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ORIGINAL ARTICLE

Exploring the relationships between chronotypes, attachment styles, and mental health in flight attendants

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ABSTRACT

Circadian rhythm-related individual differences such as chronotypes (morningness/eveningness) are associated with mental health though not elucidated in circadian-disrupted populations such as flight attendants. International flight attendants ($n = 288$) aged 21 to 55 (70.8% female, 76.4% white) completed an online survey assessing chronotypes, attachment, depression, and anxiety to investigate the associations between these variables. Results showed a prevalence of intermediate (41.6%) and evening types (40.6%). Evening chronotype was associated with and significantly predicted depression but not anxiety. Individuals who scored higher in attachment anxiety or avoidance had higher levels of depression and anxiety. Exploratory mediation showed that attachment avoidance partially mediated the relationship between anxiety and depression. Overall, chronotypes and attachment are implied as transdiagnostic factors for mental health outcomes and highlighted using a Chrono-Attachment Health Model. Further research is needed to confirm these findings among flight attendants and shift workers.

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Chronotypes; anxiety; depression; attachment theory; circadian rhythms; flight attendants; shift work

Introduction

Two processes regulate the sleep/wake cycle: the homoeostatic, sleep drive, and circadian processes. The homoeostatic process involves accumulating the sleep need during wakefulness and its reduction during sleep. The circadian process, on the other hand, is an internal biological clock that synchronizes various physiological functions, including sleep and wakefulness, based on environmental cues (Borbély 1982; Mistlberger and Skene 2004).

The circadian system promotes wakefulness during the day through exogenous factors such as social environments, work schedules, and social norms (Foster 2020; Wittmann et al. 2006).

Environmental factors, such as the light-dark cycle, act as crucial temporal signals known as zeitgebers, which can entrain this cycle through the Suprachiasmatic Nucleus (SCN), the central biological clock, and sleep pacemaker, where it coordinates with other rhythmic cells and proteins (Foster 2020).

Aviation industry workers, such as pilots and cabin crews, frequently engage in transmeridian travel, crossing multiple time zones within a short period by the nature of their profession. According to the Federal Aviation Administration (FAA 2019) and European Aviation Safety Agency (EASA 2018), these professionals often have demanding schedules of approximately 90–120 flying hours per month. Their shifts can be physically challenging, requiring them to work during night shifts and early mornings while spending extended periods inside aircraft with limited exposure to daylight (Ribeiro-Silva et al. 2016). Consequently, desynchronization occurs between the internal biological clock (circadian rhythm) and the natural light-dark cycle of the external environment. This results in two significant challenges: social jetlag and jetlag.

Social jetlag occurs because of a mismatch between an individual's internal circadian rhythm and social schedule, typically due to differences in sleep-wake patterns between workdays and free days (Wittmann et al. 2006). On the other hand, jetlag is a diagnosable circadian rhythm sleep disorder that occurs when individuals traverse multiple time zones quickly (Zalai et al. 2018). The symptoms of jetlag include irregular sleep, fatigue, insomnia, and irritability (Avers et al. 2009; Tharumalay et al. 2020; Touitou et al. 2017).

The social and jetlag combination challenges flight attendants, disrupting their circadian rhythms. This natural circadian disruption affects their sleep-wake patterns and other physiological functions as part of the collective circadian rhythms (Foster 2020) due to

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misalignment between their internal body clock and their work and social demands (Glinski and Chandy 2022; Taillard et al. 2021).

Flight attendants' circadian rhythms might be disrupted due to frequent exposure to artificial light without appropriate temporal exposure to zeitgebers or by suffering from social or jet lag (Foster 2020). Exposure to light during night shifts can cause the body clock to be set to a dark cycle, leading all shift workers to adapt to a nighttime schedule. This can cause a reversal of sleep patterns (desynchronization), where flight attendants may experience disruptions in their circadian rhythm and sleep patterns (McNeely et al. 2014; Wahl et al. 2019; Weinmann et al. 2022). conversely, it is also possible that flight attendants with inherent adaptation to nighttime schedules seek this profession to fit with their circadian preference. Nevertheless, crossing multiple time zones or working during night shifts can have various adverse effects on well-being and job satisfaction (Boudreau et al. 2018; Wen et al. 2021), cognitive performance, memory (Guan and Lazar 2021), and physical health such as obesity (Potter et al. 2016).

Chronotype (CT)

Chronotype refers to an individual's circadian difference, known as morningness/eveningness. "Morning types" are more alert in the morning and sleep early, while "evening types" prefer staying up late and sleeping in later (Kandeger et al. 2019; Roenneberg et al. 2007; Roenneberg et al. 2003). The relationship between external cues (Zeitgebers) and internal cues (Circadian clock) is known as the phase of entrainment. Individuals with varying characteristics in this respect are referred to as different chronotypes (Roenneberg et al. 2007).

A general pattern of results in literature has consistently shown that individuals with evening CT tend to have higher levels of depression and anxiety than those with morning CT in different populations (Antypa et al. 2016; Papaconstantinou et al. 2019). These studies mostly involved young adults aged 18 to 24, which may have affected the results as depression and anxiety symptoms could be linked to academic and developmental stress in younger demographics.

Systematic reviews and meta-analyses have shown strong associations between mood disorders such as bipolar disorder, major depressive disorder, and evening chronotype in various populations including shift workers (Au and Reece 2017; Li et al. 2023; Linke and Jankowski 2021).

Substantial evidence suggests that preferring evening hours may increase vulnerability to adverse mental health outcomes compared to favoring early morning orientations. Where "Eveningness" was associated with depression, sleep and eating disorders in older adults (Khan et al. 2020; Kivelä et al. 2018) and emotion dysregulation, anxiety, and somatic symptoms in healthy populations (Antypa et al. 2016; Mokros et al. 2021). Demographic factors, such as gender and age, were also associated with the risk of mental health disorders (Dinu et al. 2022; Roenneberg et al. 2007) which suggests that there might be mediating variables between demographic factors and adverse mental health (Cheng et al. 2021). These mediating factors may include chronotypes. It is observed that a majority of older adults have a morning chronotype, while younger adults predominantly demonstrate evening chronotypes (Höller et al. 2021).

