained more about stress at work when their working schedule was less predictable. This result suggests that LH pilots are likely to be more prone to experience high-stress levels during work compared to SH pilots, as they often work irregular hours (Cullen et al. 2021; Lee et al. 2017). This finding was supported by several studies which looked at the relationship between long work hours and the psychosocial stress levels of workers. A positive correlation was identified between the two variables where the psychosocial stress levels of workers increase with longer work hours (Lee et al. 2017; Maruyama and Morimoto 1996; Sato et al. 2009). This finding also relates to LH pilots more than SH pilots as the former usually fly more than 16 h on a single trip while the latter fly less than three hours on a single trip.

Furthermore, research has also identified a positive correlation between hours on duty and the stress levels of individuals, suggesting that pilots who spend longer hours on duty tend to experience higher stress levels (Kasi et al. 2007). Our present study is based on the survey instrument used in the study by Kasi et al. with regard to employing the valid GHQ-12 instrument to measure the psychological well-being of pilots (Kapur et al. 1998; Kasi et al. 2007). It should be noted that this current review examined literature from 1978 to 2021, and that most studies reviewed were cross-sectional in nature.

2.3 Research Question

This research aims to highlight the issue of job stress in the aviation industry by demonstrating the putative relationship between the stress levels of pilots and the number of hours that they fly on a single trip. A detailed examination of this topic will help to tackle high stress levels amongst pilots in order to combat possible negative consequences such as mental illness. The literature presents evidence that supports both sides of the argument (i.e., LH pilots experience higher stress levels than SH pilots, and vice versa). As a result, the present study seeks to investigate the following research question:

RQ: Do pilots who fly short-haul routes (less than three hours on a single trip) have higher levels of psychological stress than pilots who fly on longer routes (medium-, long-, ultra-long-haul (ULH)) on a single trip?

2.4 Design

A cross-sectional survey design comprising a 26-item questionnaire, containing demographic, multiple-choice, and open-ended questions was used to gather data from commercial airline pilots. In addition, the General Health Questionnaire-12 (GHQ-12) measured the psychological well-being of participants. The GHQ-12 was selected as the stress level indicator as previous studies that measured the stress levels of the general population have demonstrated the validity and reliability of this instrument (Goldberg et al. 1997). Thematic analysis was used to analyse answers to open-ended questions in order to identify key themes and trends.

3 Methodology

An internet-based survey using Google Forms was conducted over a three-week period from mid September to November 2021. An online survey was chosen for reachability, anonymity, time and cost-efficient reasons.

3.1 Population and Sample

The participants comprised commercial pilots who currently fly SH, MH, LH or ULH flights. To recruit the sample, the researchers contacted several major airlines, including airline pilot associations but due to the study's tight time constraints the researchers elected to use a snowballing method of recruitment. The online questionnaire was distributed following approval from the Human Research Ethics Committee of the University of South Australia.

The sample comprised 49 commercial airline pilots. Twenty four pilots (49%) were SH pilots, 11 MH pilots (22%), 10 LH pilots (20%), and 4 ULH pilots (8%). Ninety eight percent ($n = 48$) of participants were male. Twenty one pilots (44%) were from the Asia-Pacific region, followed by 19 pilots (39%) from Europe, 8 pilots (16%) from North America, and one participant declined to declare which region he or she was from. Fifteen pilots (31%) were aged between 26 to 35 years, 12 pilots (25%) were aged between 36 to 45 years, 11 pilots (22%) were aged between 46 to 55 years, 9 pilots (18%) were aged over 55 years, and 2 pilots (4%) were below 25 years of age.

With regard to flight experience, 13 pilots (27%) had flown between 1,001 to 5,000 h, and 13 pilots (27%) had flown between 5,001 to 10,000 h. This was followed by 9 pilots (18%) who had flown more than 15,000 h, while 8 (16%) had flown between 10,001 to 15,000 h. Three pilots (6%) had flown below 300 h and three (6%) had between 301 to 1,000 flying hours.

The majority of 43 pilots (88%) were employed full-time, with 2 pilots (4%) employed part-time and 1 pilot (2%) based on contract. One other pilot (2%) was on leave without pay, and 2 pilots (4%) were made redundant due to COVID-19. With regard to relationship/family status, 33 pilots (67%) were married, followed by 7 pilots (14%) who were single, 6 pilots (12%) were dating, 2 pilots (4%) were divorced, and 1 pilot (2%) was separated. The majority of participants did not have a child.

