

## Understanding Sleepiness and Fatigue in Cabin Crew Using COVID-19 to Dissociate Causative Factors

Candice Chien-Yu Wen; Christian L. Nicholas; Mark E. Howard; John Trinder\*; Amy S. Jordan

- OBJECTIVES:** Airline cabin crew experience high levels of fatigue and sleepiness. Whether these are solely related to their work schedules/jetlag or are in part related to individual factors is unknown. The COVID-19 pandemic has significantly disrupted the aviation industry and many cabin crew have been grounded. This provides a unique opportunity to assess the causes of fatigue and sleepiness in this population.
- METHODS:** An online anonymous survey was distributed in April–June 2020 to cabin crew who were 1) flying, 2) grounded but doing alternative work, and 3) grounded, not working, or unemployed. The survey measured fatigue, sleepiness, and mental health. It also screened their risk for insomnia, depression, and shift work disorder and assessed drug and caffeine use.
- RESULTS:** Collected were 409 valid responses: 45 currently flying; 35 grounded but doing alternate work; and 329 not working. On average, all three groups experienced normal levels of fatigue and sleepiness. The risk for major depressive disorder was 27.4%, with 59.5% of individuals reporting abnormal levels of anxiety. Caffeine intake and the use of drugs and alcohol to facilitate sleep were common, although not different between those currently flying vs. grounded.
- CONCLUSIONS:** With reduced workloads or not flying, cabin crew reported lowered fatigue and sleepiness compared to prepandemic findings, along with reduced risk for major depressive disorder. However, a high occurrence of negative emotional states were reported, potentially related to the uncertainty surrounding the pandemic. This study suggests fatigue and sleepiness is primarily related to airline operational rather than personal variables.
- KEYWORDS:** flight attendant, fatigue, sleepiness, COVID-19, mental health, occupational health, shift work disorder.

Wen CC-Y, Nicholas CL, Howard ME, Trinder J, Jordan AS. *Understanding sleepiness and fatigue in cabin crew using COVID-19 to dissociate causative factors. Aerosp Med Hum Perform. 2022; 93(1):50–53.*

In the aviation industry, the majority of employees are shift workers, providing services around the clock, all year round. Pilots and cabin crew in particular work irregular shift hours and, additionally, commonly battle with jetlag. Past research on airline cabin crew has found them to experience high levels of fatigue and sleepiness,<sup>3,9</sup> with potential elevated risk for insomnia, shift work disorder (SWD), and depression.<sup>11</sup> Whether cabin crews' experience of fatigue and sleepiness is solely associated with operational factors (e.g., irregular work hours/jet lag) or whether individual factors (e.g., personal habits/behaviors such as alcohol use to aid sleep onset) play a role too cannot be easily differentiated. Therefore, to date, it is difficult to ascertain the appropriate strategies to best support cabin crews' sleep health and fatigue management.

On 11<sup>th</sup> of March 2020, the World Health Organization declared the novel coronavirus (COVID-19) a pandemic.<sup>12</sup>

COVID-19 has severely restricted global travel, with the International Civil Aviation Organization reporting a decline of 50–60% in passenger traffic in 2020 compared to 2019.<sup>7</sup> For the first time in history, the majority of airplanes globally were grounded in 2020 and cabin crew did not operate flights. Many airlines have asked their cabin crew to take leave, offered

\*Posthumously

From the John Trinder Sleep Laboratory, University of Melbourne, Melbourne, Victoria, Australia.

This manuscript was received for review in May 2021. It was accepted for publication in October 2021.

Address correspondence to: Candice Chien-Yu Wen, the John Trinder Sleep Laboratory, Melbourne School of Psychological Sciences, Redmond Barry Building, The University of Melbourne, Parkville, Victoria 3010, Australia; candice.wen@unimelb.edu.au.

Reprint and copyright © by the Aerospace Medical Association, Alexandria, VA.

DOI: <https://doi.org/10.3357/AMHP.5925.2022>

alternative work, or made cabin crew redundant. This provides researchers an opportunity to investigate the impact of not operating normal schedules on cabin crews' health and to tease apart the role of individual vs. operational factors on their health. The primary aim of this study was to evaluate the occurrence of fatigue and sleepiness on cabin crew who are not currently flying as compared to active cabin crew. The secondary aim was to assess cabin crews' mental health during this time.

