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THE EFFECT OF SOCIAL JETLAG ON BURNOUT IN
PORTUGUESE AERONAUTIC SHIFTWORKERS

Dissertation submitted to Universidade Católica Portuguesa
to obtain a Master's Degree in Psychology in Business and
Economics

By

Fanni Dézsenyi

Faculdade de Ciências Humanas & Católica Lisbon School
of Business and Economics

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Thank you!

Abstract

This cross-sectional study aimed to examine the levels of social jetlag (SJJ) and burnout and if SJJ can predict burnout. For this we used a sample of 348 workers from the aeronautic field (aircraft maintenance technicians) working in regular shift schedule, in a morning-evening shift structure, or in a rotating night – evening - morning shift condition in a Portuguese company. In this study we use the Munich ChronoType Questionnaire - MCTQ^{Shift}, the Oldenburg Burnout Inventory and the Karasek's Job Content Questionnaire to measure chronotype, SJJ, burnout and stress at work of the workers. Results suggested that working in shifts increased the possibility of having SJJ as described previously. Moreover, individuals with late chronotype were more likely to have SJJ as well as those working in 3 shifts, while sleep duration was not a significant factor for circadian misalignment. Burnout score was higher for those working in 3 shifts, and it was also predicted by social jetlag, age and stress at work. However, in this specific sample, all 3 groups showed elevated levels of burnout. This raises questions and opportunities for improving workers' health and well-being by implementing measures for reduce circadian strain and stress levels optimizing working conditions of the aeronautic maintenance technicians. The sample has its limitations due to the self-report measures, and its specificities (less women and less regular workers), however, the study prompts further research to find the real underlying causes of burnout, and to disentangle the specific predictors of this multidimensional phenomenon.

Keywords: circadian misalignment, social jetlag, aeronautic maintenance technicians, burnout, shift work

Resumo

Este estudo transversal teve como objetivo avaliar os níveis de jet lag social (JLS) e burnout e testar se o JLS é preditor para o burnout. Para tal utilizamos uma amostra de 348 trabalhadores do sector aeronáutico (técnicos de manutenção aeronáutica) a trabalhar em horário regular, num sistema de 2 turnos (manhã – tarde) e de 3 turnos rotativos (noite – tarde – manhã) numa companhia portuguesa. Neste estudo foi utilizado o Questionário de Cronotipo de Munique versão trabalho por turnos (MCTQ^{shift}), o inventário de burnout the Oldenburg e o questionário de conteúdo de trabalho de Karasek para medir cronotipo, JLS, burnout e stress no trabalho dos trabalhadores. Os resultados sugerem que trabalhar por turnos aumenta a possibilidade de ter níveis elevados de JLS, como descrito em estudos anteriores. Também indivíduos com um cronotipo tardio bem como indivíduos que trabalham em 3 turnos. Contudo a duração do sono não foi um fator significativo para o desalinhamento circadiano. Os indivíduos que trabalham em 3 turnos mostraram níveis elevados de burnout, mas jet lag social, idade e stresse no trabalho também foram preditores para o burnout. Para esta amostra em particular, os 3 grupos apresentaram níveis elevados de burnout. Isso levanta questões relevantes e oportunidades para melhorar a saúde e o bem-estar dos trabalhadores através da implementação de medidas para reduzir o desalinhamento circadiano e os níveis de stresse, otimizando as condições de trabalho dos técnicos de manutenção aeronáutica. A amostra, apesar das limitações (auto-reporte), as especificidades da amostra (menos mulheres e amostra de trabalhadores regulares reduzida), leva-nos a sugerir novos estudos com o objetivo de encontrar as reais causas subjacentes ao burnout e para encontrar preditores específicos deste fenómeno multidimensional.

Palavras-chave: desalinhamento circadiano, jet lag social, técnicos de manutenção aeronáutica, burnout, trabalho por turnos

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I – Introduction

The human daily life is influenced by three factors which also influence each other: a social, an internal and an external factor that has to be in synchrony in order for the individual to function properly. Social factors include the schedule of work or school, internal factors are our biological genetically influenced circadian rhythms and external factors consist of the rotation of the Earth, the light, etc (Roenneberg et al., 2019). Scientific evidence shows that shift work may interfere with human daily life and alter the cycles of the human body (Anund et al., 2018; Castilhos Beauvalet et al., 2017; Schernhammer et al., 2001). The individual's chronotype may moderate the effect of shift work on circadian rhythms (Dickerman et al., 2016; Juda et al., 2013a; Leung et al., 2016; Papantoniou et al., 2015).

The dissertation is going to give an insight into circadian rhythms, chronotype and its importance, circadian misalignments in general, social jetlag, shift work in general, shift work disorder, burnout and its relation to shift work and it is going to end the introduction by describing the importance of research about aeronautic mechanical workers.

1. Circadian Rhythms

Circadian rhythms are near 24-hour oscillations found in essentially every physiological process in the human brain and body, but these rhythms can be found in all living organisms (Thorpy, 2017). These rhythms are endogenously driven and regulate many physiological processes. They synchronize with the Earth's rotation by various stimuli, photic or non-photoc, which may be found in the physical environment. These stimuli are also called "*zeitgebers*" which in German means "time-givers", light is the primary zeitgeber, however, activity and eating schedules are also important synchronizers (Golombek & Rosenstein, 2010). This synchronization of biological endogenous processes to the zeitgebers is called entrainment and the relationship between the biological clock and the zeitgebers is called the phase of entrainment (Roenneberg et al., 2019). The endogenous biological clock if isolated from social stimulus and light, follows a 24.18 hour period (Czeisler et al., 1999), therefore, it is important to have it entrained every day to the 24-hour zeitgebers to maintain the human organisms' healthy rhythms (e.g., a healthy sleep-wake cycle) (Roenneberg et al., 2003).

In order to understand the possible effects of shift work on the central circadian timing system, the basic knowledge of the underlying mechanisms is needed. It has three main components: firstly the suprachiasmatic nucleus (SCN) located in the anterior hypothalamus, which synchronizes the changes in the external environment in a 24-hour period with changes in the internal environment in 24 hours; the second component consists of the input pathways for the various stimuli that do the synchronization, and the last component contains the output pathways that are regulated by the SCN (Benarroch, 2008).

As mentioned above, the suprachiasmatic nucleus is a key agent in the regulating process: photic information from the retina received via indirect – retinogeniculate – and direct – retinohypothalamic – pathways and non-photoc information received from the raphe nuclei converge in the SCN. Furthermore, the SCN receives information from the posterior hypothalamus, medulla, pons and basal forebrain. The SCN has numerous efferent pathways as well, as it sends information to various other parts of the brain (Zee et al., 2013).

The SCN interprets the photic information to determine in which part of the day the individual is, and when it perceives to be in dim light condition, it sends signals to the pineal gland to secrete melatonin, to promote sleepiness and help maintaining sleep, thus it has a coordinating function in the peripheral metabolism as well. With circadian rhythms aligned, the fluctuations of melatonin levels are as follows: it has its onset approximately 2 hours before the natural sleep time peaking during the middle of the night. (Greco & Sassone-Corsi, 2019; Zee et al., 2013).

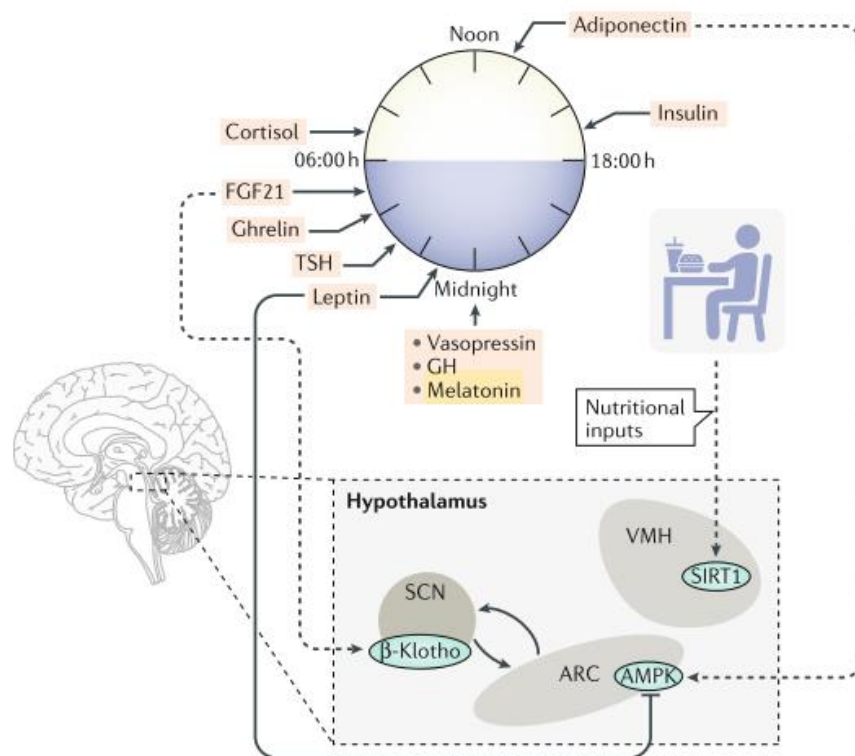
A huge breakthrough in chronobiology research took place when scientists discovered evidence for further circadian clocks in regions of the brain (other than the suprachiasmatic nucleus) and almost in all peripheral tissues (Cermakian & Boivin, 2009). A growing body of scientific evidence shows that the master regulating clock is still in the SCN and this is what governs peripheral clocks, which feed back to the central circadian clock (Greco & Sassone-Corsi, 2019).

Figure 1. shows the interaction between central and peripheral clocks. Oscillating levels of hormones secreted peripherally such as insulin, cortisol, thyroid-stimulating hormone (TSH), ghrelin, growth hormone (GH), vasopressin and the above mentioned melatonin mediate centrally the circadian physiology over a 24-hour-long period – a day – providing

negative and positive feedback to the clocks in the brain. The SCN is in touch with every cell of the body as well: the AMP-activated protein kinase (AMPK) is an essential sensor for cellular energy, which is involved in the regulation of the whole body-energy status (López et al., 2016). The AMPK's hypothalamic activity is balanced by the action of adiponectin and leptin which are adipokines. Research suggests that the leptin–adiponectin–AMPK axis may send feedback to the SCN through the arcuate nucleus, ARC. The SCN is modulated by further humoral and metabolic regulators as well (Greco & Sassone–Corsi, 2019).

Figure 1.

The interaction between central and peripheral clocks



Note. The interaction between central and peripheral clocks (Greco & Sassone–Corsi, 2019). Dotted arrows mean activation, while solid arrows mean inhibition.

2. Chronotypes

The three factors mentioned in the introduction – social, external and internal factors – may influence the individual's chronotype (Potter et al., 2016). This concept may be interpreted in two ways: as a psychological preference or as a biological construct. If interpreted as a psychological construct it means the diurnal preferences assessed via self-assessment using the Morningness-Eveningness Questionnaire (MEQ) (Horne & Ostberg, 1976). However, recently the opinion that it is a biological construct became increasingly popular among scientists, according to which it is an endogenously regulated biological rhythm, which defines the period of wakefulness and sleep in a (24-hour-long) day (Potter et al., 2016).

There are vast differences in people's chronotypes: ranging from extreme early (who prefer to wake up early and go to bed early) to extreme late types (who prefer to sleep late and wake up late), with the majority of the population showing preferences between these extremes (Wittmann et al., 2006). Therefore, the human chronotypes are thought to be normally distributed in the general population (Roenneberg et al., 2019).