Mediating variables between chronotypes and depression were examined, such as resilience, suicidality, sleep quality (Mokros et al. 2021; Park et al. 2018; Zhou et al. 2021), and moderating individual differences such as the Big Five (Gorgol et al. 2022). However, the origins of these variables or the roles of otherpsychosocial factors, such as attachment styles, have not been elucidated. Additional evidence indicates that evening CT can be a transdiagnostic correlate or antecedent of drug use severity, attention difficulties, anxiety, and aggression (Alvaro et al. 2017; Taylor and Hasler 2018), and a bidirectional association might exist between depression and evening CT (Haraden et al. 2017). Developmental stressors in young adolescents may have affected these results, so replication in other populations is necessary.

Carvalho et al. (2014) found that urban areas with greater exposure to light had a higher prevalence of psychiatric disorders, while rural populations had less social jet lag. These findings are relevant to our study, especially in populations such as flight attendants who encounter artificial light exposure and irregular work schedules, potentially leading to increased mental health issues.

Where these environments can influence flight attendants' chronotype variability over time, a longitudinal study by Druiven et al. (2020) found stability of chronotype over seven years and its association with depression and that an advanced chronotype (earlier sleep-wake pattern) was significantly associated with lower severity of depression, but not anxiety. The study included control groups of healthy individuals and participants diagnosed with anxiety and depression in the Netherlands, controlling for socioeconomic factors but not for potential underpinning psychosocial factors like attachment styles.

Limited research exists on populations with disrupted circadian rhythms, such as flight attendants.

Studying their chronotypes and individual differences can reveal unique factors separate from the combined effects of sleep disruption and circadian misalignment (Foster 2020). Distinguishing their contributions among shift workers is challenging, but investigating psychosocial factors could provide new insights.

Attachment Style

Attachment theory explains how early experiences affect an individual's behavior in close relationships (Bowlby 1979; Schaffer and Emerson 1964); attachment style is complex and is influenced by biopsychosocial factors (Fraley 2019). Having a secure foundation in childhood can lead to healthy relationships later in life (Doherty and Feeney 2004). Adults may exhibit one of four attachment patterns in two-dimensional space based on their attachment anxiety and avoidance level: secure, anxious/preoccupied, avoidant/dismissive, or fearful/disorganized; the three latter types are forms of attachment insecurity, which are typically characterized by high levels of avoidance, anxiety, or both (Fraley et al. 2000; Hesse 2008; Levy et al. 2011). Secure attachment is the most common type across cultures, with avoidant being predominant in Western cultures and anxious in non-Western cultures. A normative pattern shows "23% dismissing, 58% secure, 19% preoccupied, and 18% disorganized" with no sex differences in non-clinical populations (Bakermans-Kranenburg and van IJzendoorn 2009, 246).

Individuals with higher attachment anxiety engage in rumination, self-criticism, worrying, and poor mental health outcomes, such as depression, compared to secure individuals (Dagan et al. 2018; Young et al. 2020). However, it was often meditated by psychobiological variables such as resilience and emotional regulation (Calvo et al. 2020; Lewczuk et al. 2021), as well as age and cultural orientation as moderators of attachment insecurity and depression, as shown by a meta-analysis by Zheng et al. (2020).

Conversely, individuals with higher attachment avoidance tend to use distancing strategies such as disengaging, denying stress, and attention diversion to cope with stress (Marganska et al. 2013). They may engage in distractions to suppress negative emotions, through their increasing use of social media, which suggests that they are more vulnerable to adverse mental health outcomes (Young et al. 2020). However, the magnitude of the association between attachment avoidance and depression was found to be somewhat less substantial compared to attachment anxiety Zheng et al. (2020). Moreover, the connection between attachment avoidance and these coping strategies is less consistent than that of attachment anxiety, as some studies have reported conflicting results (Stanton and Campbell 2014; Vowels et al. 2022); nevertheless, both attachment avoidance and anxiety have been associated with sleep difficulties and downstream effects on mental health outcomes (Zheng et al. 2020) and often mediating between behavioral outcomes such as addiction and suicidality (Guo et al. 2022; Stagaki et al. 2022).

These sets of behaviors unique to each attachment style's internal working model can predict an individual's coping strategies when going through stressful environments or events, subsequently affecting mental health outcomes such as depression and anxiety (Captari et al. 2021; Struck et al. 2020), where attachment styles can impact how negative experiences like trauma and stress are interpreted (Lorenzini and Fonagy 2013). This can be applied to flight attendants' stressful and shifting working environments, which can be perceived as stressors and coped with according to individual strategies, possibly influencing mental health outcomes.

Flight attendants often have jobs with high mobility, frequent travel, and short-term interactions. This environment can be appealing to individuals with dismissive attachment styles who avoid deep emotional connections and prefer superficial relationships (Brennan et al. 1998; Hazan and Shaver 1990). Dismissive flight attendants may find the transient nature of their job appealing as it allows them to maintain emotional distance and avoid intimacy, triggering their attachment insecurities. Research by Malach-Pines and Yafe-Yanai (2001) indicates how individuals with high attachment avoidance tend to choose occupations with high levels of independence and low requirements for emotional involvement. This ties in with attachment theory and the psychodynamic perspective on career choice, suggesting that individuals with insecure attachment styles might be drawn to careers that compensate for their attachment insecurities or align with their attachment-related defenses.

There is limited research on the relationship between attachment and chronotypes. Işik and Kirli (2022) found that insecure attachment styles mediated the relationship between childhood traumas and chronotype, with childhood traumas significantly affecting the preference for "Eveningness" in the context of insecure attachment. In contrast, Carciofo's study (2021) found no association between "Eveningness" and attachment styles or parent-adult relationships. But found that low morning alertness or affect, a component of circadian functioning, is associated with negative emotions and attachment insecurity; the relationship between a primary caregiver and their children can significantly

impact the children's attachment formation and their ability to develop and maintain adult relationships. This can also be observed in the context of low morning alertness, which may stem from attachment insecurity. Therefore, one could infer that a caregiver's influence on their children's attachment style can also shape their circadian preferences. Both studies used a sample of young adult students facing potential developmental issues such as low self-esteem, identity development, depression, and anxiety, which may impact the accuracy of the results (Aihie and Ohanaka 2019; Kroger and Marcia 2011; Vahratian et al. 2021). Due to limited research on attachment and chronotypes, exploring this in flight attendants may be valuable.

Mental Health

During the COVID-19 Pandemic, the US Census Bureau found that anxiety and depression were the most common mental health disorders. Up to 30% of people experience anxiety disorders and up to 20% experience depression. In 2020, adults were more than three times as likely to exhibit symptoms of mood disorders as those in 2019. Specifically, anxiety decreased while depression increased from April to May (Twenge and Joiner 2020).