## METHODS

### Subjects

Cabin crew from around the world were invited to participate in an anonymous online survey. This included cabin crew who were still operating flights and those who were temporarily stood down, or have recently become unemployed. Participants were recruited through Facebook, advertising for a total of 2 wk (between 20<sup>th</sup> April 2020–17<sup>th</sup> June 2020), targeting specific cabin crew groups, allowing snowballing. The study was approved by the Human Research Ethics Committee of The University of Melbourne (Ethics ID: 1,750,491.4). Participants provided digital informed consent.

### Procedure

The survey first established whether the cabin crew were currently flying (operating flights) or not and, from this, directed respondents to one of three survey branches: Group A: cabin crew still operating flights; Group B: cabin crew currently grounded and temporarily doing alternative job(s) until the airline resumes operation; or Group C: cabin crew grounded; either on leave, on standby but were not operating a flight, or were unemployed (i.e., redundancy).

Where appropriate, the survey used the same methodologies as our prepandemic study<sup>11</sup> for a planned comparison. Both the prepandemic<sup>11</sup> and the current study used the following measures for all participants: Flinders Fatigue Scale (FFS), Sleep Condition Indicator (SCI), Epworth Sleepiness Scale (ESS), Patient Health Questionnaire (PHQ-2), and measures on individual habits and behaviors (caffeine consumption, use of alcohol and drugs to facilitate sleep). In addition, the current study performed the Depression Anxiety Stress Scale (DASS-21)<sup>8</sup> to assess negative emotional states. At the end of the current survey, all participants were invited to share any additional information with researchers if desired. Further questions were asked specifically in the different survey conditions as follows:

Group A: cabin crew still operating flights during the pandemic. Both individual demographic and full operational information regarding recent roster details matching past research were collected.<sup>11</sup> Participants were also screened for shift work disorder (SWD) using the shift work disorder questionnaire (SWDQ).<sup>4</sup>

Group B: grounded cabin crew who were temporarily doing alternative job(s). In this group, individual demographic and only limited operational information was collected due to

cabin crew being temporarily grounded. If respondents were doing shift work for their alternative job(s) they also completed the SWDQ.

Group C: grounded cabin crew who were not working. Individual demographic and limited operational information were collected.

### Statistical Analysis

All statistical analyses were carried out using SPSS. The three groups were compared and these groups were further compared to previously collected full-time active cabin crew.<sup>11</sup> ANOVA were conducted to assess if the health outcomes or individual habits and behaviors differed between groups. The descriptive statistics of each scale and measures were assessed for frequency of each health outcome.

## RESULTS

A total of 409 cabin crew consented and completed the survey. Of these, 45 were currently flying (Group A), and 364 were grounded. From the grounded crew, 35 were temporarily doing other jobs (Group B). The remaining 329 grounded crew made up Group C, with 288 on either paid/unpaid leave, or had been placed on standby but had not been flying, and 41 who were unemployed (i.e., were made redundant).

The occurrence of fatigue, sleepiness, insomnia, mental health, and SWD for the three groups along with recent prepandemic results<sup>11</sup> are shown in **Table I**. Despite Group A crew still operating flights, all three groups in the current study experienced normal levels of fatigue (FFS) and sleepiness (ESS). From Group A, 64% reported lower workload during the current pandemic than was typical for their most recent flight. This may be due to lower passenger count, more breaks (67.3% of crew received breaks for this trip), or improved departure and arrival times [the majority of the flights had an estimated time of arrival (ETA) between 16:00–19:59]. With regard to insomnia (SCI), Group C (grounded or unemployed) was at the greatest risk, with 46.5% screening positive for insomnia disorder. Nearly half of the currently flying cabin crew screened positive for SWD and, in the cabin crew who were grounded and doing alternative shift work, the SWD risk was 29%.