There is an ongoing debate in the scientific society about whether chronotype is a trait (which is stable over time and not significantly influenced by situational effects) or a current state (volatile, and dependent on situational factors). This debate originates from the following phenomenon: The phase of entrainment of a person with a specific zeitgeber may be perceived as stable, however, the signaling of the zeitgeber itself may be varying in timing, strength, therefore, in the real world, due to the volatile influence of the zeitgeber, the chronotype may be better perceived as a state rather than a stable trait (Gehrman et al., 2019). In other words, the chronotype is as stable as its entraining environment. Roenneberg and colleagues in a critical review suggested abandoning the stable trait-like concept of chronotype based on findings of recent research such as one that managed to advance the phase of entrainment of late-chronotype individuals by exerting zeitgeber changes (Facer-Childs et al., 2019) and research that acknowledged the changes in one's chronotype over life-time (age-dependent) (Roenneberg et al., 2004). One should not forget about the genetically based nature of the dynamic chronotype, to which Roenneberg also calls our attention, as in the experiment of Facer-Childs and colleagues in which the late-chronotype

individuals tended to relapse to their original phase upon terminating the intervention (Roenneberg et al., 2019; Zerbini et al., 2020).

3. Misalignment

As it is mentioned above, in order for an individual to function properly (work, eat, sleep) the circadian rhythms must be aligned with each other and with the environment. When there is a discrepancy between the circadian timing and the external environment it is called a circadian misalignment (e.g. shift work or jetlag) and a dysfunction of these biological mechanisms emerges – due to e.g. different disorders, abnormalities in the sleep-wake phase, etc. – that may lead to an internal desynchronization, which may consequently bring about circadian rhythm disorders which share common symptoms such as difficulty to fall asleep and/or maintain the sleeping state, which result in excessive sleepiness, which result in an impairment in daily functioning (Zee et al., 2013).

4. Social Jetlag

The discovery and popularization of electricity made a huge impact on our daily lives. Even when outside is dark, we switch on the light; therefore, we are only exposed to darkness when we turn the lights off thus weakening the effects of natural light as the most prevalent zeitgeber. This caused a change in the human biological clocks, which brought about a widening in the chronotype distribution and a delay in all types except for those who had a very early chronotype (Wright et al., 2013). However, the job and/or school schedules, which determine the social clock did not follow these changes, thus causing a misalignment between these two. This misalignment between the social and the biological clocks is called a social jetlag (Roenneberg et al., 2019; Wittmann et al., 2006), and it may be used to measure circadian misalignment (Hulsegge et al., 2019).

When the individual's chronotype – preferred biological timing – does not fit the socially imposed schedules in the individual's life (e.g., work, school) – the social timing – the individual may take away from the sleeping time in order to fulfil the social requirements. However, eventually the individual needs to compensate for the lost sleeping hours. The most affected individuals are the late chronotypes, who in reality show the biggest

differences between how much they get to sleep during the workdays and how much on free days (they sleep less on workdays and sleep more on weekends to balance the sleep loss) which results in a substantial sleep debt on their working days. This chronic discrepancy between the amount of sleep between the free and workdays – the socially imposed schedules and biologically preferred timing – is the social jetlag (Roenneberg et al., 2019; Wittmann et al., 2006). A recent study showed that the imposed restrictions of COVID-19 pandemic led to a relaxed social time pressure promoting more sleep, smaller SJL and reduced use of alarm clocks (Korman et al., 2020). Generally SJL, is calculated as a result of differences in sleep timing between working and non-working days and from the compensation on the free days for the work-day-related accumulated sleep debt (later mid-sleep point on free days) (Roenneberg et al., 2019; Wittmann et al., 2006). This calculation gives us the notion of negative and positive social jetlag. Negative social jetlag is rare, it is only 1-2% of the population, and it occurs when the mid-sleep times are later on workdays than on free days, while positive social jetlag is the opposite, when the mid-sleep point on weekdays falls to an earlier time than on free days (Roenneberg et al., 2019).

Jankowski proposed another formula to calculate social jetlag, in which both mid-sleep points (workdays and non-workdays) were corrected for sleep debt as he argued that the accumulated sleep debt changed both midsleep points (Jankowski, 2017).

Social jetlag was not classified as a sleep disorder as it was not included in the International classification of sleep disorders (Thorpy, 2017).

Social jetlag is associated with several adverse behavioural and health outcomes. Among the adverse behavioural outcomes there are: a tendency to follow a more unhealthy dietary pattern (Almoosawi et al., 2018); to be at an increased chance of smoking (Wittmann et al., 2006); a negative correlation to high school and university academic performance (Díaz-Morales & Escribano, 2015; Haraszti et al., 2014); and an increased verbal and physical aggression among bachelor students (Randler & Vollmer, 2013).

Among social jetlag's negative health effects there are a higher risk for being obese and to have a metabolic disorder (Alves et al., 2017; Koopman et al., 2017; Parsons et al., 2015; Wong et al., 2015).

Some studies found a relationship between social jetlag and depressive symptoms (Borisenkov et al., 2015; Levandovski et al., 2011; Polugrudov et al., 2016), although others did not suggest such a relationship (Knapen et al., 2018; Schimitt et al., 2013; Sheaves et al., 2016).

A meta-analysis conducted in 2017 examining 26 studies found mainly association of neuropsychiatric disorders with social jetlag: minor psychiatric symptoms, epilepsy, aggression, mood disorders, conduct problems, cognitive impairment, and increased risk for substance use, moreover it suggested an adverse endocrine profile and a higher cardiometabolic risk in relation to social jetlag. However, the study draws attention to the fact that there is no consensus on the associations suggested or any high-level evidence which might be due to the heterogeneity of the populations or the methods applied in different studies, therefore, caution is suggested to be applied while interpreting these results (Castilhos Beauvalet et al., 2017).

Research suggests that an important factor for the increased associated risk for unhealthy outcomes in multiple domains is the irregularity of sleep timing. However, there is a widespread misconception according to which it is advised to wake up on non-working days as early as on working days as the adverse outcomes derive from sleeping in on the free days. Despite of its best intention, this advice is counterproductive as a large cohort study found that individuals who get less sleep on working days and get no recovery sleep on the free days have a higher mortality rate (Åkerstedt et al., 2019).

5. Sleep

Sleep is a basic biological human need such as air, water or food (Grandner, 2017). Prehistoric evidence shows an immemorial fascination with the reasons and processes of sleep, which generated the first theories of sleep in both the Eastern and Western world (e.g. ancient Egypt, Mesopotamia, Greece and China) wanting to unveil the mysteries around sleep with the first beliefs dating back to 3000 BC (Williams, 2013).

Sleep is a biological need influenced by genetic, intrapersonal, social and environmental factors, which causes individual differences in sleep behaviours and practices. Humans on average dedicate 20-40% of their day to sleep (Grandner, 2017). Provided that no human

can function without sleep it was incorporated into the sociocultural structures as well. Therefore, it became indicative of social status (rich or poor), of power (powerful or powerless), area of residence (rural or urban), etc. (Williams, 2013).

While ancient theories aim to discover why and how we sleep, recent studies focused on the relationship between sleep quality and duration and the human health as well, especially regarding abnormal patterns of sleep such as the lack of sleep, circadian misalignment, etc. Studies found that the above mentioned result in inadequate sleep duration or insufficient sleep quality, which affects many physiological processes (Grandner, 2017).

Studies show that a substantial percentage of the human population does not sleep the right amount of time. Krueger and Friedman found that 28.3% of the respondents slept 6 hours or less, 30.8% slept around 7 hours, 32.5% slept 8 hours and 8.5% slept 9 or more hours on average (Krueger & Friedman, 2009). Other studies found similar results that approximately one third of the population sleeps 6 hours or less, which counts as too short amount of sleep, which has proved to affect health adversely (Grandner, 2017). Moreover, a recent American meta-analysis showed that there is a tendency that more people sleep less now compared to data from a few decades ago: e.g. 7.6% of the American sample reported to sleep less than 6 hours in 1975, while 9.3% reported the same in 2006 (Knutson et al., 2010).

According to the American Academy of Sleep Medicine and Sleep Research Society, insufficient sleep has downstream effects in the following domains: general health, metabolic, cardiovascular, immunologic and mental health, furthermore it is related to human performance, pain, cancer and mortality as well (Watson et al., 2015).

Most studies from 6 continents examining mortality risk found a correlation between mortality and too short (equal or less than 6 hours) or too long (equal or more than 9 hours) sleep duration. Those who on average sleep 6 hours or less (too short) showed a 10% to 12% increased risk of mortality, while those who sleep 9 or more hours (too long) had a 30% to 38% higher risk of mortality (Cappuccio et al., 2010; Gallicchio & Kalesan, 2009). In line with these findings a recent study using a Portuguese sample investigated the relationship between too short and too long sleep duration and chronic disorders. In this sample, 20.7 % of the population presented data that showed that they sleep 5 or less hours and 5.9% (too

short) slept 9 or more hours (too long). This study associated too short sleep with hypertension, hypercholesterolemia and gastrointestinal disease, obesity, diabetes and multimorbidity, while too long sleep was related to cardiovascular disease and depression. Both too long and too short sleep was associated with being older, having a lower level of education, being retired and being unemployed, as well as to worse quality of life and bad physical function. These people were more likely to have been hospitalized in the previous 12 months (Reis et al., 2018).

Although this was a general pattern among studies, the results are still debated. Some studies used poor measurement instruments: e.g. self-reported sleep time shows the time spent in bed, not the actual time spent with sleeping; therefore it is often an overestimation (Grandner, Hale, et al., 2010; Grandner, Patel, et al., 2010; Kurina et al., 2013). Furthermore, in spite of the fact that some explanations have been proposed why too much sleep is correlated with adverse health effects (Grandner & Drummond, 2007; Youngstedt & Kripke, 2004), it still lacks a biological basis, therefore, studies focused more on the adverse health outcomes of shorter than average sleep duration.

Scientific evidence shows an association between sleep duration and weight gain. Several longitudinal studies proved a causality effect of short or very long sleep duration for weight gain (Chaput et al., 2014; Kim et al., 2011; Watanabe et al., 2010), and objective and self-reported obesity (Grandner et al., 2014).

Insufficient sleep is also found to be associated with a 33% higher risk for incident diabetes (Shan et al., 2015), which is backed by laboratorial studies as well: a one-week sleep restriction in men reduced insulin sensitivity (Buxton et al., 2010), increased consumption of unhealthy food (Kim et al., 2011; Spaeth et al., 2014). Furthermore, metabolic studies showed that sleep loss may impact metabolic hormones (Van Cauter, E.a , Spiegel, K.b, Tasali, E.a, Leproult, 2008), and alter adipocyte function causing elevations in visfatin and leptin, which is related to inflammation and insulin resistance (Hayes et al., 2011), and influences beta-cell function as well (Perelis et al., 2016).

Scientific evidence showed that reduced sleep duration is linked to a pro-inflammatory state with higher levels of inflammatory cytokines, e.g. interleukin 1B (IL-1B), interleukin

6 (IL-6), interleukin 17 (IL-17), tumor necrosis factor- α and C-reactive protein (Grandner et al., 2013).

In addition to the above mentioned, another adverse effect of short sleep is the elevated risk of cardiovascular disease. A meta-analysis of longitudinal studies found a 20% higher chance of hypertension to be associated with habitual short sleep duration, relative to normal sleep duration (Meng et al., 2013). Moreover, it was found to be linked to the risk of coronary artery calcification (King et al., 2008) and hypercholesterolemia and objective and self-reported hyperlipidemia (Grandner et al., 2014).