3.2 Procedure

A link to the online survey was distributed via airlines, airline pilots' associations and pilots' groups on the social media platforms of Facebook and LinkedIn. Snowball sampling was used to achieve a larger sample as participants were asked to distribute the survey link to their networks and colleagues who were employed as commercial airline pilots.

3.3 Measures

The questionnaire contained demographic questions related to work role, region, gender, age, flying experience, employment type, and relationship/family status. The General Health Questionnaire-12 (GHQ-12) measure consisted of 12 statements to which respondents indicated their agreement on a four-point scale (0 = Not at all; 3 = Much more than usual; (Goldberg and Williams 1988).

3.4 Ethics Considerations

Ethical considerations included voluntary participation, informed consent, confidentiality, and participants' anonymity. Participants were notified that the questionnaire was voluntary and that the collected data would not be shared with employers or airlines. As suggested by (Murdoch et al. 2014), it was important to ensure that data was confidential and de-identified, as these factors may affect the response rate as well as participants' willingness to reveal sensitive information. Participants were also notified that there were no penalties or disadvantages for not participating in the survey. A Participant Information Sheet was provided to participants to ensure their informed consent.

3.5 Data Analysis Method

Responses to the survey were exported to Google Spreadsheet for analysis. Quantitative data as transferred to Microsoft Excel and analysed using ToolPak VBA functions. The responses to the GHQ-12 were given a score, based on the user's manual to obtain an average score for each individual. The relationship between the stress level and flight hours per trip was analysed using an independent samples t-test comparing the GHQ-12 scores of the SH pilots against the GHQ-12 scores from the sample of MH, LH and ULH pilots.

3.6 Thematic Analysis Method

Qualitative responses were exported to Microsoft Excel for thematic analysis which enabled responses to be categorised into themes and codes to allow a wide-scale understanding of the sample population (Boyatzis 1998). First, responses were grouped based on similar themes that the researchers had laid out prior to the study. Then, themes that emerged were added to the list of categories where keywords were used to identify themes. This process was completed independently by different researchers, then

cross-checking was carried out to ensure the consistency of analysis. This process was undertaken to also ensure interrater reliability.

The researchers identified six main themes, namely “income”, “job security”, “quarantine”, “time away from family”, “lockdown” and “infected by COVID-19”. Lastly, the frequencies of each keyword appearing in the responses were recorded to allow the presentation of findings in a bar chart.

4 Findings and Results

4.1 Mean GHQ-12 Score of Pilot Categories

The total mean GHQ-12 score for each of the four categories of pilots show that MH pilots reported the lowest level of stress (12), followed by SH pilots (12.96), ULH pilots (14.25) and LH pilots (15.3) reported the highest level of stress. Our study noted a positive relationship between the number of hours that pilots flew on a single trip with their stress levels (see Fig. 1), suggesting that pilots who fly longer hours on a single trip experience a higher stress level than pilots who fly shorter trips. This may be due to the nature of long-haul flight operations, where work-related stressors such as unpredictable working schedules, crossing multiple time zones which is associated with hormone disruptions, and anti-social work hours may be contributing to their stress levels (Bidaisee et al. 2019; Cullen et al. 2021). The impact of the COVID-19 pandemic and the ensuing disruptions to international long-haul flights are likely to have also impacted the stress levels of LH commercial pilots (Table 1).

Table 1. Median, Mean and Total GHQ scores for each pilot category

Pilot category (N = 49)	Flight hours per trip	Median GHQ score	Total median GHQ score	Total mean GHQ score	Mean GHQ score
Short-haul pilots (n = 24)	1–4 h	0.96	11.50	12.96	1.08
Medium-haul pilots (n = 11)	5–9 h	1.08	13.00	12	1
Long-haul pilots (n = 10)	10–14 h	1.08	13.00	15.3	1.28
Ultra-Long-haul pilots (n = 4)	15 h and above	1.21	14.50	14.25	1.19

T-test Analysis: An independent samples t-test was performed to investigate any differences between the sample of SH pilots and the other sample comprising MH, LH and ULH pilots. The 24 SH participants ($M = 13$, $SD = 5.92$) compared to the 25 MH, LH and ULH participants [$M = 13.68$, $SD = 6.32$] did not report significantly more stress, $t(47) = -0.39$, $p = .70$.