Anxiety and Depression are reliable mental health indicators. There are consistent associations between depression, anxiety, and insecure attachments, where attachment anxiety and avoidance are associated with depression (Oon-Arom et al. 2021; Simon et al. 2019), and attachment anxiety is more associated with anxiety symptomology in various populations (Manning et al. 2017; Wiltgen et al. 2015); however, none have been published on populations such as flight attendants.

Flight attendants are twice as likely to experience anxiety and depression than the general population, with 40% reporting depression symptomology (Roderick 2023; Weinmann et al. 2022; Wen et al. 2021), whereas being female was found to be twice as likely to experience depression than the general population and male flight attendants are five times more likely. Forty percent of flight attendants are at risk, with longer job tenure increasing the likelihood of depression and anxiety, and 36.3% have been diagnosed with depression and/or anxiety (Cappadona et al. 2021; Wen et al. 2023). Nevertheless, empirical findings revealed a negative correlation between age and the incidence of depression among flight attendants, with a decrement of 0.02 units in the PHQ-2 score (Wen et al. 2021). These findings suggest that demographic factors also contribute to the prevalence of depression in this population.

Furthermore, shift work might explain these findings as it is a significant contributor to the prevalence of anxiety and depression among other shift workers (Zaki et al. 2016), where excessive sleep, insomnia, and "eveningness" are the most significant elements in shift workers (Wang et al. 2021). Intermediate and evening CT was the most prevalent among shift workers, though associated with young age (Choi et al. 2020). This evidence challenges the idea that flying alone is the sole creason of mental health issues for flight attendants. However, it does not entirely dismiss the notion that such disorders are prevalent among shift workers and that disrupted sleep patterns may contribute to these problems. Nevertheless, underlying factors or individual differences that may buffer or exacerbate the relationship remain unclear.

Limited research exists on how different chronotypes, attachment styles, and mental health affect flight attendants. Studying these individual differences is important to understanding the effects of disrupted sleep patterns on their psychological well-being. Considering biopsychosocial factors related to working irregular hours can help in developing interventions. Additionally, examining mediating factors can improve understanding and expand on previous research.

Hypotheses:

H1: Evening CT is associated with adverse mental health.

H2: Insecure attachment styles are predictive of increased anxiety and depression scores.

H3: Flight attendants with an insecure attachment style are more likely to have an avoidant/dismissing than an anxious/preoccupied subtype.

H4: Attachment styles mediate the relationship between CTs and mental health.

Materials and Methods

Participants

A global online survey was conducted from February to May 2023, inviting flight attendants aged between 21 and 55 y who have been actively flying and have not taken any sleep, pain, or psychotropic medications in the last six months. The survey was promoted through various channels, including SONA on the University of

Strathclyde website, where part-time student flight attendants voluntarily participated in the study to earn class credit. The survey was conducted anonymously in English, given that flight attendants are required to be proficient in the language as part of the recruitment process.

The study was promoted on aviation-related Facebook pages and aviation forums to reach flight attendants found through a Google search. Instagram and Facebook targeted regions with prominent airline hubs, such as the United Arab Emirates, the United Kingdom, the United States of America, and Australia. Additionally, the researcher employed word-of-mouth advertising through social media.

Participants provided digital informed consent before participating in the study to collect data for potential linkage to future research. The survey took approximately ten minutes and consisted mainly of multiple-choice and open-ended questions. The initial section focused on demographic and operational data and medication. The subsequent sections covered the scales in the following order: Chronotypes, Attachment, Depression, and Anxiety.

A priori power analysis was conducted using G*Power for sample size estimation for a correlational design with a significance criterion of $\alpha = .05$, and at least power = .80 to detect a small to medium effect size; r^2 values between .01 to .08 for small effect and .09 to .024 for medium effect (Cohen et al. 2002); According to G* Power the minimum sample size needed is $N = 193$ to adequately get a power = .80 and detect a small to medium effect size which aligns with similar studies (Choi et al. 2020; Young et al. 2020).

Three Hundred and Nineteen consented to participate in the survey in total. Of these ($n = 288$) have completed the survey in full. 76.4% of participants identified as White, primarily from the United States, Canada, and the United Kingdom; their Demographics shown in Table 1. Seventy-one participants who have disclosed taking medications in the past six months by answering a nominal measure of "Are you taking any medications in the past six months (i.e. pain medications, sleep aids, psychotropic drugs)" were included in the study since they completed the Qualtrics survey regarding their medication usage and that was controlled for in the analysis. Moreover, operational information were collected, such as seniority (within airlines seniority), which is operationalized as the time each flight attendant has been flying in months and years (Wen et al. 2021, 2023).

Table 1. Demographic characteristics of participants.

Characteristics	n	%
Sex		
Male	79	27.4
Female	204	70.8
Non-Binary	3	1
Prefer not to say	2	.7
Age Range		
21–25	48	16.7
26–30	56	19.4
31–35	77	26.7
36–40	49	17
41–45	27	9.4
46–50	15	5.2
51–55	16	5.6

Ethical approval was granted by The School of Psychological Sciences and Health Ethics Committee (University of Strathclyde [UoS]), 48.4 January 2023.

Design

Cross-sectional. Examining the correlations between chronotypes, attachment styles, depression, and anxiety.

Materials

Five validated scales to assess Chronotype, Attachment Style, and Mental Health:

Chronotype (CT)

We have utilized rMEQ, which measures circadian preference.

Reduced Morningness-Eveningness Questionnaire (rMEQ; Adnan & Admiral, 1991). It assesses the chronotype using items 1, 7, 10, 18, and 19 from the original MEQ (Horne and Ostberg 1976; Di Milia et al. 2013). Higher scores indicate greater morningness (Adan and Almirall 1991). It has good convergent and construct validity, with correlations ranging from .87 to .90 with the MEQ (Horne and Ostberg 1976, Di Milia et al. 2013; Young 2018), and good test-retest reliability (range: .76 to .79) (Carciofo et al. 2012; Chelminski et al. 2000; Danielsson et al. 2019). The rMEQ effectively classifies extreme chronotypes and requires less time to complete compared to the MEQ (Tonetti and Natale 2019). Cronbach's alpha for the rMEQ is satisfactory at $\alpha = .68$ (Danielsson et al. 2019). Cronbach's alpha for the present study is $\alpha = .70$

Attachment Style

Categorical and dimensional scales to assess attachment styles and potential mediation effects.