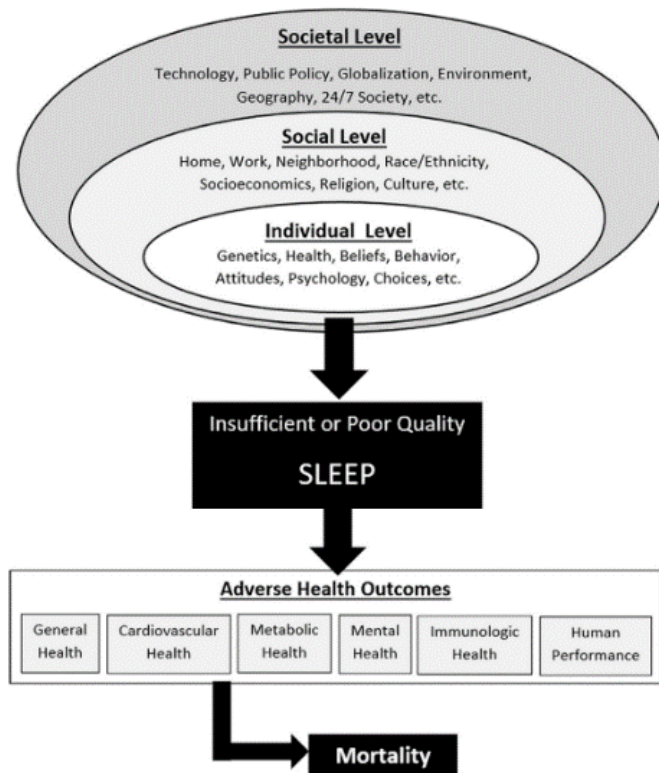
Several studies examined the correlation between sleep loss and neurocognitive functioning. Sleep loss affects cognitive and psychomotor speed, executive and vigilant attention, working memory and higher cognitive abilities.

Evidence shows that sleep time is negatively correlated with attentional lapses and that cognitive deficits caused by premature sleep curtailment and sleep fragmentation accumulate over time to severe levels even without the individual being fully aware of it. Studies using functional neuroimaging techniques showed that sleep-deprivation-induced cognitive lapses that are frequent and progressively longer are suggested to be long-lasting as they involve changes in the cortex and deeper areas as well: in the frontal and parietal control areas, areas responsible for secondary sensory processing and thalamic areas (Goel et al., 2009). Furthermore, some studies showed that a reduction in sleep duration was associated with drowsy driving (Maia et al., 2013) and that disturbed sleep schedule due to extended-shift work was associated with higher occupational accidents (Chiu & Tsai, 2013).

Abnormal sleep patterns are a common feature of many mental disorders (APA, 2013). A recent study identified a difficulty maintaining and initiating sleep to be a risk factor for suicidal ideations (Chakravorty et al., 2015).

The social ecological model in Figure 2, first published in 2010 (Grandner, Hale, et al., 2010), explains how societal factors influence sleep and what are their downstream outcomes. The model places the individual factors influencing sleep in the social context, which is embedded into the society. It is clear from this model that work – especially shift work (Sallinen & Kecklund, 2010) – which is placed at the at the social level, is related to sleep quality and quantity (Grandner, 2017).

Figure 2. *Social Ecological model (Grandner, 2017)*



6. Shift work

The Portuguese legislation defines shift work as: any organization of team work in which workers successively occupy the same jobs, at a certain pace, including in a rotating, continuous or discontinuous way, being able to perform work at different times, in a given period of days or weeks (Portuguese Parliament, 2009).

To Kecklund and Axelsson, shift work means: work time arrangements outside of the normal conventional daytime hours (6:00h-18:00h), “which includes fixed early morning, evening, and night work, as well as roster - or scheduled - work and rotating three shift work” (Kecklund & Axelsson, 2016:1). The International classification of sleep disorders recognizes the following shift types: “...evening shifts, night shifts, early morning shifts, rotating shifts, split shifts, on-call overnight duty, and long duration work shifts that include work hours at night” (Thorpy, 2017:215).

The classification of shifts and the definitions of the above mentioned shifts are not always identical, however night shift usually starts between 18:00h and 4:00h (Drake & Wright, 2010) , early morning shifts start 4:00h and 7:00h (Thorpy, 2017), afternoon or evening shift workers usually start working between 14:00h and 18:00h (Drake & Wright, 2010). Rotating three shift work means that the employee has a regular alternating schedule of early morning, daytime and night shifts (Kecklund & Axelsson, 2016). Split shifts – in order to follow peak hours – separate the working period into 2 or more segments. They usually include an early morning part (e.g., 5:00h-9:00h) with a long break and an afternoon part (e.g.,15:00h-19:00h) (Anund et al., 2018).

According to a European Working Conditions Survey, 19% of the European working population has a night shift at least once a month, and 21% works shifts (Eurofound, 2017), while in the US 29% of the workers work in unconventional time arrangements (Alterman et al., 2012).

Some type of shifts work forcefully interrupt one of our most important circadian rhythms, the sleep-wake cycle, which normally consists of 8 hours of sleep and 16 hours of wakefulness in a 24-hour day. Studies have shown that shift work is associated with a decrease in the quality and quantity of sleep leading to excessive fatigue (Sallinen & Kecklund, 2010). Early morning shifts, night shifts and rotating shifts are the most commonly associated with sleep disturbances, as in these cases there might be a reduction of 1- 4 hours in the total sleeping time and the quality of sleep may be unsatisfactory (Thorpy, 2017). Growing evidence suggests that shift work has long-term adverse health consequences; however, evidence is still somewhat inconsistent.

There is a scientific debate about whether shift work is a direct cause of chronic diseases, and although some research points out the lack of evidence for it (Puttonen et al., 2010), various studies nevertheless associated shift work with adverse health consequences. It is hard to determine a causality effect of night shifts and early morning shifts resulting in acute sleep loss, therefore, the consequences of these shifts are similar to that of insufficient sleep.

The negative consequences associated with shift work were: an elevated risk for cardiovascular disease, general fatigue, anxiety, reduction in the quality and quantity of sleep, depression, an increased risk of miscarriage or premature birth and low birth weight,

gastrointestinal disorders (Harrington, 2001), an increased risk for accidents, type 2 diabetes, coronary heart disease, weight gain, stroke (Kecklund & Axelsson, 2016), poor eating habits (Morikawa et al., 2008), an increased risk of breast cancer (Davis et al., 2001; Schernhammer et al., 2001) and an increased risk of duodenal ulcers (Pietroiusti et al., 2006).

Furthermore, laboratory studies indicated that cognitive impairments and cardio-metabolic stress are exacerbated by sleep loss as well as by shift work. Given the similarities, these two phenomena probably share common underlying mechanisms, although in order to establish causality, additional research is needed (Kecklund & Axelsson, 2016).

As it is seen above, there is a huge amount of evidence showing that poor sleep quality and/or sleep loss (insomnia-related symptoms) have similar adverse long-term health consequences to that of shift work, therefore, insomnia related symptoms may mediate the effects of shift work on health (Kecklund & Axelsson, 2016).

Chronotype may modify the effects of shift work on health (Dickerman et al., 2016; Juda et al., 2013a; Leung et al., 2016; Papantoniou et al., 2015).

A considerable amount of shift workers may develop Shift Work Disorder (SWD). Many factors may play a role in determining the shift worker's susceptibility to the SWD, namely: differences in types of shift work, the frequency and duration of the shift, differences in circadian and sleep physiology and in the family social responsibilities. According to the diagnostic criteria of *The International Classification of sleep disorders – third edition (ICSD-3)*, SWD is diagnosed when the individual experiences for a minimum period of 3 months: a chronic excessive sleepiness during the wake time (working hours) of the daily sleep-wake cycle; and/or experiences symptoms of insomnia during the desired or required sleep time; and these symptoms occur due to the unconventional schedules of shift work, which (at least partially) overlap the usual time of sleep (Thorpy, 2017).

This disorder is directly associated with sleep loss and circadian misalignment. Due to the weakened zeitgebers, e.g., working under artificial light at night, eating in normal sleeping time generates a sleep disturbance which may result in sleep loss. Tolerance for working at night shows great individual differences and appears to involve differences in the extent of circadian adaptation to an inverted schedule (night-work, day-sleep) or alternatively it may be related to the fact that individuals respond differently to homeostatic

and circadian influences on the regulation of the sleep-wake cycle. Social and environmental factors may increase sleep loss related to shift work schedule: e.g., domestic chores, social programs, commuting time, trying to resume a normal night-sleep and daytime-activities schedule on free days due to peer/family pressure, etc. (Thorpy, 2017).

As a consequence of SWD gastrointestinal, reproductive, neoplastic, metabolic and cardiovascular disorders may be exacerbated, the individual might develop substance abuse and dependency attempting to combat fatigue, excessive sleepiness and sleep disturbances. SWD patients frequently have disrupted family and social life (Thorpy, 2017).

The individuals working in night, early morning and rotating shifts are the most susceptible for sleep disturbances as in these cases there might be a reduction of 1-4 hours in the total sleeping time and the quality of sleep may be unsatisfactory. SWD usually occurs only for the period of working in the shift schedule, however in some cases the sleep disturbance might be chronic and may persist even after the individual has switched to conventional working hours (Thorpy, 2017).

According to the ICSD-3, the clinical estimates of the prevalence of the disorder are between 2-5% in the general population. However, a study conducted in 2005 suggested a lower percentage, as it stated that SWD prevalence in the general population is approximately 1%. The ICSD-3 estimated a ~10% - 38% prevalence of SWD among rotating and night shift workers excluding those working early morning or split shift work, which may add further percentages to the estimates (Thorpy, 2017).

Drake and colleagues found a 10% prevalence in rotating and night shift workers in their study of 2005 (Drake et al., 2005). A 2009 study asking a total of 103 oil rig workers, working in different shifts at the North Sea (for two weeks working 12-hour shifts on 7 nights/7 days, with 4 weeks off), found that 24 individuals were suffering from SWD, which yields to a 23.3% of prevalence in the oil rig worker sample (Waage et al., 2009). A 2012 study found that the prevalence of SWD was up to 40% among nurses (Flo et al., 2012).

7. Burnout

Burnout or burnout syndrome was first mentioned in 1974 (Freudenberger, Herbert, 1974), and although some papers suggested to be used as a diagnosis for an illness (Préat,

2000) so much that in some countries it is an accepted category for sick leave (Friberg, 2009), it is still not recognized as a distinct pathology by the DSM-5 (APA, 2013), but it is often viewed as a form of depression which has 3 characteristics that are caused by chronic occupational stress: emotional exhaustion, depersonalization and reduced personal accomplishment (Bianchi et al., 2015). Other explanations include factors such as having negative behaviors and attitudes towards clients, the users, the work itself and the organization explaining burnout as a gradual process of subjective experiences that result in emotional and practical problems for both the individual and the organization (Murofuse et al., 2005).

The most accepted definition of the ICD-11 (World Health Organization, 2018) of burnout syndrome understands it as a phenomenon to be exclusively interpreted in an occupational context (and no other areas of life), which is a result of chronic workplace stress that was not successfully dealt with, and it defines it as a three-dimensional concept, which includes:

- a. feelings of exhaustion and energy depletion;
- b. mental distancing of the individual of his/her job, feelings of cynicism or negativism in relation to his/her job;
- c. a perceived lack of accomplishment and ineffectiveness.

Research suggested a huge variety of the prevalence of burnout depending on the examined population which may range from 4% up to 85.7% (Trigo et al., 2007).

Burnout has been associated with adverse mental and physical health consequences, adverse social outcomes and negative consequences in the working context as well (Galindo et al., 2012; Murofuse et al., 2005; Trigo et al., 2007).

Among the adverse mental and physical health consequences there are: cardiovascular diseases; chronic fatigue; headache; migraine; insomnia; peptic ulcers; joint or muscle pain; anxiety; depression; irritability (Galindo et al., 2012; Murofuse et al., 2005; Trigo et al., 2007).