Major depressive disorder (PHQ-2) risk ranged from 25.7–29.8% between the three postpandemic groups. Further assessment of mental health (DASS-21) found the majority of the cabin crew experienced abnormal levels of anxiety. Perhaps not surprisingly, Group C (grounded or unemployed) had the worst mental health in two emotional states: depression and anxiety. Additional analyses into Group C found no significant differences in DASS depression [ $t(327) = -0.33, P = 0.74$ ] or anxiety [ $t(327) = -0.91, P = 0.37$ ] scores between the recently unemployed cabin crew compared with the crew on paid/unpaid leave or standby. However, looking at the percentage of abnormal reports, the DASS anxiety score appeared to be higher in recently unemployed cabin crew, with 73.2% considered to be vulnerable compared with 61.5% of crew on paid/unpaid leave or standby.

**Table I.** Participant Demographics and Prepandemic Results.

MEASURES (SCALES)	GROUP A (N = 45)	GROUP B (N = 35)	GROUP C (N = 329)	WEN ET AL. <sup>11</sup> (N = 930)
Age (years)				
Mean ± SD	34.1 ± 11.8	33.3 ± 10.7	32.8 ± 9.4	32.7 ± 10.6
Range	20-65	20-55	19-61	19-63
Sex				
Female	66.7%	74.3%	75.1%	74.7%
Male	33.3%	25.7%	24.9%	25.5%
Tenure – all airlines (years)				
Mean ± SD	9.0 ± 9.4	8.9 ± 8.6	8.3 ± 7.3	8.6 ± 8.2
Range	0-30	1-30	0-30	0-30
Fatigue (FFS)				
Mean ± SD	11.02 ± 5.93**	11.77 ± 7.00*	11.27 ± 6.05**	14.53 ± 5.09
Abnormal %	42.2%	40.0%	41.9%	63.5%
Sleepiness (ESS)				
Mean ± SD	7.02 ± 3.72**	7.91 ± 3.75**	7.42 ± 4.22**	10.42 ± 4.58
Abnormal %	20.0%	20.0%	22.5%	46.9%
Insomnia (SCI)				
Mean ± SD	18.16 ± 7.65	19.69 ± 8.32**	17.93 ± 7.11**	15.54 ± 6.79
Abnormal %	37.8%	31.4%	46.5%	57.7%
Major depressive disorder (PHQ-2)				
Mean ± SD	1.76 ± 1.55	1.51 ± 1.69*	2.09 ± 1.64	2.36 ± 1.68
Abnormal %	26.7%	25.7%	29.8%	40.0%
Mental Health (DASS) – Depression				
Mean ± SD	12.09 ± 8.94	9.83 ± 8.91	13.53 ± 9.61	N/A
Abnormal %	55.6%	42.9%	60.8%	
Mental Health (DASS) – Anxiety				
Mean ± SD	8.22 ± 6.03	8.80 ± 5.96	10.38 ± 7.11	N/A
Abnormal %	55.6%	60.0%	62.9%	
Mental Health (DASS) – Stress				
Mean ± SD	13.82 ± 7.88	14.11 ± 7.51	15.16 ± 7.58	N/A
Abnormal %	44.4%	40.0%	45.0%	
Shift Work Disorder (SWDQ)				
Positive %	48.6%	28.6%	N/A	68%

Flinders Fatigue Scale (FFS): occurrence of fatigue; Epworth Sleepiness Scale (ESS): sleepiness; Sleep Condition Indicator (SCI): insomnia; Patient Health Questionnaire (PHQ-2): major depressive disorder; Depression Anxiety Stress Scale (DASS-21): mental health and shift work disorder (SWDQ) for Groups A (flying), B (grounded and doing alternative job), C (grounded/unemployed, no work), and Wen *et al.*<sup>11</sup>

Cut-off scores for the following scales:

FFS: ≤ 12 (normal), 13-15 (borderline fatigue), 16-20 (moderate fatigue), and ≥ 21 (severe fatigue).

ESS: ≤ 10 (normal), 11-12 (mild sleepiness), 13-15 (moderate sleepiness), and 16-24 (severe excessive sleepiness).

SCI: ≤ 16 screens possible insomnia disorder.

PHQ-2: ≥ 3 screens for major depressive disorder.

DASS depression: ≤ 9 (normal), 10-13 (mild), 14-20 (moderate), 21-27 (severe), ≥ 28 (extremely severe).