Relationship Questionnaire (RQ; Bartholomew and Horowitz 1991). A categorical questionnaire was designed to measure four adult attachment styles: secure, fearful, preoccupied, and dismissing, the latter

three are subtypes of insecure attachment (Wongpakaran et al. 2021). It consists of two parts, RQ1 and RQ2. In RQ1, participants select the paragraph that best describes their attachment. In RQ2, participants rate their agreement with each attachment prototype on a seven-point scale. Attachment categories are determined based on the highest rating. The RQ has good reliability and validity. The retest reliability of the measure ranges from .74 to .88 (Ligiéro and Gelso 2002). With satisfactory convergence and discriminant validity across 62 different cultures (Schmitt et al. 2004).

Experience in Close Relationship Scale- Short Form (ECR-S; Wei et al., 2007). Designed to assess maladaptive attachment in adults. It measures two crucial factors of adult attachment: Attachment avoidance and Attachment anxiety, utilizing a seven-point Likert scale. Single participants can answer by how they felt in their past relationships. It has high internal consistency, with coefficient alphas ranging from .77 to .86 for Anxiety and .78 to .88 for Avoidance. The Anxiety and Avoidance subscales show low correlations ($r = .19$), indicating distinct attachment dimensions. Higher scores indicate greater attachment anxiety/avoidance, lower attachment security, and vice versa (Fraley et al. 2000).

Mental Health

Two scales were utilized to measure Depression and Anxiety.

Severity Measure for Depression – Adult (Adapted from the Patient Health Questionnaire–9 Items [PHQ-9; Kroenke and Spitzer 2002]). It assesses the severity of depression. Each item corresponds to one of the diagnostic criteria for major depressive disorder in the DSM-5. Participants rate the frequency of experiencing these symptoms over the past two weeks on a scale from 0 (not at all) to 3 (nearly every day). Higher scores indicates greater severity of depressive symptoms. It has good internal consistency ($\alpha = 0.87$), test-retest reliability (0.86), and convergence validity (Ghazisaeedi et al. 2021).

Generalized Anxiety Disorder 7-Item (GAD-7; Spitzer et al. 2006). It assesses the severity of generalized anxiety disorder. It consists of seven items that measure the frequency of anxiety symptoms experienced over the past two weeks. Participants rate each item on a four-point Likert scale. Scores above 10 are considered to be in the clinical range. It has good reliability ($\alpha = 0.89$), test-retest reliability ($r = 0.83$), and construct validity and has been successfully utilized in various demographic samples (Sun et al. 2021).

Procedure

The survey was administered using QualtricsXM software (www.qualtrics.com) (Qualtrics, Seattle, WA, USA), accessible from all electronic devices.

Statistical Analysis

Analyses were carried out in IBM SPSS Statistics (version 28.0.0.0). A two-tailed p-value of < 0.05 was used as the threshold for statistical significance. Mean values (SD) were used to represent continuous data, while frequencies and percentages were used to represent categorical data. For our analysis, circadian preferences (rMEQ) were considered both as a continuous variable (higher scores indicate a tendency for morning CT) and as a categorical variable (<12 points denote evening CT; 12–17 points denote intermediate CT; >17 points morning CT) and attachment was analyzed dimensionally (ECR) and categorically (RQ1) to clarify associations and according to previous research (Işik and Kirli 2022; Young et al. 2020).

Data is not normally distributed according to the Kolmogorov–Smirnov test results in Tables 2 and 3. Hence all continuous variables were analyzed using the Kruskal-Wallis test followed by the Mann-Whitney U-test using Bonferroni correction to adjust the probability. Categorical variables were analyzed using the chi-square test, which was non-significant. To examine the relationships between CTs, attachment Styles, depression, and anxiety, correlation analyses were performed to test our hypotheses by calculating Spearman's correlation coefficients given that the PHQ9 and GAD7 distributions are positively skewed with skew values of .846 and .989, respectively, which is more than twice its standard error attributed to the exponential distributions of depression and anxiety in general populations (Löwe et al. 2008; Tomitaka et al. 2018).

Additionally, hierarchical multiple regression analysis was performed to control for confounding variables (demographics and medication) to predict depression, anxiety, CTs, and attachment styles. Previous studies (Dinu et al. 2023) have linked being female and age to CTs, and medication was correlated with some variables; sex, medication, and age were entered in Step 1 of the hierarchical regression, while in Step 2, all independent variables were utilized.

To check for linearity in each regression, the assumption was evaluated using partial regression plots. The Durbin-Watson statistic value of 2.17 confirms that the residuals are independent. This meant there was no correlation between adjacent residuals in the regression analysis. The multicollinearity assumption was also met

Table 2. Descriptives of the participants by the three Chronotypes percentaged on column totals. Data is not normally distributed according to the Kolmogorov–Smirnov significant *p* values.

	N (%)			
	Morning (n = 51)	Intermediate (n = 120)	Evening (n = 117)	Normality (sig.)
Sex, male				
N (%)	11 (21.6)	27 (22.5)	41 (35)	.000
Seniority				
(M and SD)	11.58 (7.77)	9.30 (7.07)	9.42 (6.25)	.000
Age Range N (%)				
21–25	4 (7.8)	24 (20)	20 (17.1)	<.001
26–30	10 (19.6)	26 (21.7)	20 (17.1)	
31–35	9 (17.5)	27 (22.5)	41 (35.0)	
36–40	13 (25.5)	18 (15.0)	18 (15.4)	
41–45	8 (15.7)	12 (10.0)	7 (6.0)	
46–50	2 (3.9)	7 (5.8)	6 (5.1)	
51–55	5 (9.8)	6 (5.0)	5 (4.3)	
PHQ9				
(M and SD)	7.14 (5.47)	7.95 (4.97)	8.45 (4.98)	.000
GAD7		5.79 (4.23)	6.59 (5.03)	.000
(M and SD)	6.29 (5.43)			

PHQ9: Severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder.

Table 3. Quantitative variables' scores analysis with median values for skewed variables ($n = 288$).