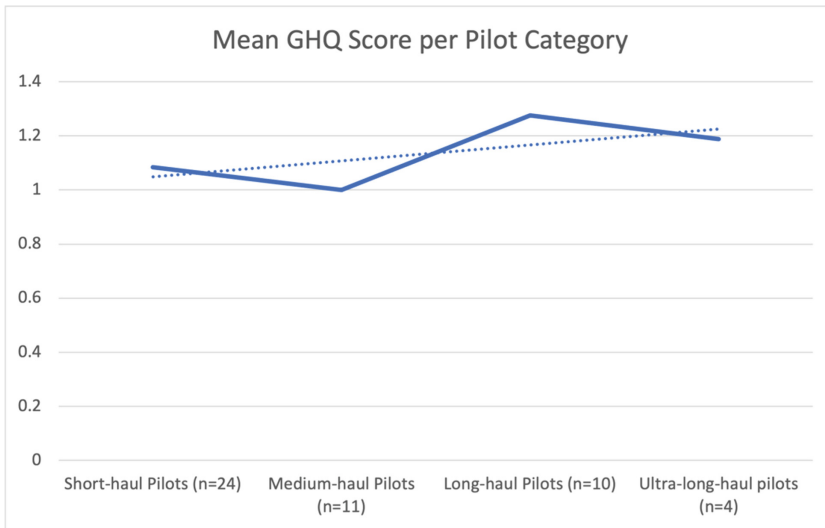


Fig. 1. Mean GHQ score per pilot category

4.2 Factors Affecting Stress Levels

To further investigate pilot stress levels, participants were asked to rank the top three factors that they believed impacted their stress levels. By applying a score-based approach, the researchers multiplied the first reported factors by 3, the second factors by 2 and the third by 1. It was discovered that the reported factor with the highest score was the ‘changing nature of the industry’, followed by ‘anti-social hours’ and then the ‘divergence of values between pilots and management’ (see Fig. 2). The divergence of values between pilots and management suggests that both entities hold differing views and perspectives towards matters. For example, this was evident when participants stated that “*management expiations need to change*”, as well as the “*company used covid as leverage and succeeded in worsening contracts dramatically.*” These comments portray the reality of pilots’ views in the context of the pandemic and are supported by (Cullen et al. 2021), who found that pilots experienced a disconnection between their values and those of their line managers.

4.3 Impact of COVID-19

As mentioned above, a majority of participants selected the “changing nature of the industry” as the factor that most impacted their stress levels. As this phenomenon is likely to be related to the impact of COVID-19, and in order to gather rich data about how participants were affected by COVID-19, all participants were asked to respond to an open-ended question. By applying thematic analysis, the researchers identified the categories of pilots who were most impacted by the pandemic, and also gained insights into their perceptions of the pandemic’s impact (see Fig. 3).

Figure 3 shows that 82% of MH pilots were impacted by the COVID-19 pandemic, followed by 75% of ULH pilots, 70% of LH pilots and 46% of SH pilots.