DASS anxiety: ≤ 7 (normal), 8-9 (mild), 10-14 (moderate), 15-19 (severe), ≥ 20 (extremely severe).

DASS stress: ≤ 14 (normal), 15-18 (mild), 19-25 (moderate), 26-33 (severe), ≥ 34 (extremely severe).

\*\* $P < 0.01$  Tukey post hoc analysis, group(s) significantly different to Wen *et al.*<sup>11</sup> sample; \* $P < 0.05$  Tukey post hoc analysis, group(s) significantly different to Wen *et al.*<sup>11</sup> sample.

Fatigue and sleepiness were not statistically different between the three groups (A–C); however, they differed when compared to prepandemic data<sup>11</sup> (ANOVA  $P < 0.001$ ), with Tukey post hoc analyses indicating groups A, B, and C all had lower fatigue and sleepiness as compared to the prepandemic full-time cabin crew (Table I). Despite Group A operating flights during the pandemic, cabin crew on average worked 3.40 duty days per week and an average of 3.96 consecutive workdays compared to the prepandemic crew average of 4.29 duty days and 5.21 average consecutive workdays.

Caffeine was commonly consumed in all groups A–C, with a range of 35.5–42.8% consuming three or more servings per day. No significant differences were found between groups A–C and the prepandemic cabin crew for caffeine consumption [ $F(3, 1335) = 0.20, P = 0.90$ ] nor for the use of alcohol to facilitate sleep [ $F(3, 1335) = 1.31, P = 0.27$ ]. Similarly, no significant

differences were found for the use of over-the-counter [Welch's  $F(3, 98.35) = 2.64, P = 0.05$ ] and prescription drugs [Welch's  $F(3, 101.03) = 1.93, P = 0.13$ ] to facilitate sleep.

## DISCUSSION

COVID-19 has dramatically influenced the aviation industry and, not surprisingly, the majority of cabin crew surveyed were not operating flights. This study found that with reduced workloads or no flight operations, cabin crew experienced lower levels of fatigue and sleepiness, and had reduced risk for insomnia and SWD, suggesting that the abnormally high levels found before the COVID-19 pandemic may relate to the work itself and are not intrinsic to the cabin crew population. In contrast, it was of interest that with changed work conditions, there were

no significant changes to their personal habits in caffeine consumption and use of alcohol and drugs to facilitate sleep. Past research suggested the use of caffeine may act as a coping strategy to combat sleepiness;<sup>11</sup> however, the current study indicates it may be intrinsic or difficult to alter long-term learned behaviors in individuals, rather than circumstances.

The pandemic has, not surprisingly, impacted cabin crews' mental health. Although there was lower risk for major depressive disorder compared to the prepandemic data, there were an alarming number of reports regarding anxious, depressed, and stressed mental states, which is also found with the general population during the pandemic.<sup>5</sup> This may be due to job insecurity and/or financial worry, as a common theme in the comments from the grounded cabin crew was "COVID situation has brought on a lot of uncertainty and stress over financial and job security...I love my job and these unprecedented times have been hard to deal with". With the significantly lowered reports of fatigue and sleepiness, another common theme among the grounded crew comments suggested improved wellbeing and sleep when one ceased shift work, consistent with past research:<sup>1</sup> "I haven't been flying for the past 50 days and I feel great! My body totally recovered from fatigue, I'm sleeping at night (which is a privilege for us) ...and my mood feels better". Some grounded crew were still operating shift work as their temporarily job; however, the risk for SWD more than halved compared to the prepandemic cabin crew. The SWD risk for Group B was similar to the nursing industry.<sup>2,6</sup> However, some evidence suggests there are long-term effects of shift work on sleep<sup>10</sup> and some grounded crew found the lack of schedule led to difficulty in establishing a sleep routine. "Since being grounded I've found it increasingly more difficult to sleep... I lie there for 5-6 hours before I sleep".