Social consequences of burnout may be: altered the personal domestic life; altered family relationships due to the lack of free time for them (Galindo et al., 2012; Murofuse et al., 2005; Trigo et al., 2007). In the working context the consequences of burnout are:

absenteeism, higher job turnover, increase of violent behaviors and a decrease in the quality of the individual's work (Galindo et al., 2012; Murofuse et al., 2005; Trigo et al., 2007).

8. Burnout and shift work

Burnout has not been extensively researched in relation to shift work (Vidotti et al., 2018). A cross-sectional study of 12 European countries suggested that nurses who worked shifts of more than 12 hours were more likely to experience burnout than those of working 8-hour-long shifts (Dall'Ora et al., 2015). A study conducted in 2018 found higher prevalence for burnout syndrome among those nurses who worked the day-shift compared to those doing the night shift. The levels of emotional exhaustion and low professional fulfilment followed the same pattern. The researchers suggested individual differences, sedentary lifestyle and higher work demand during the day shift as possible underlying motives for these findings (Vidotti et al., 2018).

A cross-sectional Brazilian study found no correlation between working in shifts and having burnout compared to those who do not do shifts, but the overall prevalence (39%) of burnout was higher in this sample than it was generally observed in other studies (Nascimento et al., 2019), (4,7%(Galindo et al., 2012) - 35% (Rodrigues et al., 2014)).

A study using a nationwide survey of 16 440 Taiwanese shift workers of 4 type of shifts: fixed day or fixed night shifts and rotating day or night shifts found that those workers who reported to work in fixed night shifts showed the shortest hours of sleep and insomnia. Women in fixed night shifts were more likely to experience burnout and other mental health problems. However, upon controlling for insomnia, this association disappeared suggesting a mediating role for insomnia between doing fixed night shifts and burnout in women (Cheng & Cheng, 2017).

Other studies also found factors such as insufficient sleep to be a significant predictor of burnout (Söderström et al., 2012).

An Iranian study examining nurses found that this who worked permanent, irregular shifts and more than 40 weekly hours had higher levels of burnout. One underlying reason might be that the circadian rhythm of those working in irregular shifts is repeatedly disrupted resulting in poor sleep quality. This – and improper social interactions – may result in

irritability and isolation which increases the likelihood of emotional exhaustion, which is often described as one of the characteristics of burnout. Females reported higher levels of burnout syndrome and also those who tolerated sleepiness to a lesser amount. Those who were less satisfied with their job or had less workplace support were more likely to experience burnout (Bagheri Hosseinabadi et al., 2019).

A study using a Thai sample of health care professionals found that the years spent in shift work was positively associated with the level of burnout (above 10 years of working in shifts corresponded to increased levels of burnout). It suggested adequate sleeping hours and free days as likely protective factors against burnout (Wisetborisut et al., 2014).

A recent Dutch study investigating the relationship between shift work and burnout using non-shift factory workers and rotating-5-shift workers (rotation of 2 morning/afternoon or evening shifts with 3-4 free days) found that shift work was related to distress and burnout in those experiencing job dissatisfaction and in those perceived that their lives were highly impacted by working in shifts (Hulsegge et al., 2020).

9. Aeronautical mechanic workers

Mechanic aeronautic workers are technicians who are responsible for the aeronautic maintenance. Similar to that of airline pilots, their job is also highly demanding, and a possible error can compromise the safety of the aircraft. Both, pilots and technicians work in shifts, therefore they are both susceptible for the negative health effects of shift work, e.g., excessive fatigue and/or sleepiness (Reis et al., 2016, 2020).

However, unlike for airline pilots, where the scheduling of the shifts has been regulated to balance the work and resting times and to counterweight the negative effects (EASA, 2019), the shifts of aeronautic mechanic workers have not been regulated, even knowing that these technicians usually work alone, contrary to pilots who at least have one co-pilot with them in the cabin (Reis et al., 2020).

A recent study investigating aeronautic maintenance technicians who worked in regular shifts (4 days) and backward rotating shifts (night-evening-morning) found that they have an increased risk for excessive daytime sleepiness, which may increase the risk for errors and the possibility to have the aircraft's safety compromised. In line with previous research,

which showed that this type of rotating shifts may influence the individual's sleep and fatigue (Bambra et al., 2008; Kecklund & Axelsson, 2016), this study suggested – after controlling for known factors affecting excessive sleepiness such as age and BMI (Booker et al., 2018) – that working in shifts might be the cause of the high values of excessive daytime sleepiness (Reis et al., 2020).

It is essential to remember that excessive sleepiness was associated with SWD (Booker et al., 2018; Vanttola et al., 2020), therefore, there is a probability that great part of the technicians in regular rotating shifts who obtained high scores for excessive sleepiness might suffer from SWD as well (Reis et al., 2020).

Due to all the above mentioned, it is of utmost importance that the aeronautical mechanic workers' shift schedules be researched, moreover it is essential to find the best possible work-rest distributions in order to minimize the possibility of the errors and consequent aircraft accidents. This study aims to investigate the effect of social jetlag on burnout in a Portuguese sample of aeronautic technicians who work in shifts. The study seeks to add information to the current body of knowledge in this area and possibly contribute scientifically to establishing the future regulation of the work and rest times of aeronautical maintenance technicians.

II – The current study

1. Aim of the Study

The study aimed to evaluate the effects of social jetlag on burnout in a sample of shift workers from the aviation field, namely aeronautic mechanical technicians.

2. Hypotheses

H1: Workers who work in shifts have a statistically significant higher social jetlag than workers who do not work in shifts in Portuguese aircraft maintenance technicians.

H2: Workers who work in 3 shifts have a statistically significantly higher level of social jetlag than workers who work in 2 shifts in Portuguese aircraft maintenance technicians.

H3: Workers who work in shifts experience higher burnout levels than workers who do not work in shifts in Portuguese aircraft maintenance technicians.

H4: Workers who work in 3 shifts have a statistically significantly higher level of burnout than workers who work in 2 shifts in Portuguese aircraft maintenance technicians.

H5: There is a statistically significant association between social jetlag and burnout levels in Portuguese aircraft maintenance technicians.

3. Methods

3.1 Study Design

It is a part of an epidemiological, cross-sectional study in Portugal. 600 shift workers, who were aeronautical maintenance technicians who were invited via email, and SMS to participate in this study, from which 348 valid responses were obtained, with a 60% response rate. The data collection happened between May-June 2019 using an online format, which was sent by email after the adjustment of the instrument with a pre-test. The time to complete the questionnaire (Annex I) was estimated to take about 40 to 60 minutes.

This questionnaire was composed of socio-demographic data (age, gender, current marital status, place of residence, educational level, number of people at home/residence, number and age of children); working schedules; and psychological valuation instruments (sleep wake behavior, chronotype, social jet lag, burnout).

3.2 Participants

This study is composed of 348 aeronautical mechanic workers 51(14.7 %) working in a regular schedule, 128 (36.8%) working in a two shift (morning, evening) rotating schedule, and 169 (48.6%) working in a three-shift (morning, evening, night) rotating schedule. Regular workers work from 7:45h to 16:00h. Shift worker schedules were as follows: morning shift (7:00h-15:30h), evening (15:00h – 23:30h) and night (23:00h-07:30h).

Inclusion criteria – those aeronautic maintenance technicians of both genders and of all educational levels who were active workers when the study was developed.

Exclusion criteria – those technicians who were retired or in maternity or medical leave

The questionnaire contained various questions on sociodemographic, working and health data, from which this paper describes only those which are relevant to the matter of this study.

All participants gave informed consent to participate in the study, the questionnaire was only available for response after it was obtained. This study was approved by the Ethics Committee of the Faculty of Medicine of the University of Lisbon (Reference nº 190/19), on 14/05/2019 (Annex A).

3.3 Instruments

- *Munich ChronoType Questionnaire - MCTQ^{Shift}*: Chronotype and social jetlag data was obtained using The Munich Chronotype Questionnaire for Shiftworkers (Juda et al., 2013b) Just like the original MCTQ, the MCTQ^{Shift}, which expands its questions to workers working in a 3-shift system of rotating/changing shifts, also assesses chronotype and possibly other factors due to the detailed obtained information about people's sleeping behaviours. The MCTQ^{Shift} uses the same variables (*bedtime, time of preparing to fall asleep, sleep latency, time of awakening (with or without an alarm clock), time to get up, and if the individual can choose freely their sleep times on the non-working days*) but it examines them separately in the 3 types of shifts: morning (M), evening (E), night (N) shifts. These variables enable us to compute the

sleep onset ($SO = \text{sleep latency} + \text{time of preparing to fall asleep}$) and sleep end ($SE = \text{time of awakening}$), which 2 concepts are used to calculate sleep duration ($SD = SE - SO$) and mid-sleep points ($MS = SO + SD/2$). These are calculated to workdays separately to each types of shifts and to free days. Moreover, another concept, the weighted average of sleep duration for working and non-working days in a week-long period can be calculated taking into consideration the shift schedule: $\bar{SD} = (N_{\text{workdays}} * SD_W + N_{\text{free-days}} * SD_F)/7$. Social jetlag (SL) can be also calculated using this questionnaire, calculating the difference between the mid-sleep times on working and non-working days.

- *Oldenburg Burnout Inventory* – OLBI: Work relationship was evaluated by the OLBI version which was adapted (translated and validated) to Portuguese (Sinval et al., 2019). This self-report tool uses a 5-point Likert scale, ranging from 1- ‘strongly disagree’ to 5 – ‘strongly agree’. The reduced English version of OLBI, which served as a basis for the adapted version, contained 16 questions. It understood burnout as a second-order factor which loads on 2 disengagement and exhaustion (first-order factors). The original English version had 8 questions in both dimensions: disengagement and exhaustion (Demerouti et al., 2001). Items measuring disengagement understand the concept as a process of distancing from one’s work in terms of content and object as well while developing negative and cynical attitudes towards one’s job (Bakker et al., 2004). The other dimension to measure burnout, exhaustion is understood as a perceived physical fatigue and overtaxing and feelings of emptiness regarding one’s work (Demerouti & Bakker, 2008). The adaptation of the questionnaire was carried out following The ITC Guidelines for Translating and Adapting Tests (International Test Commission, 2018) based on the Orthographic Agreement signed by both Portugal and Brazil in 2009, upon consultation with Portuguese and Brazilian methodologists and psychologists in order to keep the essence of the concepts but in a culturally, semantically adapted way reaching a consensus on idiomatic equivalence in the two countries. During the validation process of the adapted version, 1 item (item 13) was eliminated thus obtaining a 15-item-scale. Altogether, the new instrument showed good validity evidence with good

internal consistency values and good goodness-of-fit with possibly moderate errors of the population approximation. Furthermore, it is freely available, which makes it an optimal instrument to measure burnout in Brazil and Portugal (Sinval et al., 2019). For our sample OLBI displayed a good reliability (15 item) with an internal consistency of .881 (Cronbach α), similar to the Portuguese validated version (Sinval et al., 2019).

- *Karasek's Job Content Questionnaire's version (JCQ)* - Stress at work was evaluated by the translated and validated version to Portugal (Vilas-Boas & Cerqueira, 2017). It contains 19 items that ask the participant's perception regarding their work context using a 4-point Likert scale (1 "strongly disagree" to 4 "strongly agree"). The items are divided into 4 scales: decision latitude (measuring skill discretion and decision authority), psychological job demands, supervisor support, co-worker support. Cronbach's α for this measure was .76.

3.4 Statistical Analysis

The database was corrected to eliminate errors of consistency due to errors in coding or typing in the answers.

Provided that it was a convenient sample, a power analysis was carried out post-hoc using the GPower v.3.1 software, which resulted in a statistical power of 95.1%, meaning that there is a high probability that the results are valid.