	Mean	SD	Median	Range.	Normality (sig.)
Seniority	9.75	6.96	8.00	0.16-35	.000
ECR-Anxiety	3.91	1.01	3.83	1-7	.046
ECR-Avoidance	2.86	1.02	2.83	1-5.83	.003
rMEQ	13.04	4.25	12.00	5-25	.000
PHQ9	8.01	5.07	7.00	0-27	.000
GAD7	6.20	4.80	5.00	0-21	.000

ECR-Anxiety: Anxiety dimension of the Experience in Close Relationships revised, ECR-Avoidance: Avoidance dimension of the Experience in Close Relationships revised, PHQ9: severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder, rMEQ: reduced Morningness-Eveningness Questionnaire.

since all the VIF and Condition Index values were less than 10 and 30, respectively. Maximum Std. Residuals were 3.6, which is above the standard 3 value showing outliers' presence, but upon checking Cook's for influence, it was not significant (not exceeding 1), so outliers were included in the analysis.

Finally, mediation analysis was conducted using the SPSS macro PROCESS (Model 4) using the bootstrapping approach for mediation (Hayes 2017), which entails generating multiple representations of a population by repeatedly sampling from the current sample to reproduce the initial sampling. Ten thousand bootstrapping samples were generated to check if the mediation effect is significant if the 95% confidence interval excludes zero (Hayes 2017).

Results

Descriptive Statistics

Characteristics of the Participants by the Three Chronotypes

Participants' ($n = 288$) characteristics in the three Chronotypes (Table 2).

Table 3 presents average scores for quantitative variables and seniority, with the average flying seniority being 9.76 years ($SD = 6.92$), ranging from .16 to 35 years.

ECR mean scores were slightly higher than the 25th percentile, and ECR norms indicated the prevalence of insecure attachment styles in the sample (Fraley et al. 2000).

RQ1 categorical scale was used to find frequencies of attachment styles related to CTs in percentages and average scores for continuous variables using categorical analysis (Table 4). Kruskal-Wallis and post-hoc tests are shown in Table 5 to examine differences between the independent groups. Bonferroni corrected t-tests were utilized to conduct it on the variables we are interested in (attachment dimensions and demographic factors).

Inferential Statistics

Correlations Between Variables

Spearman's correlations were calculated to explore the relationships between variables and biosocial factors (Table 6).

Table 4. Categorical analysis according to chronotypes and mental health, one-sample chi-square test was significant ($p < 0.001$) for all variables.

RQ1	rMEQ Total M(SD)	Morning ($n = 51$) %	Intermediate ($n = 120$) %	Evening ($n = 117$) %	PHQ9 M(SD)	GAD7 M(SD)
Secure ($n = 118$)	12.88 (4.05)	16 (13.6)	54 (45.8)	48 (40.7)	6.92 (4.47)	5.49 (4.56)
Preoccupied ($n = 42$)	13.30 (4.31)	9 (21.4)	15 (35.7)	18 (42.9)	8.59 (5.79)	6.90 (5.69)
Dismissive ($n = 79$)	13.74 (4.64)	20 (25.3)	33 (41.8)	26 (32.9)	8.79 (5.13)	6.40 (4.77)
Fearful/Disorganized ($n = 49$)	12.04 (3.91)	6 (12.2)	18 (63.3)	25 (51.0)	8.85 (5.32)	7.02 (4.38)

RQ1: Relationship Questionnaire 1, PHQ9: Severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder, rMEQ: reduced Morningness-Eveningness Questionnaire.

Table 5. Kruskal-Wallis and post hoc test results for significant groups.

Variable	Questionnaire	df	p-value	Post Hoc Comparisons (p-value*)
ECR Anxiety	PHQ9	4	<0.001	Minimal vs. Mild (0.020)
				Minimal vs. Severe (0.001)
				Minimal vs. Moderate (0.002)
				Minimal vs. Moderately Severe (0.006)
	GAD7	3	<0.001	Minimal vs. Moderate (0.003)
				Minimal vs. Severe (0.000)
				Mild vs. Severe (0.000)
ECR Avoidance	PHQ9	4	<0.001	Minimal vs. Moderate (0.001)
				Minimal vs. Moderately Severe (0.002)
				Minimal vs Severe (0.005)
	GAD7	3	<0.001	Minimal vs. Severe (0.002)
Sex	PHQ9	3	<0.001	Male vs. Female (0.004)
	GAD7	3	<0.001	Male vs. Female (0.003)
				Male vs. Prefer not to say (0.028)
Age	rMEQ		0.023	
	ECR-Anxiety		0.042	

*Bonferroni corrected.
ECR-Anxiety: Anxiety dimension of the Experience in Close Relationships revised, ECR-Avoidance: Avoidance dimension of the Experience in Close Relationships revised, PHQ9: severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder, rMEQ: reduced Morningness-Eveningness Questionnaire.

Table 6. Spearman's correlations between chronotypes, attachment, depression, anxiety, and biosocial factors.

Variables	1	2	3	4	5	6	7	8	9
1. rMEQ	1								
2. ECR- Anxiety	−.083	1							
3. ECR- Avoidance	.013	.292**	1						
4. PHQ9	−.130*	.301**	.328**	1					
5. GAD7	−.073	.334**	.260**	.690**	1				
6. RQ1	.068	.075	.271**	.154**	.093	1			
7. Sex	.125*	.032	−.036	.231**	.241**	−.007	1		
8. Seniority	.048	−.042	−.072	−.119*	−.093	.011	−.168**	1	
9. Age Range	.141*	−.034	−.124*	−.058	−.176**	.056	−.176**	.631**	1
10. Medications	−.115	.208**	−.001	.204**	.176**	.122*	−.016	.037	.055

* $p < 0.005$, ** $p < 0.001$.
ECR-Anxiety: Anxiety dimension of the Experience in Close Relationships revised, ECR-Avoidance: Avoidance dimension of the Experience in Close Relationships revised, PHQ9: severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder, rMEQ: reduced Morningness-Eveningness Questionnaire. RQ1: Relationship Questionnaire 1.

The scores for Depression and Anxiety showed a strong positive correlation. They were also positively correlated with attachment anxiety and avoidance. Moreover, unexpected positive correlations between sex and CTs, depression, and anxiety (indicating that being female is associated with higher adverse mental health outcomes and intermediate/evening CTs).

Multiple linear regressions were conducted after identifying significant associations to study the influence of independent variables on mental health variables, including demographic and quantitative factors.

Prediction Levels for the Regressions Relating to All Variables

The prediction levels and coefficients are summarized in Table 7.

Concerning all variables, the regression models were statistically significant in step 1 (Medication, Sex, and Age Range) for all except RQ1 and ECR-Avoidance models as dependent variables ($p > 0.05$). However, adding the rest of the variables in step 2, the predictive value, effect size (medium to large), and significance of the regression models were increased

Table 7. Hierarchical multiple regressions (enter method) controlling for demographics for all variables.