This study demonstrates the impact of the continuously changing COVID-19 climate on employment, sleep, and mental health in a heavily impacted shift work population. Due to the uncertainty of travel demand and border restrictions, it is not possible to predict when airlines will resume 'normal' operation. However, when that happens, it is advised that work schedules be designed with cabin crews' fatigue and sleepiness in mind to prevent the prepandemic level of sleepiness and fatigue. In addition, intervention programs that focus on self-assist strategies for cabin crew to recognize and manage their fatigue, sleepiness, and mental health could potentially improve their overall well-being.

## ACKNOWLEDGMENTS

We would like to thank A Fly Guy's Cabin Crew Lounge for their assistance in promoting our study to their members. We would also like to thank the

Marketing and Communications Team from the Faculty of Medicine, Dentistry and Health Sciences from The University of Melbourne for their support in advertising this study on social media.

Ethics Approval: Human Research Ethics Committee of The University of Melbourne, Ethics ID: 1750491.4. Data are available upon reasonable request.

*Financial Disclosure Statement:* There is no funding to report for this submission. There are no competing interests for any author.

*Authors and Affiliations:* Candice Chien-Yu Wen, B.Sc.(Hon.), M.Sc.(Hon.), Christian L. Nicholas, B.Sc.(Hon.), Ph.D., John A. Trinder, Ph.D. (posthumously), and Amy S. Jordan, B.Sc.(Hon.), Ph.D., University of Melbourne, Melbourne, Victoria, Australia; and Mark E. Howard, M.B.B.S., Ph.D., Institute for Breathing and Sleep, Austin Hospital, Heidelberg, Victoria, Australia.

## REFERENCES

- Åkerstedt T, Nordin M, Alfredsson L, Westerholm P, Kecklund G. Sleep and sleepiness: impact of entering or leaving shiftwork - a prospective study. *Chronobiol Int*. 2010; 27(5):987–996.
- Asaoka S, Aritake S, Komada Y, Ozaki A, Odagiri Y, et al. Factors associated with shift work disorder in nurses working with rapid-rotation schedules in Japan: The Nurses' Sleep Health Project. *Chronobiol Int*. 2013; 30(4):628–636.
- Avers KB, King SJ, Nesthus TE, Banks J. Flight Attendant Fatigue, Part I: National Duty, Rest, and Fatigue Survey. Oklahoma City (OK): Federal Aviation Administration; 2009.
- Barger LK, Ogeil RP, Drake CL, O'Brien CS, Ng KT, Rajaratnam SMW. Validation of a questionnaire to screen for shift work disorder. *Sleep*. 2012; 35(12):1693–1703.
- Czeisler MÉ, Lane RI, Petrosky E, Wiley JF, Christensen A, et al. Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24–30, 2020. *MMWR Morb Mortal Wkly Rep*. 2020; 69(32):1049–1057.
- Flo E, Pallesen S, Magerøy N, Moen BE, Grønli J, et al. Shift work disorder in nurses - assessment, prevalence and related health problems. *PLoS One*. 2012; 7(4):e33981.
- International Civil Aviation Organisation. Effects of novel coronavirus (COVID-19) on civil aviation: economic impact analysis. 2020. [Accessed Nov. 8, 2021]. Available from: [https://www.icao.int/sustainability/Documents/COVID-19/ICAO\\_Coronavirus\\_Econ\\_Impact.pdf](https://www.icao.int/sustainability/Documents/COVID-19/ICAO_Coronavirus_Econ_Impact.pdf).
- Lovibond SH, Lovibond PF. Manual for the depression anxiety stress scales, 2nd ed. Sydney: Psychology Foundation; 1995.
- McNeely E, Gale S, Tager J, Kincl L, Bradley J, et al. The self-reported health of U.S. flight attendants compared to the general population. *Environ Health*. 2014; 13(1):13.
- Rotenberg L, Silva-Costa A, Diniz TB, Griep RH. Long-term deleterious effects of night work on sleep. *Sleep Sci*. 2011; 4(1):13–20.
- Wen CCY, Nicholas CL, Clarke-Errey S, Howard ME, Trinder J, Jordan AS. Health risks and potential predictors of fatigue and sleepiness in airline cabin crew. *Int J Environ Res Public Health*. 2020; 18(1):13.
- World Health Organisation. WHO Director - General's opening remarks at the media briefing on COVID-19 - 11 March 2020. [Accessed 2020 July 29]. Available from: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>.