In order to compare the SJL values between participants we calculated the average of the SJL for each type of shifts. This is a circadian misalignment proxy, and it is obtained based on the difference between the average mid-sleep point on free days (MSF) and the average mid-sleep point on workdays (MSW) in hours. We obtained the SJL pertaining to each shift type (morning, evening, night), then made an average in a following way: those not working in shifts only had their SJL value for the morning shifts, therefore, this was their relative SJL value. Those working in 2 shifts had 2 SJL values, that we averaged with the following function: $(SJL_{\text{Morning}} + SJL_{\text{evening}}) / 2 = \text{Average SJL of 2 shift workers}$. Those working in 3 shifts had 3 corresponding SJL values, that we also averaged using the following function: $(SJL_{\text{Morning}} + SJL_{\text{evening}} + SJL_{\text{night}}) / 3 = \text{Average SJL of 3 shift workers}$. We

excluded participants with missing values to avoid noise in the data, thus obtaining a SJL average that may be comparable.

The burnout score for our sample was dichotomised as: with burnout and without burnout according to the P75 of the values obtained for the Portuguese validated version (Sinval et al., 2019). All individuals in our sample with a score above 3.20 were considered as having burnout.

The data analysis included the description of the sample studied through absolute and relative frequencies of qualitative variables. To test the normality and homogeneity of the distribution of quantitative variables, the Shapiro-Wilk and Levene tests were used, respectively. For comparison of groups: categorical variables, a Chi-square test was performed to calculate possible associations. For continuous variables, a t-Student was performed according to the data distribution.

Logistic regression analysis and ANCOVAs were used. Logistic linear regression when the outcome variable was categorical (e.g., with vs without burnout). This was used to solve the problem of violating linearity, as it uses logarithmic (logit) terms in the equation of multiple linear regression thus computing a probability of a case belonging to a certain category. ANCOVA combines analysis of variance and regression in a general linear model. It calculates the results using the means of the dependent variable (DV) checking for equality across levels of the independent variables (IV) while allowing for controlling for other variables (covariates) that are not in the center of interest but may have an effect on the relationship between the DV and the IV.

3.4.1 Control Variables. For all analysis having children under 18 years living at home, age, average 24-hour sleep duration and chronotype were control variables. All variables are associated with poor sleep and a higher SJL. For shift workers, having children living at home is an additional source for lack of sleep since workers tend to cope with the children's schedules.

Statistical analyses were performed using IBM SPSS 26 software. The tests performed were considered statistically significant at $p < 0.05$.

Table 1. *Correlations between variables*

Variable	M	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	40.30	8.62	-										
2. Decision latitude	24.41	3.19	.08	-									
3. Psychological job demand	7.68	1.10	-.08	.23**	-								
4. Supervisor support	10.47	2.59	-.04	.23**	.15**	-							
5. Co-worker support	12.25	1.84	-.04	.19**	.19**	.23**	-						
6. Average SJL	2.23	1.41	.04	.16**	-.05	.03	-.07	-					
7. Average sleep duration in 24 hours	6.88	1.05	-.14*	-.06	-.01	-.07	-.03	.02	-				
8. Disengagement	2.84	.69	-.08	-.39**	-.26**	-.34**	-.22**	.05	-.03	-			
9. Exhaustion	3.04	.56	-.07	-.12*	-.25**	-.25**	-.20**	.08	-.03	.58**	-		
10. Burnout	2.94	.56	-.08	-.30**	-.28**	-.34**	-.24**	.07	-.04	.91**	.87**	-	
11. Average chronotype	4.99	1.42	-.25**	-.05	.07	-.06	-.02	.16**	.07	.02	-.07	-.02	-

* $p < .05$. ** $p < .01$.

4. Results

The analysis of the results of the questionnaires allowed to know the work of aircraft technicians from themselves directly, thus obtaining an overview of their sleep habits and their health outcomes, as well as an insight to their perception of their performance in this profession in terms of difficulties, rigor, demands, stress and adversities. More sensitive points and possibly health detriments were identified.

4.1 Sociodemographic data

The average age of aircraft mechanics was 40.3 years (SD 8.6, min. 17, max. 62 years), with the majority being male (96.3%), married (75.9%), with children (70.1%), with an average of 0.8 marriages (SD 0.7, min. 0, max. 5 marriages), and live on average with 2.9 family members (SD 1.1, min 1, max. 6). Regarding the level of education, most had completed secondary education (65.8%).

The average age of non-shift workers was 40.6 (SD 10.6, min. 21, max. 61 years) majority of people working in regular shifts were males (92.2 %), more than half of them were married (54.9%) with an average of 0.9 marriages (SD 0.8, min. 0, max. 3 marriages) with a secondary education (54.9%) with children (68.6%) living on average with 2.8 family members (SD 1.1, min 1, max. 5).

The average age of 2-shift workers was 38.5 (SD 8.9, min. 17, max. 62 years). The majority of people working in 2-shifts were also male (96.1%), married (77.3 %), with an average of 0.7 marriages (SD 0.6, min. 0, max. 2 marriages), with secondary education

(71.1%) with children (64.8%), living on average with 2.9 family members (SD 1.1, min 1, max. 6).

The average age of 3-shift workers was 41.6 (SD 7.5, min. 23, max. 60 years). The majority of people working in 3-shifts were also male (97.6%), married (81.1 %), with an average of 0.9 marriages (SD 0.7, min. 0, max. 5 marriages) with secondary education (65.1%) with children (74.6%), living on average with 3 family members (SD 1.1, min 1, max. 6).

4.2 Social Jetlag

The level of SJL was assessed separated by shift types. The highest level of SJL was measured among those, who worked in night shift with an average of 7.7 hours (SD 2.5, min. 0, max. 12.6), followed by those working morning shifts with an average SJL of 1.5 hours (SD 1.1, min. 0, max. 5.5), followed by those working evening shifts with an average of 0.9 hours (SD 0.9, min. 0, max. 5.8).

4.3 Burnout

Total burnout score and binomial burnout concept was measured (*yes* or *no*) for all types of shifts. The highest level of burnout was measured among those, who worked in 3 shifts with an average score of 3 (SD 0.6, min. 1.3, max. 4.5), followed by those working 2 shifts with an average score of 2.9 (SD 0.6, min. 1.7, max. 4.9), followed by those not working in shifts with an average score of 2.9 (SD 0.5, min. 1.9, max. 4.4).

Binomial burnout score was also computed for all types of workers. Among regular workers out of 51 people, 10 showed the symptoms of burnout (19.6%), out of 128 people who worked 2 shifts, 32 (25.0%) can be classified as having burnout, while the highest burnout level was measured among those working in 3 shifts as out of 169 people 59 (34.9%) could be categorized as dealing with burnout.

4.4 Hypotheses Testing

In hypothesis 1 a multivariate linear regression analysis was conducted to test whether working in shifts predicts a higher SJL controlling for age, if the participants had children under 18 years at home or not (“yes”/ “no”), average sleep duration in a 24-hour

period and chronotype. In hypothesis 2 to test the effect of working in two shifts and working in three shifts on SJL levels (with the regular workers being the control group) we conducted an ANCOVA controlling for age, having children, chronotype and average sleep duration in a 24-hour-long period. In hypothesis 3 a binary logistic regression analysis was conducted to test whether working in shifts predicts to have burnout controlling for age and if the participants had children, average sleep duration in 24 hours, chronotype and the Karasek stress factors. In hypothesis 4 to test the effect of working in two shifts and working in three shifts on burnout scores (with the regular workers being the control group), we conducted an ANCOVA controlling for age and having children, chronotype and average sleep duration in a 24-hour-long period and the Karasek stress factors. In hypothesis 5 a multivariate linear regression was used to test if higher levels of SJL predict a higher burnout score controlling for age, average sleep duration in 24 hours, children (yes/no), chronotype, all 4 factors of the Karasek stress scale (decision latitude, job demand, support from the boss, colleague support) and being a shift worker.

4.4.1 Hypothesis 1. A multivariate linear regression analysis was conducted to test whether working in shifts predicts a higher SJL controlling for age, if the participants had children, average sleep duration in a 24-hour period and chronotype. Results showed that the regression model was statistically significant, ($F(5, 302) = 7.433, p < .001$). Proportionally, the model explains 11% ($R^2 = .110$) of the social jetlag variance. Results showed that the effect of age ($\beta = .07; p = .255$), the effect of having children ($\beta = -.669; p = .504$), the effect of sleep duration in 24 hours ($\beta = .011; p = .845$) were not significant on SJL. The effect of working in shifts ($\beta = .291; p < .001$) and the effect of chronotype ($\beta = .12; p < .001$) had a statistically significant effect on having SJL. This means that working in shifts predicted a higher social jetlag level ($SJL_{\text{non-shift}} = .344, SJL_{\text{shift}} = .344 + 1.134 = 1.478$) and for each 1.412 increase in chronotype, there is a .167 ($= .120 * 1,391$) increase in social jetlag, ($\beta = .12, p = .044$).

4.4.2 Hypotheses 2. To test the effect of working in two shifts and working in three shifts on SJL levels, we conducted an ANCOVA controlling for age and having children,

chronotype and average sleep duration in a 24-hour-long period. Working in 2 and 3 shifts were entered as between-subjects factors and social jetlag levels as the dependent variable. Levene's test showed that the variances for social jetlag scores were equal ($F(2,301)=12.008$; $p<.001$). Results showed a statistically significant effect of working in shifts on the average SJL levels, $F(2,301)=226.34$, $p<.001$, $\eta^2=.601$ and chronotype ($F(1,301)=5.433$, $p=.02$, $\eta^2=.018$). People who worked in a regular schedule showed a higher mean of SJL ($\mu_{\text{SJLregular}}=1.313$) than people working in two shifts ($\mu_{\text{SJLtwo-shifts}}=1.156$) with the 3-shift-workers showing the highest mean ($\mu_{\text{SJLthre-shift}}=3.363$). The difference between the mean levels of SJL was statistically significant for the three-shift workers compared to those of working in two-shifts or in a regular schedule. Having children ($F(1,301)=.013$, $p=.91$, $\eta^2=.00$), or age ($F(1,301)=.927$, $p=.336$, $\eta^2=.003$), average sleep duration in a day ($F(1,301)=.338$, $p=.067$, $\eta^2=.011$) did not have a significant effect on the dependent variable.

4.4.3 Hypothesis 3. A binary logistic regression analysis was conducted to test whether working in shifts predicts to have burnout controlling for age and if the participants had children, average sleep duration in 24 hours, chronotype and the four dimensions of stress in the Karasek model. Results showed that: working in shifts ($\text{Exp}(B)=.748$; $p=.499$), chronotype ($\text{Exp}(B)=1.038$; $p=.720$), average sleep duration ($\text{Exp}(B)=1.002$; $p=.989$) and support from the colleagues ($\text{Exp}(B)=.914$; $p=.241$) did not have a statistically significant effect on the dependent variable. However, age ($\text{Exp}(B)=.958$; $p=.022$), having children ($\text{Exp}(B)=2.084$; $p=.045$), decision latitude ($\text{Exp}(B)=.885$; $p=.012$), job demand ($\text{Exp}(B)=.656$; $p=.003$) and support from the boss ($\text{Exp}(B)=.819$; $p=.001$) had a significant effect on the dependent variable. The Omnibus test of model coefficients was significant ($\chi^2=52.937$ $p<.001$), meaning that the model was a better fit than the baseline model.