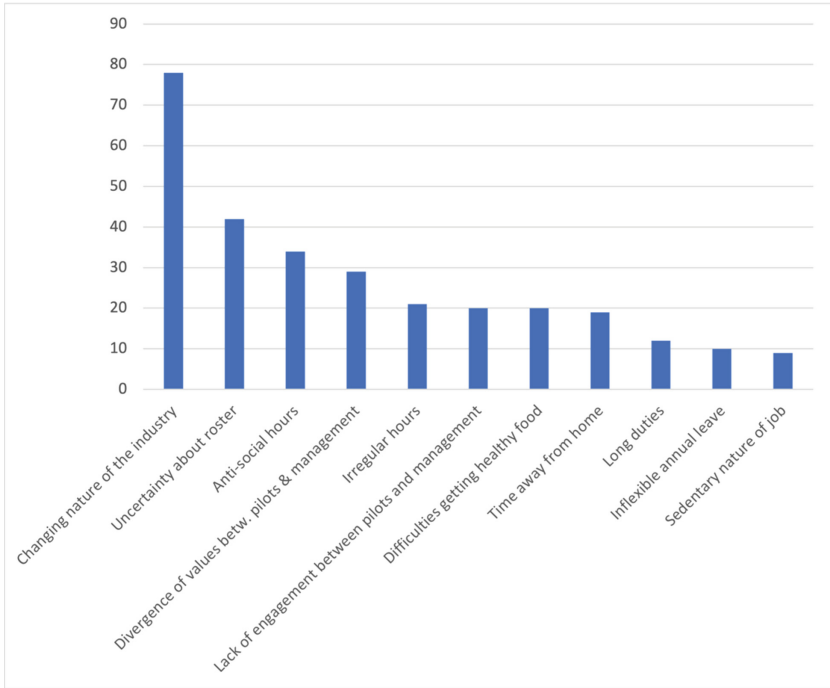


Fig. 2. Reported stress factors

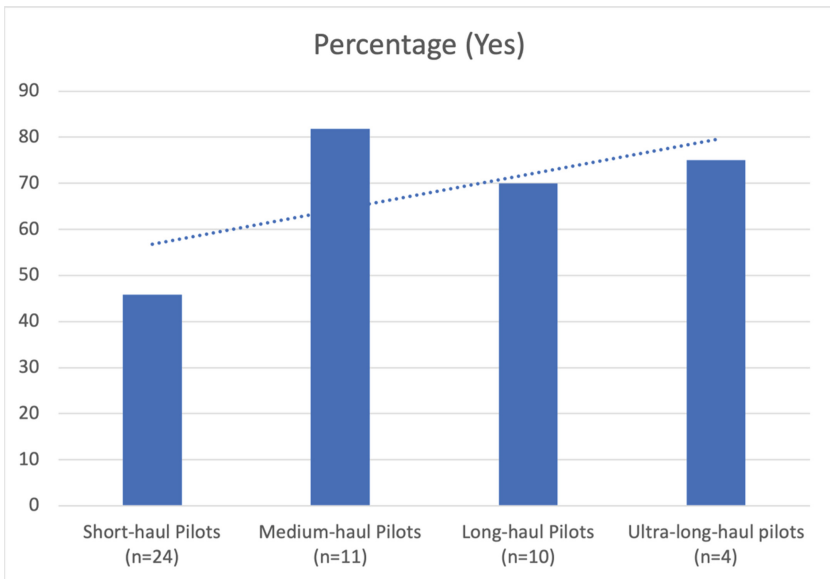


Fig. 3. Percentage of pilots impacted by COVID-19 per each category

Due to the small sample size of 49 participants, we were not able to undertake further quantitative analyses but did establish a trend line to demonstrate the positive relationship between the number of hours that pilots fly, with the percentage of pilots affected by COVID-19 (see Fig. 3). This result is likely due to the nature of flight operations during the pandemic where short-haul domestic flights were allowed to operate however, in most regions, the majority of long-haul international operations were halted. This finding is supported by statistics released by the International Civil Aviation Organization reporting that international passenger traffic plummeted by 50% as the number of passengers flown decreased by 2.7 billion in 2020 compared to 2019 (International Civil Aviation Organization [ICAO] 2021).

In analysing the qualitative responses to the question “Has COVID-19 impacted your wellbeing?”, several themes were identified which included income, job security, quarantine, time away from family, lockdown and infected by COVID-19 (see Fig. 4).

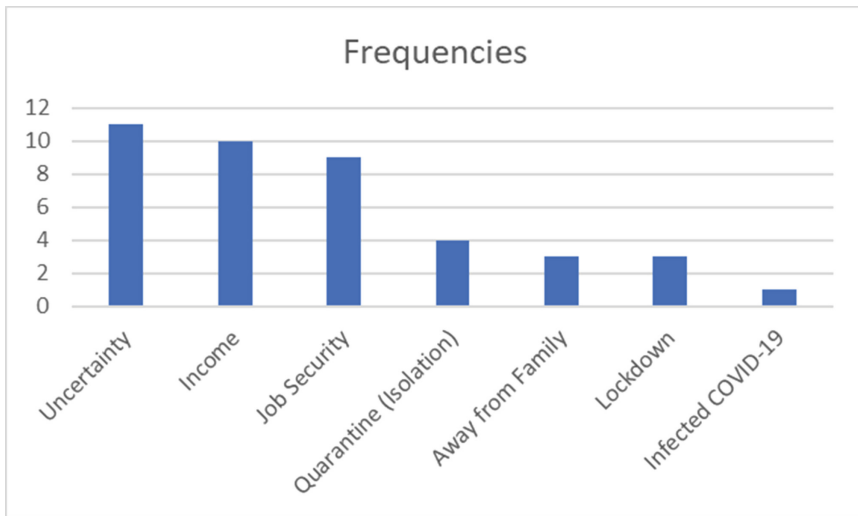


Fig. 4. Frequency of themes reported

The majority of participants reported that the aviation industry has an uncertain future and COVID-19 has affected their income and job significantly, with some participants losing their jobs. Participant responses were categorized and organized in themes as shown in Table 2.