	RQ1	PHQ9	GAD7	ECR-Avoidance	ECR-Anxiety	rMEQ
Hierarchical Regression						
R^2 (step 1)	.017	.114***	.134***	.006	.063**	.065***
R^2 (Step 2)	.105***	.571***	.565***	.229***	.213***	.107*
ΔR^2 (difference)	.089***	.457***	.431***	.212***	.150**	.043*
Standardized Coefficients (β)						
Step 1						
Medication	.118*	.191***	−.180**	.005	.223***	−.125*
Sex	−.006	.273***	.269***	.004	1.738	.159**
Age Range	.045	−.014	−.082	−.129*	−.043	.187**
Step 2						
Medication	.128*	.056	.028	−.113*	.169**	−.099
Sex	−.037	.104*	.096*	−.103	.291	204***
Age Range	.053	.080	−0.75	−.140*	.331	.195***
rMEQ	.107	−.117*	.043	.069	−.036	–
ECR-Anxiety	−.051	−.004	.169***	.210***	–	−.040
ECR-Avoidance	.253***	.169***	−.012	–	.214***	.080
GAD7	−.045	.639***	–	−.021	.305***	.088
PHQ9	.116	–	.643***	.305***	−.007	−.244**
RQ1	–	.055	−.022	−.218***	−.045	.106

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

ECR-Anxiety: Anxiety dimension of the Experience in Close Relationships revised, ECR-Avoidance: Avoidance dimension of the Experience in Close Relationships revised, PHQ9: severity of depression for adults adapted from Patient Health Questionnaire, GAD7: Generalized Anxiety Disorder, rMEQ: reduced Morningness-Eveningness Questionnaire. RQ1: Relationship Questionnaire 1.

except for the rMEQ it was decreased. Controlling for demographic variables, the overall regression models were significantly predicting variance ($p < 0.001$) for RQ1 (small effect), PHQ9 and GAD7 (large effect), and ECR-Avoidance (moderate to large-sized effect) except for ECR-anxiety ($p < 0.01$, moderate-sized effect) and rMEQ ($p < 0.05$, small-sized effect) (Cohen et al. 2002).

Significant predictors were rMEQ ($\beta = -.117$, $p < 0.05$), where evening CTs predicted higher scores in depression. ECR-avoidance as a sole attachment dimension ($\beta = .169$, $p < 0.001$) positively predicted depression, and similarly, ECR-anxiety ($\beta = .169$, $p < 0.001$) positively predicted anxiety. Conversely and relatively stronger, depression ($\beta = .305$, $p < 0.001$) positively predicted attachment avoidance, and anxiety ($\beta = .305$, $p < 0.001$) positively predicted attachment anxiety. Medication negatively predicted attachment avoidance ($\beta = -.113$, $p < 0.05$), positively predicted attachment anxiety ($\beta = .169$, $p < 0.01$), and positively predicted RQ1 ($\beta = .128$, $p < 0.05$). Further information on the medication group in Appendix 1. Sex was also a significant predictor, where females positively predicted higher scores in Depression ($\beta = .104$, $p < 0.05$), Anxiety ($\beta = .096$, $p < 0.05$), and rMEQ ($\beta = .204$, $p < 0.001$).

The study's results have validated hypothesis 2, which posits that individuals with insecure attachment styles are more prone to experiencing heightened levels of depression and anxiety. Hypothesis 1, on the other hand, was only partially substantiated, revealing that evening CT is linked to depression but not anxiety. The study has also supported hypothesis 3, indicating that flight attendants with insecure attachment styles displayed higher incidences of dismissive attachment styles.

Exploratory Mediation Analysis

We explored the mediation of attachment on anxiety and depression, given the strong relationship in our results and based on prior research suggesting attachment mediates between various mental health indicators (Guo et al. 2022; Işik and Kirli 2022; Stagaki et al. 2022), we excluded CTs from our mediation analysis as it did not emerge as a significant predictor of attachment or anxiety. Depression was entered as a dependent variable, anxiety as a predictor, age, sex, and medications as covariates, and attachment avoidance and anxiety as mediators. Only the model where attachment avoidance entered as a mediator was significant, as shown by the bootstrapped confidence intervals being > 0.

The indirect (mediation) pathway from anxiety to depression via attachment avoidance was significant $\beta = 0.05$, 95% CI [0.021, 0.083], $p = 0.000$, and the direct pathway from anxiety to depression was significant $\beta = 0.68$, 95% CI [0.588, 0.772]. This suggests that attachment avoidance partially mediates the relationship between anxiety and depression. Hence, hypothesis 4 was not corroborated by the study, as there was no evidence to suggest that attachment styles fully mediate the relationship between CTs and mental health.

Discussion

Previous research has found that CTs are related to adverse mental health outcomes such as anxiety and

depression, where evening CT is associated with anxiety and depression (Kivelä et al. 2018; Li et al. 2023; Papaconstantinou et al. 2019), and attachment has been proposed as a mediator between CTs and psychosocial factors (Carciofo 2021; Işik and Kirli 2022). Moreover, insecure attachment has been consistently associated with depression and anxiety (Manning et al. 2017; Oon-Arom et al. 2021). Since there is no similar research on shift workers or flight attendants, our study aimed to expand on previous research by investigating the connections between CTs, attachment styles, anxiety, and depression among flight attendants. Specifically, we explored the impact of attachment on the relationships between these variables.

The sample predominantly comprised female flight attendants, with a higher frequency of individuals aged 31–35 and was predominantly White yet inclusive of individuals from diverse ethnic backgrounds. The results showed that evening and intermediate CT were the highest in the sample. CTs were linked to depression but not anxiety. This might oppose the presumption that all shift workers adjust to nighttime schedules (Foster 2020) and that CTs might oscillate by advancing or delaying according to the flying schedules, which explains the prevalence of mild anxiety and depression scores in our sample (Druiven et al. 2020). Attachment styles were not linked to CTs but were significantly associated with anxiety and depression. Dismissing was the dominant insecure attachment, partially mediating mental health outcomes.

Chronotypes

The distribution of CTs in our sample aligns with previous studies where the predominance of intermediate and evening CTs was prevalent in shift workers (Choi et al. 2020; Wang et al. 2021). In our research, older flight attendants tend to have morning CTs. Evening CTs had the highest scores in anxiety and depression which partly supports our first hypothesis and is concordant with previous research where evening CT was associated with depression in culturally diverse samples (Carciofo 2021; Gorgol et al. 2022; Li et al. 2023).