4.4.4 Hypothesis 4. To test the effect of working in two shifts and working in three shifts on burnout scores, we conducted an ANCOVA controlling for age and having children, chronotype and average sleep duration in a 24-hour-long period, and the four dimensions of stress in the Karasek model. Working in 2 and 3 shifts were entered as between-subjects

factors and burnout scores as the dependent variable. Levene's test showed that the variances for burnout scores were equal ($F(2,298)=1.553$; $p = .213$). Results did not show a statistically significant effect of 24-hour sleep duration on the burnout scores ($F(1,298)= 1.083$, $p = .299$, $\eta^2 = .004$), neither of having children ($F(1,298)= 3.586$, $p= .059$, $\eta^2 = .012$) or chronotype ($F(1,298)= .992$, $p= .320$, $\eta^2 = .003$). However, there was a statistically significant effect of age ($F(1,298)=9.003$, $p= .003$, $\eta^2 = .029$), working in different types of shifts ($F(2,298)=4.040$, $p=.019$, $\eta^2 = .026$) and all the factors of stress on the burnout level: decision latitude ($F(1,298)=17.373$, $p< .001$, $\eta^2 = .055$), job demand ($F(1,298)=10.973$, $p= .001$, $\eta^2 = .036$), support from the boss ($F(1,298)=16.574$, $p<.001$, $\eta^2 = .053$) and support from co-workers ($F(1,298)=5.290$, $p= .022$, $\eta^2 = .017$). Burnout score mean differences were only statistically significant between the group who work in 2-shifts and the group who work in 3 shifts, with those people who work in 3 shifts having higher mean ($\mu_{2\text{-shifts}}=2.856$, $\mu_{3\text{-shifts}}=3.033$)

4.4.5 Hypothesis 5. A multivariate linear regression was used to test if higher levels of SJL predict a higher burnout score controlling for sleep duration in a day, age, children (yes/no), chronotype, all 4 factors of the Karasek stress scale (decision latitude, job demand, support from the boss, colleague support) and being a shift worker. Results showed that the regression model was statistically significant ($F(10, 307) = 10.389$, $p<.001$). Proportionally, the model explains 25.9% ($R^2 = .259$) of the variances in the burnout score. Results showed that the effect chronotype ($\beta= -.025$; $p= .249$), the effect of working in shifts ($\beta= -.009$; $p= .916$), and the effect of sleep duration in 24 hours ($\beta= -.035$; $p= .195$) and the effect of having kids (yes/no) ($\beta= -.138$; $p= .056$) were not significant on the burnout scores. The effect of age ($\beta = -.010$; $p= .006$), the effect of average social jetlag ($\beta= .052$; $p= .018$), the effect of job decision latitude ($\beta= -.039$; $p<.001$), the effect of job demand ($\beta= -.088$; $p= .001$), the effect of support from the boss ($\beta= -.051$; $p<.001$), the effect of support from the colleagues ($\beta= -.035$; $p= .023$) had a statistically significant effect on the burnout scores. The above mentioned means that for each 8.75 increase in age, there is a .06 ($= -.010*6.41$) decrease in burnout score; for each 1.39 increase in SJL, there is a .33 ($= .052*6.41$) increase in burnout score; for each 3.18 increase in decision latitude, there is a .25 ($= -.039*6.41$) decrease in burnout score; for each 1.11 increase in job demand, there is a .56 ($= -.088*6.41$) decrease

in the burnout score; for each 2.47 increase in support from the boss, there is a 0.33 ($= -.051 * 6.41$) decrease in the burnout score and for each 1.90 increase in support from the colleagues, there is a .22 ($= -.035 * 6.41$) decrease in the burnout scores.

5. Discussion

The study confirmed hypotheses 1 and 2 as it found that working in shifts increased the possibility of having social jetlag and individuals with late chronotype were more likely to have SJJ, while sleep duration was not a significant factor for this circadian misalignment. In line with previous research, when testing the 3 groups separately (regular workers, working in 2 and 3 shifts), those working the night shift (3-shift workers) showed higher levels of SJJ (Thorpy, 2017).

We expected that people working in shifts would be a predictor for burnout levels in the sample (possibly those working in 3 shifts to a higher extent), but when comparing regular and shiftworkers, shiftworking did not predict burnout levels. However, when contrasting the 3 groups, the results suggested that working in a nightshift (3-shifts) predicted higher levels of burnout than working in only 2 shifts. Interestingly, all workers had some levels of burnout including regular workers, which might explain why there was no statistical difference between the burnout levels of the regular workers and those working in shifts. This raises numerous questions and prompts further research. Provided that age, and all factors of stress in the workplace and possibly having children showed a significant effect on burnout (although a small one) suggests that there might be other underlying factors that may explain burnout better; factors that this study did not examine.

Trying to integrate the previous 4 hypotheses, the integrative model of Hypotheses 5 found that higher levels of social jetlag predicted burnout along with age, stress but not sleep duration, as previously reported in a group of nurses (Chin et al., 2015). The effect of having kids also lost its significance. The model explained a smaller proportion of the whole phenomenon (25.9%) that prompts further research to explain the real underlying causes of burnout.

These findings suggest that although all workers had burnout, the underlying causes might be different for each group. For those, who work in shifts, the more shifts a person

worked, the higher the social jetlag was, which may explain higher levels of burnout for them the 3-shift working group. In order to find out what predicted burnout for regular workers, further research is needed. One reason might be lying in the differences in the overall health state of the workers. Those people who present a worse overall state of health or that cannot adapt to shift work, usually stop doing shift work, and the company put them working in the normal working hours as a protective measure. Saying this it might be possible that regular workers, given their possible worse overall health state, cannot cope so effectively with the characteristics of this job (e.g., stress or other factors). Given the multidimensionality of burnout (exhaustion, disengagement), for future studies levels of fatigue (e.g., mental or general fatigue) should be evaluated, as well as factors that may interfere with sleep propensity (smoking, coffee-taking habits) (Söderström et al., 2012), further socio-demographic characteristics as protective factors against burnout, stress-coping mechanisms, their overall satisfaction with their job (Bagheri Hosseinabadi et al., 2019) and working conditions (Vidotti et al., 2018).

The above-mentioned findings can help raise awareness to the importance of regulating the working conditions and shift schedules of the aeronautic maintenance technicians realizing their ever-increasing importance in the aviation field. The fact that technicians working in this company showed symptoms of burnout, may provide a good opportunity for the management to optimize their cost-benefit structures.

6. Limitations and Future Recommendations

Provided the cross-sectional nature of the study using self-report questionnaires may add noise to the data. Further studies using biomarkers or other objective measures may provide a more exact answer about the sleeping habits of workers. Furthermore, the sample contained fewer women (which mainly represents the real-life ratio in gender-differences in this field), although the possible confounding effects of gender differences could not be tested for this sample. The groups sample sizes was also not proportional, with a lower representativeness of regular workers (51 regular workers, 128 in 2-shifts and 169 in 3 shifts).

Moreover, the social jetlag data was averaged for the groups and according to each shift, this average may generate some noise in the data, although this weighted average mainly represented the monthly levels of social jet lag.

As future recommendation we suggest applying measures to reduce circadian misalignment to their working schedules in order to reduce burnout levels as well as overall health. One simple measure to implement might be a forward rotation shifts schedule since these workers are performing backward rotations and this might be a contributing factor for circadian strain (Kecklund and Axelsson, 2016). Another measure could be to align work of workers according to their chronotype since this was already shown to reduce SJL and increase average sleep duration (Vetter et al., 2015).

III – Conclusion

We conclude that in general aircraft maintenance technicians suffer from burnout, and those, who work in 3 shifts might be more susceptible to it.

Like previously reported social jet lag was higher for shift workers, namely to the ones performing also the night shift, and to individuals with a later chronotype.

Social jet lag was shown to be a predictor for burnout as well as age, having children, working in 3 shifts and stress at work factors, but not sleep duration.

With this work we could find some important predictors of burnout, for which simple measures to reduce it might be suggested to these workers. This work had contributed to adding further knowledge for burnout in organizations.

Trying to find causes of aircraft maintenance workers burnout, and applying protective measures against it, in long-term may reduce the company health care costs, absenteeism, reduce turnover and increase productivity and safety.

IV – Bibliography

- (APA), A. P. A. (2013). Dignostic and Statistical Manual of Mental Disorders (DSM-5®).
In *American Psychiatric Pub.*
- Åkerstedt, T., Ghilotti, F., Grotta, A., Zhao, H., Adami, H. O., Trolle-Lagerros, Y., & Bellocco, R. (2019). Sleep duration and mortality – Does weekend sleep matter? *Journal of Sleep Research, 28*(1), 1–11. <https://doi.org/10.1111/jsr.12712>
- Almoosawi, S., Palla, L., Walshe, I., Vingeliene, S., & Ellis, J. G. (2018). Long sleep duration and social jetlag are associated inversely with a healthy dietary pattern in adults: Results from the UK national diet and nutrition survey rolling programme Y1–4. *Nutrients, 10*(9), 1–20. <https://doi.org/10.3390/nu10091131>
- Alterman, T., Luckhaupt, S. E., Dahlhamer, J. M., Ward, B. W., & Calvert, G. M. (2012). Prevalence rates of work organization characteristics among workers in the U.S.: Data from the 2010 National Health Interview Survey. *American Journal of Industrial Medicine, 56*(6), 647–659. <https://doi.org/10.1002/ajim.22108>
- Alves, M. S., Andrade, R. Z., Silva, G. C., Mota, M. C., Resende, S. G., Teixeira, K. R., Gonçalves, B. F., & Crispim, C. A. (2017). Social jetlag among night workers is negatively associated with the frequency of moderate or vigorous physical activity and with energy expenditure related to physical activity. *Journal of Biological Rhythms, 32*(1), 83–93. <https://doi.org/10.1177/0748730416682110>
- Anund, A., Fors, C., Ihlström, J., & Kecklund, G. (2018). An on-road study of sleepiness in split shifts among city bus drivers. *Accident Analysis and Prevention, 114*(May 2017), 71–76. <https://doi.org/10.1016/j.aap.2017.05.005>
- Bagheri Hosseinabadi, M., Ebrahimi, M. H., Khanjani, N., Biganeh, J., Mohammadi, S., & Abdolahfard, M. (2019). The effects of amplitude and stability of circadian rhythm and occupational stress on burnout syndrome and job dissatisfaction among irregular shift working nurses. *Journal of Clinical Nursing, 28*(9–10), 1868–1878. <https://doi.org/10.1111/jocn.14778>
- Bakker, A. B., Demerouti, E., & Verbeke, W. (2004). Using the job demands-resources model to predict burnout and performance. *Human Resource Management, 43*(1), 83–104. <https://doi.org/10.1002/hrm.20004>

- Bambra, C., Whitehead, M., Sowden, A., Akers, J., & Petticrew, M. (2008). “A hard day’s night?” The effects of Compressed Working Week interventions on the health and work-life balance of shift workers: A Systematic review. *Journal of Epidemiology and Community Health*, *62*(9), 764–777. <https://doi.org/10.1136/jech.2007.067249>
- Benarroch, E. E. (2008). Suprachiasmatic nucleus and melatonin: Reciprocal interactions and clinical correlations. *Neurology*, *71*(8), 594–598. <https://doi.org/10.1212/01.wnl.0000324283.57261.37>
- Bianchi, R., Schonfeld, I. S., & Laurent, E. (2015). Is it time to consider the “burnout syndrome” □ a distinct illness? *Frontiers in Public Health*, *3*(June), 1–3. <https://doi.org/10.3389/fpubh.2015.00158>
- Booker, L. A., Magee, M., Rajaratnam, S. M. W., Sletten, T. L., & Howard, M. E. (2018). Individual vulnerability to insomnia, excessive sleepiness and shift work disorder amongst healthcare shift workers. A systematic review. *Sleep Medicine Reviews*, *41*, 220–233. <https://doi.org/10.1016/j.smrv.2018.03.005>
- Borisenkov, M. F., Petrova, N. B., Timonin, V. D., Fradkova, L. I., Kolomeichuk, S. N., Kosova, A. L., & Kasyanova, O. N. (2015). Sleep characteristics, chronotype and winter depression in 10-20-year-olds in northern European Russia. *Journal of Sleep Research*, *24*(3), 288–295. <https://doi.org/10.1111/jsr.12266>
- Buxton, O. M., Pavlova, M., Reid, E. W., Wang, W., Simonson, D. C., & Adler, G. K. (2010). Sleep restriction for 1 week reduces insulin sensitivity in healthy men. *Diabetes*, *59*(9), 2126–2133. <https://doi.org/10.2337/db09-0699>
- Cappuccio, F. P., D’Elia, L., Strazzullo, P., & Miller, M. A. (2010). Sleep duration and all-cause mortality: A systematic review and meta-analysis of prospective studies. *Sleep*, *33*(5), 585–592. <https://doi.org/10.1093/sleep/33.5.585>
- Castilhos Beauvalet, J., Luísa Quiles, C., Alves Braga de Oliveira, M., Vieira Ilgenfritz, C. A., Hidalgo, M. P., & Comiran Tonon, A. (2017). Social jetlag in health and behavioral research: a systematic review. *ChronoPhysiology and Therapy, Volume 7*, 19–31. <https://doi.org/10.2147/cpt.s108750>
- Cermakian, N., & Boivin, D. B. (2009). The regulation of central and peripheral circadian clocks in humans. *Obesity Reviews*, *10*(SUPPL. 2), 25–36.