It was found that pilots, in general, were currently experiencing a higher stress level than normal, with concerns revolving around the uncertainty of the industry, income, and job security. As expected, only LH and ULH pilots were stressed by the quarantine restrictions and the time spent away from family. At the same time, some SH pilots experienced an improvement in their well-being due to the pandemic as it provided them with more spare time and allowed them to spend more time with their families (see Table 3). A possible explanation for this result is that SH flights were not completely halted during the period, thus allowing SH pilots to continue flying throughout the

Table 2. Thematic analysis of responses showing negative impacts of COVID-19

Theme	Example	Pilot category
Uncertainty	“It gets demoralising at times whenever there seems no sign of recovery in the industry yet”	Short-haul
	“More uncertainty in relation to career prospects”	Medium-haul
	“Uncertainty of the industry”	Long-haul
	“Stress of having young family and uncertain of future”	Ultra-long-haul
Income	“Only income has been affected”	Short-haul
	“In terms of income, yes. 50% pay cut”	Medium-haul
	“Loss of income”	Long-haul
Job security	“Stressed due to Layoffs”	Short-haul
	“Lost my career”	Medium-haul
	“Caused massive lay-offs”	Long haul
	“I am now unemployed”	Ultra-long-haul
Quarantine (Isolation)	“Isolation after the flights, unable to go out in layovers”	Long-haul
	“Stress of having to isolate or be sent into quarantine”	Ultra-long-haul
Away from family	“Can’t be with family”	Long-haul
	“Yes, been away from family for too long”	Ultra-long-haul
Lockdown	“Lockdowns; no exercises and no social contracts”	Short-haul
	“The stress and mental strain of being lockdown”	Long-haul
Infected COVID-19	“I had COVID early 2020”	Short-haul

period. Conversely, LH operations were reduced to a minimum which resulted in LH pilots experiencing an adverse affect. However, overall, the results show that regardless of flight hours per trip, pilots have been impacted by the pandemic in various ways, which has also likely impacted their stress levels.

4.4 Strengths and Limitation

A clear strength of this study is that it aims to fill the knowledge gap within the aviation industry regarding the impact of flying hours in a single trip on a pilot’s well-being and mental health. To date, this area has been overlooked and the adverse impact of the COVID-19 pandemic has only escalated the potential for harm for pilots and other workers in the industry. The present study has also identified pilots’ views on both the negative and positive impacts of the pandemic and this rich information is vital to aviation managers and airlines who can initiate interventions and strategies to enhance

Table 3. Thematic analysis of responses showing positive impacts of COVID-19

Theme	Example	Pilot category
Improved well-being	“It has improved my well-being significantly by giving much more time at home”	Short-haul
	“Improving my well-being. Reason is extra time with my family”	Short-haul
	“Had enjoyed time home”	Short-haul
	“Best time of my life because of extra free time”	Short-haul

work environments and in particular, address the divergence of views between pilots and management.

There are, however, several limitations to this research, including: (1) the cross-sectional design (Sedgwick 2014); (2) the use of self-reported data which is dependent on the honesty of participants and could be affected by social desirability bias (Meleis & Dagenais 1980; Thea 2008); (3) the time constraints of the study which did not permit the researchers to achieve the targeted sample size; and (4) the ensuing small sample of 49 commercial pilots limits the generalizability of our findings. Finally, it was unfeasible to completely exclude factors external to the research such as the impact of COVID-19 which adversely affected the psychological stress levels of pilots.

5 Conclusion

As pilots are more susceptible to high-stress levels than the general population, this study has taken a step in identifying the category of pilots who are most vulnerable to stress and shows a trend related to the stress levels of pilots with the number of hours they fly in a single trip. The results suggest that LH and ULH pilots are more vulnerable than SH and MH pilots in experiencing higher levels of stress which could deteriorate the mental well-being of pilots when on duty and also impair their performance.

To date, minimal research has been undertaken on job stress in pilots, and this is also likely to be due to pilots being reluctant to openly talk about work-related stressors, which may, in the long run, threaten the safety benchmark of the aviation industry. Added to that is the negative impact of the recent pandemic, which only increases the need for aviation authorities to look deeper into pilot’s mental health and well-being.

Lastly, this study induces a rethink on the requirements of medical certificates for pilots in that the sensitivity of mental health issues and stigmas may have prevented pilots from openly discussing mental well-being issues (Cullen et al. 2021; Lollis et al. 2009). Also, further research could look at external factors that can contribute to the high-stress levels of pilots (e.g., relationship and work-home conflict).

In summary, the qualitative responses obtained in the present study reveal a trend that commercial pilots who fly more than 10 h on a single trip experience a higher stress level compared to pilots who fly less than 10 h. It is also important to acknowledge that pilots are continuing to experience a higher than usual level of stress stemming from the

impact of the COVID-19 pandemic. Therefore, this is an area where aviation authorities can play a part in mitigating this issue with targeted initiatives directed to the more vulnerable categories of pilots.

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