The literature lacks clarity regarding the relationship between shiftwork and mood disorders (Cheng et al. 2021). Thus, our findings on the association between evening CT and depression can be complemented by previous research on the mediating role of insomnia between mood disorders and evening CT (Taylor and Hasler 2018). Given the frequent exposure of flight attendants to jetlag, often associated with insomnia, the unique influence of evening CT may further contribute to an increased risk of developing depression in flight attendants.

Another possible explanation for the connection between depression, evening CT and being a flight attendant is the lack of natural light and overexposure to artificial light inside aircraft (Touitou et al. 2017). This disrupts the SCN, causing desynchrony with the day and night cycle (Foster 2020), negatively impacting mental health as previous studies (Carvalho et al. 2014; Wahl et al. 2019) showed a link between artificial light exposure and psychiatric disorders, which further explain the association with depression.

On the other hand, evening CT was not significantly associated with anxiety which is discordant with previous studies (Dinu et al. 2022; Wang et al. 2021). It is possible that the discrepancies in the results were caused by the varying scales used to measure CTs and the choice of their population, which differed from flight attendants. However, in our results, CTs and sex significantly predicted anxiety and depression when used in a prediction model, along with attachment styles controlling for age and medications, like Dinu et al. (2022) findings, where being female was associated with higher depression and anxiety, which can be attributed to gender-related stressors and social expectations in the job context.

Evidence for the association between CTs and depression and anxiety has been suggested by numerous studies (Papaconstantinou et al. 2019), which is discrepant with the lack of finding in our study of a correlation between CTs and anxiety; it can be due to age differences where their population being only undergraduate university students, which might confound the results by the potential developmental and academic stressors that students typically experience (Aihie and Ohanaka, 2019; Kroger and Marcia 2011), as opposed to our diverse and older sample. Nevertheless, our results suggest the potential influence of circadian disruption on mood regulation, given the significant moderate effect of CTs in predicting mental health outcomes. Future studies should focus more on the temporal relationships among flight attendants using longitudinal studies.

Attachment Styles

Attachment distribution in our sample deviated from the normative pattern, where the insecure attachment was predominant in our sample over secure attachment, and the dismissive was slightly higher than the norms (Bakermans-Kranenburg and van IJzendoorn, 2009), which suggests an interaction between occupation, and

attachment. Attachment styles were not found to be associated with CTs which is concordant with Carciofo (2021), where evening type was not associated with insecure attachment; however, they differed in finding an association of morning affect (energy in the morning) with attachment insecurity and mental health outcomes; it has to be noted that their methodology was different where they used different scales to measure mental health outcomes as a whole (anxiety, stress, and depression) without isolating the variables as we did, and they measured CTs using MESSi (eveningness, distinctness, and morning affect) that measures circadian functioning (Randler et al. 2016) as opposed to rMEQ in the present study which measures circadian preference (from extreme morningness to extreme eveningness) (Adan and Almirall 1991).

Moreover, our results diverged from Işik and Kirli (2022), who found a relationship between attachment and CTs (small effect) and a mediation of attachment between childhood trauma and CT, given that they used the same scales for measuring attachment and CTs as we did. This discordance might be to the following: First, their larger sample size ($n = 673$), predominantly young students (ranging from 21 to 24 years old). Second, the sample used in the study is limited to individuals with a reported history or diagnosis of a mental health disorder (clinical population), which may have exaggerated the results. The prevalence of childhood trauma in the sample was also noted through their use of a childhood trauma questionnaire (Işik and Kirli 2022).

Given the mixed concordance with the studies in the literature on attachment and CTs with our results, one can infer that our unique sample had a role in the results due to the jetlag and circadian rhythm disruption that characterizes flight attendants. Our sample's overall scores may differ from those of the general population (Işik and Kirli 2022) but are more similar to shift workers regarding CTs and mental health outcomes (Li et al. 2023).

Still, attachment style was a strong predictor of anxiety and depression in our regression models while controlling for demographics and medication, where attachment avoidance predicted depression and attachment anxiety predicted anxiety, which aligns with the literature (Young et al. 2020). As the coping mechanisms of each style differ, attachment-avoidant individuals tend to use distancing strategies; stress denials and dismissal are more associated with depression; and anxious individuals tend to ruminate, worry, and self-criticize, which is associated with anxiety (Calvo et al. 2020; Manning et al. 2017; Lewczuk et al. 2021; Young et al. 20200). Overall, attachment dimensions were strongly associated with depression and anxiety with a medium to large effect.

Anxiety and depression are often comorbid, where having one increases the risk of developing the other (Brown and Barlow 1992), which explains their strong relationship in our analyses. As a result, upon further exploration, we found a significant partial mediation effect of attachment avoidance on the relationship between anxiety and depression. Initially, we expected that attachment fully mediates between both mental health outcomes, as previous studies found attachment to fully mediate between psychosocial outcomes (Guo et al. 2022; Işik and Kirli 2022; Stagaki et al. 2022), which might be accounted for by our flight attendant sample. Our results highlight the role of avoidance in explaining how anxiety influences depression in flight attendants.

This is the first study showing that attachment avoidance partially mediates anxiety and depression in flight attendants. It suggests that flight attendants who exhibit higher anxiety levels and display higher attachment avoidance may be prone to experience depression, consequently exacerbating their symptomatology. This can be traced back to the unique coping mechanisms of individuals who are high on avoidance, such as stress denial, distancing, and suppression of negative affect which can result in depression (Young et al. 2020; Zheng et al. 2020). They tend to avoid emotional closeness and connections, which indicates that difficulty in maintaining close relationships may be relevant for understanding the link between anxiety and depression in flight attendants, along with their demanding and stressful work environments, which can contribute to elevated levels of anxiety (Roderick 2023). In short, having high levels of anxiety combined with a tendency to avoid emotional closeness and struggle to form secure attachments may further impact flight attendants' mental health and increase their chances of depression.

As per our third hypothesis, our sample had a prevalence of dismissive attachment among the insecure type; it can be linked to the high-stress occupation of irregular schedules, frequent travel, and separations from loved ones that flight attendants experience (Ribeiro-Silva et al. 2016; Wen et al. 2023) potentially contributing to the development of attachment avoidance (Fraley 2019). Another possibility is that flight attendants' transient lifestyle and limited long-term interpersonal commitments can be a suitable fit for someone with a predisposed dismissive attachment style or high attachment avoidance due to the unique coping strategies of that attachment, as discussed earlier.