<https://doi.org/10.1111/j.1467-789X.2009.00660.x>

- Chakravorty, S., Katy Siu, H. Y., Lalley-Chareczko, L., Brown, G. K., Findley, J. C., Perlis, M. L., & Grandner, M. A. (2015). Sleep duration and insomnia symptoms as risk factors for suicidal ideation in a nationally representative sample. *Primary Care Companion to the Journal of Clinical Psychiatry*, *17*(6), 402–422.
<https://doi.org/10.4088/PCC.13m01551>
- Chaput, J. P., Bouchard, C., & Tremblay, A. (2014). Change in sleep duration and visceral fat accumulation over 6 years in adults. *Obesity*, *22*(5), 9–12.
<https://doi.org/10.1002/oby.20701>
- Cheng, W. J., & Cheng, Y. (2017). Night shift and rotating shift in association with sleep problems, burnout and minor mental disorder in male and female employees. *Occupational and Environmental Medicine*, *74*(7), 483–488.
<https://doi.org/10.1136/oemed-2016-103898>
- Chin, W., Guo, Y. L., Hung, Y. J., Yang, C. Y., & Shiao, J. S. C. (2015). Short sleep duration is dose-dependently related to job strain and burnout in nurses: A cross sectional survey. *International Journal of Nursing Studies*, *52*(1), 297–306.
<https://doi.org/10.1016/j.ijnurstu.2014.09.003>
- Chiu, H. Y., & Tsai, P. S. (2013). The impact of various work schedules on sleep complaints and minor accidents during work or leisure time: Evidence from a national survey. *Journal of Occupational and Environmental Medicine*, *55*(3), 325–330.
<https://doi.org/10.1097/JOM.0b013e31827cba69>
- Czeisler, C. A., Duffy, J. F., Shanahan, T. L., Brown, E. N., Mitchell, J. F., Rimmer, D. W., Ronda, J. M., Silva, E. J., Allan, J. S., Emens, J. S., Dijk, D. J., & Kronauer, R. E. (1999). Stability, precision, and near-24-hour period of the human circadian pacemaker. *Science*, *284*(5423), 2177–2181.
<https://doi.org/10.1126/science.284.5423.2177>
- Dall’Ora, C., Griffiths, P., Ball, J., Simon, M., & Aiken, L. H. (2015). Association of 12 h shifts and nurses’ job satisfaction, burnout and intention to leave: Findings from a cross-sectional study of 12 European countries. *BMJ Open*, *5*(9).
<https://doi.org/10.1136/bmjopen-2015-008331>

- Davis, S., Mirick, D. K., & Stevens, R. G. (2001). Night shift work, light at night and risk of breast cancer. *Journal of the National Cancer Institute*, *93*(20), 1557–1562. <https://doi.org/10.1093/occmed/kql078>
- Demerouti, E., & Bakker, A. B. (2008). The Oldenburg Burnout Inventory: A Good Alternative to Measure Burnout (and Engagement). *Handbook of Stress and Burnout in Health Care*, 1–25.
- Demerouti, E., Nachreiner, F., Bakker, A. B., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied Psychology*, *86*(3), 499–512. <https://doi.org/10.1037/0021-9010.86.3.499>
- Díaz-Morales, J. F., & Escribano, C. (2015). Social jetlag, academic achievement and cognitive performance: Understanding gender/sex differences. *Chronobiology International*, *32*(6), 822–831. <https://doi.org/10.3109/07420528.2015.1041599>
- Dickerman, B. A., Markt, S. C., Koskenvuo, M., Hublin, C., Pukkala, E., Mucci, L. A., & Kaprio, J. (2016). Sleep disruption, chronotype, shift work, and prostate cancer risk and mortality: a 30-year prospective cohort study of Finnish twins. *Cancer Causes and Control*, *27*(11), 1361–1370. <https://doi.org/10.1007/s10552-016-0815-5>
- Drake, C. L., Roehrs, T., Richardson, G., Walsh, J. K., & Roth, T. (2005). Shift Work Sleep Disorder: Prevalence and Consequences Beyond that of Symptomatic Day Workers. *Sleep*, *28*(1), 9–11. <https://doi.org/10.1088/0335-7368/4/6/309>
- Drake, C. L., & Wright, K. P. (2010). Shift Work, Shift-Work Disorder, and Jet Lag. In *Principles and Practice of Sleep Medicine: Fifth Edition* (Fifth Edit, Issue December 2011). Elsevier Inc. <https://doi.org/10.1016/B978-1-4160-6645-3.00071-2>
- EASA. (2019). *Effectiveness of Flight Time Limitation (FTL) Report*. 1–11. [https://www.easa.europa.eu/sites/default/files/dfu/Report on effectiveness of FTL_final.pdf](https://www.easa.europa.eu/sites/default/files/dfu/Report%20on%20effectiveness%20of%20FTL_final.pdf)
- Eurofound. (2017). 6th European Working Conditions Survey : 2017 update. In *European Union*.
- Facer-Childs, E. R., Middleton, B., Skene, D. J., & Bagshaw, A. P. (2019). Resetting the late timing of ‘night owls’ has a positive impact on mental health and performance. *Sleep Medicine*, *60*, 236–247. <https://doi.org/10.1016/j.sleep.2019.05.001>

- Flo, E., Pallesen, S., Magerøy, N., Moen, B. E., Grønli, J., Nordhus, I. H., & Bjorvatn, B. (2012). Shift work disorder in nurses - assessment, prevalence and related health problems. *PLoS ONE*, 7(4), 1–9. <https://doi.org/10.1371/journal.pone.0033981>
- Freudenberger, Herbert, J. (1974). Staff Burn-Out. *Journal of Social Issues*, 90(1), 159–165.
- Friberg, T. (2009). Burnout: From popular culture to psychiatric diagnosis in Sweden. *Culture, Medicine and Psychiatry*, 33(4), 538–558. <https://doi.org/10.1007/s11013-009-9149-z>
- Galindo, R. H., de Oliveira Feliciano, K. V., dos Santos Lima, R. A., & de Souza, A. I. (2012). Síndrome de Burnout entre enfermeiros de um hospital geral da cidade do Recife. *Revista Da Escola de Enfermagem*, 46(2), 420–427. <https://doi.org/10.1590/S0080-62342012000200021>
- Gallicchio, L., & Kalesan, B. (2009). Sleep duration and mortality: A systematic review and meta-analysis. *Journal of Sleep Research*, 18(2), 148–158. <https://doi.org/10.1111/j.1365-2869.2008.00732.x>
- Gehrman, P. R., Ghorai, A., Goodman, M., McCluskey, R., Barilla, H., Almasy, L., Roenneberg, T., & Bucan, M. (2019). Twin-based heritability of actimetry traits. *Genes, Brain and Behavior*, 18(5). <https://doi.org/10.1111/gbb.12569>
- Goel, N., Rao, H., Durmer, J. S., & Dinges, D. F. (2009). Neurocognitive consequences of sleep deprivation. *Seminars in Neurology*, 29(4), 320–339. <https://doi.org/10.1055/s-0029-1237117>
- Golombek, D. A., & Rosenstein, R. E. (2010). Physiology of circadian entrainment. *Physiological Reviews*, 90(3), 1063–1102. <https://doi.org/10.1152/physrev.00009.2009>
- Grandner, M. A. (2017). Sleep, Health, and Society. *Sleep Medicine Clinics*, 12(1), 1–22. <https://doi.org/10.1016/j.jsmc.2016.10.012>
- Grandner, M. A., Chakravorty, S., Perlis, M. L., Oliver, L., & Gurubhagavatula, I. (2014). Habitual sleep duration associated with self-reported and objectively determined cardiometabolic risk factors. *Sleep Medicine*, 15(1), 42–50. <https://doi.org/10.1016/j.sleep.2013.09.012>

- Grandner, M. A., & Drummond, S. P. A. (2007). Who are the long sleepers? Towards an understanding of the mortality relationship. *Sleep Medicine Reviews*, *11*(5), 341–360. <https://doi.org/10.1016/j.smr.2007.03.010>
- Grandner, M. A., Hale, L., Moore, M., & Patel, N. P. (2010). Mortality associated with short sleep duration: The evidence, the possible mechanisms, and the future. *Sleep Medicine Reviews*, *14*(3), 191–203. <https://doi.org/10.1016/j.smr.2009.07.006>
- Grandner, M. A., Patel, N. P., Gehrman, P. R., Perlis, M. L., & Pack, A. I. (2010). Problems associated with short sleep: Bridging the gap between laboratory and epidemiological studies. *Sleep Medicine Reviews*, *14*(4), 239–247. <https://doi.org/10.1016/j.smr.2009.08.001>
- Grandner, M. A., Sands-Lincoln, M. R., Pak, V. M., & Garland, S. N. (2013). Sleep duration, cardiovascular disease and pro-inflammatory biomarkers. *Nature and Science of Sleep*, *5*, 93–107. <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.813.4965&rep=rep1&type=pdf>
- Greco, C. M., & Sassone-Corsi, P. (2019). Circadian blueprint of metabolic pathways in the brain. *Nature Reviews Neuroscience*, *20*(2), 71–82. <https://doi.org/10.1038/s41583-018-0096-y>
- Haraszti, R. Á., Ella, K., Gyöngyösi, N., Roenneberg, T., & Káldi, K. (2014). Social jetlag negatively correlates with academic performance in undergraduates. *Chronobiology International*, *31*(5), 603–612. <https://doi.org/10.3109/07420528.2013.879164>
- Harrington, J. M. (2001). Health effects of shift work and extended hours of work. *Occupational and Environmental Medicine*, *58*(1), 68–72. <https://doi.org/10.1136/oem.58.1.68>
- Hayes, A. L., Xu, F., Babineau, D., & Patel, S. R. (2011). Sleep duration and circulating adipokine levels. *Sleep*, *34*(2), 147–152. <https://doi.org/10.1093/sleep/34.2.147>
- Horne, J. A., & Ostberg, O. (1976). A self assessment questionnaire to determine Morningness Eveningness in human circadian rhythms. In *International Journal of Chronobiology* (Vol. 4, Issue 2, pp. 97–110).
- Hulsege, G., Loef, B., van Kerkhof, L. W., Roenneberg, T., van der Beek, A. J., &