Moreover, the psychodynamic perspective suggests that individuals often gravitate towards occupations or lifestyles that align with their unconscious psychological needs or defenses (Malach-Pines and Yafe-Yanai 2001).

Incorporating this perspective provides a broad understanding of the underlying dynamics between attachment avoidance and mental health outcomes among flight attendants. Qualitative methods should be employed to investigate that in flight attendants.

Summary of Findings

Our research has explored circadian rhythm-related individual differences in flight attendants; results have shown significant associations between CTs and depression (small effect), attachment styles and depression (medium effect), and anxiety (small to medium effect) according to r^2 values between .01 and .08 for small effect and .09 to .024 for medium effect (Cohen et al. 2002). Following our regression model, CTs, and attachment styles were significant predictors of depression and anxiety and explained between 43% and 45% of the variance with moderate effect size. Attachment avoidance partially mediates anxiety and depression, and this sample's prevalent insecure attachment type was dismissive. Flight attendants are usually associated with social and jetlag, deeming their circadian rhythm disrupted more than shift workers (Li et al. 2023), given the literature on the association of sleep disruption with circadian rhythm disruption and depression and anxiety (Foster 2020) and the incidence of mild anxiety and depression in the sample. The results indirectly demonstrated the population's sleep disruption and helped enhance our understanding of the relationships between variables, suggesting theoretical and practical implications.

Practical Implications

Chrono-Attachment Health in Flight Attendants

As flight attendants differ in CTs, attachment styles, and demographics, a conceptual model is proposed based on how impactful these variables were for designing an intervention targeting anxiety and depression, considering CTs as a transdiagnostic tool (Taylor and Hasler 2018). It potentiates tailored interventions, such as chronotherapy and attachment-based therapies. Chrono-Attachment Health might improve mental health outcomes in this group and other shift workers.

Figure 1 illustrates significant relationships between predictors of anxiety and depression (Taylor and Hasler 2018). It is grounded in established frameworks of attachment and circadian rhythm theories (Foster 2020; Fraley 2019). It can be used to assess flight attendants in future interventions by focusing on biopsychosocial factors. Further research can help refine and expand upon this model by applying it to different shift workers.

The major strengths of this study were: first, the hierarchical regression model controlled for extraneous factors; therefore, the association between CTs, attachment styles, and mental health and their incremental predictive power was not confounded by medication use, age, or sex. Second, the relatively large, diverse

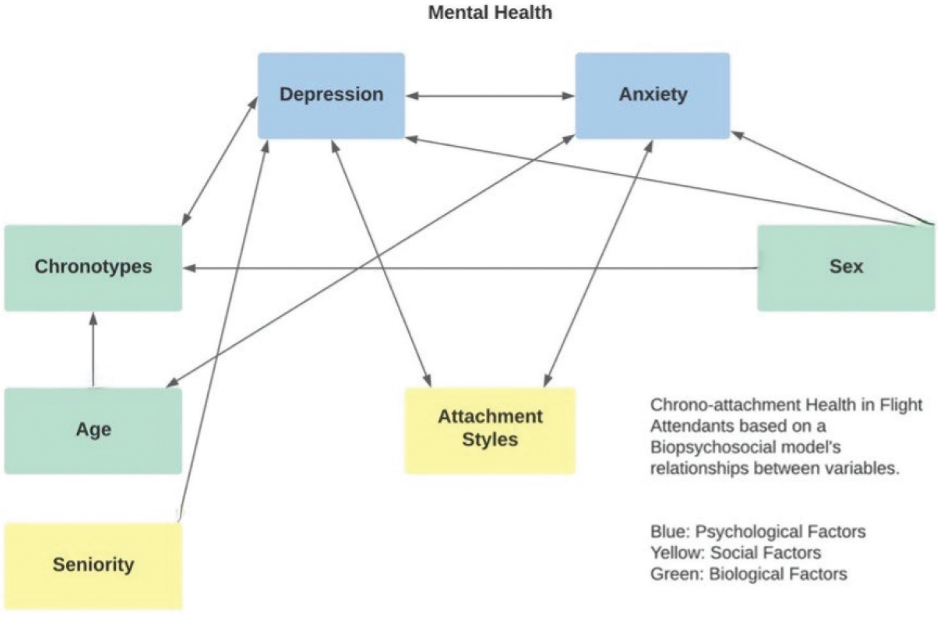

Figure 1. Chrono-attachment health in flight attendants.

sample size with sufficient statistical power. The sample included flight attendants from different countries, suggesting generalizability to various cultures. Although our sample was predominantly female due to the nature of the occupation, it was controlled for in the analysis.

The cross-sectional design and lack of control groups limit the study, precluding causal inferences and temporal relationships. Longitudinal studies on flight attendants must confirm these results and claim causal inferences. Utilizing self-report questionnaires to gather data may have induced response or recall bias. However, our findings align with previous studies that used similar measures. The present study represents a first attempt to examine biopsychosocial factors in flight attendants; further research investigating sleep would have strengthened the study. We invite researchers to use our proposed model to further explore its significance in more flight attendants and shift workers.

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Data Availability Statement

The data supporting this study's findings are available from the corresponding author, [KN], upon reasonable request.

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Appendix 1. Exploratory T-Test

As the medication group ($n = 71$) was highly correlated with attachment anxiety, depression, anxiety, and attachment style scores, a t-test was used to compare the two conditions on the variables where medicated participants scored significantly higher in ECR-Anxiety ($M = 4.31, SD = 1.00$) than non-medicated participants ($M = 3.79, SD = .98$), $t(286) = -3.856, p < .001, d = .992$, higher in PHQ9 scores ($M = 9.75, SD = 5.06$) than non-medicated participants ($M = 7.44, SD = 4.95$), $t(286) = -3.384, p < .001, d = 4.979$, higher in GAD7 scores ($M = 7.73, SD = 5.29$) than non-medicated participants ($M = 5.71, SD = 4.52$), $t(286) = -3.136, p = .002, d = 4.718$, and finally higher in RQ1 scores ($M = 2.55, SD = 1.25$) than non-medicated participants ($M = 2.20, SD = 1.25$), $t(286) = -2.057, p = .42, d = 1.249$.

This suggests that medicated participants have a history or a current diagnosis of anxiety or depression and are high on attachment anxiety and attachment insecurity. Hence, we have controlled for this variable in our analyses.