- Proper, K. I. (2019). Shift work, sleep disturbances and social jetlag in healthcare workers. *Journal of Sleep Research*, 28(4). <https://doi.org/10.1111/jsr.12802>
- Hulsegge, G., van Mechelen, W., Proper, K. I., Paagman, H., & Anema, J. R. (2020). Shift work, and burnout and distress among 7798 blue-collar workers. *International Archives of Occupational and Environmental Health*, 93(8), 955–963. <https://doi.org/10.1007/s00420-020-01536-3>
- International Test Commission. (2018). ITC Guidelines for Translating and Adapting Tests (Second Edition). *International Journal of Testing*, 18(2), 101–134. <https://doi.org/10.1080/15305058.2017.1398166>
- Jankowski, K. S. (2017). Social jet lag: Sleep-corrected formula. *Chronobiology International*, 34(4), 531–535. <https://doi.org/10.1080/07420528.2017.1299162>
- Juda, M., Vetter, C., & Roenneberg, T. (2013a). Chronotype modulates sleep duration, sleep quality, and social jet lag in shift-workers. *Journal of Biological Rhythms*, 28(2), 141–151. <https://doi.org/10.1177/0748730412475042>
- Juda, M., Vetter, C., & Roenneberg, T. (2013b). The Munich ChronoType Questionnaire for shift-workers (MCTQ Shift). *Journal of Biological Rhythms*, 28(2), 130–140. <https://doi.org/10.1177/0748730412475041>
- Kecklund, G., & Axelsson, J. (2016). Health consequences of shift work and insufficient sleep. *BMJ (Online)*, 355, 1–13. <https://doi.org/10.1136/bmj.i5210>
- Kim, S., Deroo, L. A., & Sandler, D. P. (2011). Eating patterns and nutritional characteristics associated with sleep duration. *Public Health Nutrition*, 14(5), 889–895. <https://doi.org/10.1017/S136898001000296X>
- King, C. R., Knutson, K. L., Rathouz, P. J., Sidney, S., Liu, K., & Lauderdale, D. S. (2008). Short sleep duration and incident coronary artery calcification. *JAMA - Journal of the American Medical Association*, 300(24), 2859–2866. <https://doi.org/10.1001/jama.2008.867>
- Knapen, S. E., Riemersma-van der Lek, R. F., Antypa, N., Meesters, Y., Penninx, B. W. J. H., & Schoevers, R. A. (2018). Social jetlag and depression status: Results obtained from the Netherlands Study of Depression and Anxiety. *Chronobiology International*, 35(1), 1–7. <https://doi.org/10.1080/07420528.2017.1374966>

- Knutson, K. L., Van Cauter, E., Rathouz, P. J., DeLeire, T., & Lauderdale, D. S. (2010). Trends in the prevalence of short sleepers in the USA: 1975-2006. *Sleep*, *33*(1), 37–45. <https://doi.org/10.1093/sleep/33.1.37>
- Koopman, A. D. M., Rauh, S. P., Van 'T Riet, E., Groeneveld, L., Van Der Heijden, A. A., Elders, P. J., Dekker, J. M., Nijpels, G., Beulens, J. W., & Rutters, F. (2017). The Association between Social Jetlag, the Metabolic Syndrome, and Type 2 Diabetes Mellitus in the General Population: The New Hoorn Study. *Journal of Biological Rhythms*, *32*(4), 359–368. <https://doi.org/10.1177/0748730417713572>
- Korman, M., Tkachev, V., Reis, C., Komada, Y., Kitamura, S., Gubin, D., Kumar, V., & Roenneberg, T. (2020). COVID-19-mandated social restrictions unveil the impact of social time pressure on sleep and body clock. *Scientific Reports*, *10*(1), 1–10. <https://doi.org/10.1038/s41598-020-79299-7>
- Krueger, P. M., & Friedman, E. M. (2009). Sleep duration in the united states: A cross-sectional population-based study. *American Journal of Epidemiology*, *169*(9), 1052–1063. <https://doi.org/10.1093/aje/kwp023>
- Kurina, L. M., McClintock, M. K., Chen, J. H., Waite, L. J., Thisted, R. A., & Lauderdale, D. S. (2013). Sleep duration and all-cause mortality: A critical review of measurement and associations. *Annals of Epidemiology*, *23*(6), 361–370. <https://doi.org/10.1016/j.annepidem.2013.03.015>
- Leung, M., Tranmer, J., Hung, E., Korsiak, J., Day, A. G., & Aronson, K. J. (2016). Shift work, chronotype, and melatonin patterns among female hospital employees on day and night shifts. *Cancer Epidemiology Biomarkers and Prevention*, *25*(5), 830–838. <https://doi.org/10.1158/1055-9965.EPI-15-1178>
- Levandovski, R., Dantas, G., Fernandes, L. C., Caumo, W., Torres, I., Roenneberg, T., Hidalgo, M. P. L., & Allebrandt, K. V. (2011). Depression scores associate with chronotype and social jetlag in a rural population. *Chronobiology International*, *28*(9), 771–778. <https://doi.org/10.3109/07420528.2011.602445>
- López, M., Nogueiras, R., Tena-Sempere, M., & Diéguez, C. (2016). Hypothalamic AMPK: A canonical regulator of whole-body energy balance. *Nature Reviews Endocrinology*, *12*(7), 421–432. <https://doi.org/10.1038/nrendo.2016.67>

- Maia, Q., Grandner, M. A., Findley, J., & Gurubhagavatula, I. (2013). Short and long sleep duration and risk of drowsy driving and the role of subjective sleep insufficiency. *Accident Analysis and Prevention*, *59*, 618–622.
<https://doi.org/10.1016/j.aap.2013.07.028>
- Meng, L., Zheng, Y., & Hui, R. (2013). The relationship of sleep duration and insomnia to risk of hypertension incidence: A meta-analysis of prospective cohort studies. *Hypertension Research*, *36*(11), 985–995. <https://doi.org/10.1038/hr.2013.70>
- Morikawa, Y., K, M., & Satoshi, S. (2008). Evaluation of the effects of shift work on nutrient intake: a cross-sectional study. *Journal of Occupational Health Psychology*, *50*, 270–278. <https://doi.org/10.1037/1076-8998.8.3.c2>
- Murofuse, N. T., Abranches, S. S., & Napoleão, A. A. (2005). Reflexões sobre estresse e burnout e a relação com a enfermagem. *Revista Latino-Americana de Enfermagem*, *13*(2), 255–261. <https://doi.org/10.1590/s0104-11692005000200019>
- Nascimento, J. O. V., dos Santos, J., Meira, K. C., Pierin, A. M. G., & Souza-Talarico, J. N. (2019). Shift work of nursing professionals and blood pressure, burnout and common mental disorders. *Revista Da Escola de Enfermagem*, *53*, 1–9.
<https://doi.org/10.1590/S1980-220X2018002103443>
- Papantoniou, K., Castaño-Vinyals, G., Espinosa, A., Aragonés, N., Pérez-Gómez, B., Burgos, J., Gómez-Acebo, I., Llorca, J., Peiró, R., Jimenez-Moleón, J. J., Arredondo, F., Tardón, A., Pollan, M., & Kogevinas, M. (2015). Night shift work, chronotype and prostate cancer risk in the MCC-Spain case-control study. *International Journal of Cancer*, *137*(5), 1147–1157. <https://doi.org/10.1002/ijc.29400>
- Parsons, M. J., Moffitt, T. E., Gregory, A. M., Goldman-Mellor, S., Nolan, P. M., Poulton, R., & Caspi, A. (2015). Social jetlag, obesity and metabolic disorder: Investigation in a cohort study. *International Journal of Obesity*, *39*(5), 842–848.
<https://doi.org/10.1038/ijo.2014.201>
- Perelis, M., Ramsey, K. M., Marcheva, B., & Bass, J. (2016). Circadian Transcription from Beta Cell Function to Diabetes Pathophysiology. *Journal of Biological Rhythms*, *31*(4), 323–336. <https://doi.org/10.1177/0748730416656949>
- Pietrojusti, A., Forlini, A., Magrini, A., Galante, A., Coppeta, L., Gemma, G., Romeo, E.,

- & Bergamaschi, A. (2006). Shift work increases the frequency of duodenal ulcer in H pylori infected workers. *Occupational and Environmental Medicine*, 63(11), 773–775. <https://doi.org/10.1136/oem.2006.027367>
- Polugrudov, A. S., Panev, A. S., Smirnov, V. V., Paderin, N. M., Borisenkov, M. F., & Popov, S. V. (2016). Wrist temperature and cortisol awakening response in humans with social jetlag in the North. *Chronobiology International*, 33(7), 802–809. <https://doi.org/10.3109/07420528.2016.1168829>
- Portuguese Parliament. (2009). Law No. 7/2009, of 12 February, which approves the revision of the Portuguese Labour Code. *Diário Da República / Official Journal of the Portuguese Republic*, 1.^a(30), 926–1029. <https://dre.pt/application/file/602193>
- Potter, G. D. M., Skene, D. J., Arendt, J., Cade, J. E., Grant, P. J., & Hardie, L. J. (2016). Circadian rhythm and sleep disruption: Causes, metabolic consequences, and countermeasures. *Endocrine Reviews*, 37(6), 584–608. <https://doi.org/10.1210/er.2016-1083>
- Préat, B. (2000). Burnout syndrome: A disease of modern societies? *Occupational Medicine*, 50(7), 512–517. <https://doi.org/10.1093/occmed/50.7.512>
- Puttonen, S., Härmä, M., & Hublin, C. (2010). Shift work and cardiovascular disease — pathways from circadian stress to morbidity. 36(2), 96–108.
- Randler, C., & Vollmer, C. (2013). Aggression in young adults - A matter of short sleep and social jetlag? *Psychological Reports*, 113(3), 754–765. <https://doi.org/10.2466/16.02.PR0.113x31z7>
- Reis, C., Dias, S., Rodrigues, A. M., Sousa, R. D., Gregório, M. J., Branco, J., Canhão, H., & Paiva, T. (2018). Sleep duration, lifestyles and chronic diseases: A cross-sectional population-based study. *Sleep Science*, 11(4), 217–230. <https://doi.org/10.5935/1984-0063.20180036>
- Reis, C., Mestre, C., Canhão, H., Gradwell, D., & Paiva, T. (2016). Sleep complaints and fatigue of airline pilots. *Sleep Science*, 9(2), 73–77. <https://doi.org/10.1016/j.slsci.2016.05.003>
- Reis, C., Staats, R., Pellegrino, P., Alvarenga, T. A., Bárbara, C., & Paiva, T. (2020). The prevalence of excessive sleepiness is higher in shift workers than in patients with

- obstructive sleep apnea. *Journal of Sleep Research*, 29(4), 1–6.
<https://doi.org/10.1111/jsr.13073>
- Rodrigues, E. P. ereir., Rodrigues, U. S. antan., Oliveira, L. de M. M. ot., Laudano, R. C. unh. S., & Sobrinho, C. L. ope. N. (2014). Prevalence of common mental disorders in nursing workers at a hospital of Bahia. *Revista Brasileira de Enfermagem*, 67(2), 296–301. <https://doi.org/10.5935/0034-7167.20140040>
- Roenneberg, T., Daan, S., & Merrow, M. (2003). The art of entrainment. *Journal of Biological Rhythms*, 18(3), 183–194. <https://doi.org/10.1177/0748730403018003001>
- Roenneberg, T., Kuehnle, T., Pramstaller, P. P., Ricken, J., Havel, M., Guth, A., & Merrow, M. (2004). A marker for the end of adolescence. *Current Biology*, 14(24), 1038–1039. <https://doi.org/10.1016/j.cub.2004.11.039>
- Roenneberg, T., Pilz, L. K., Zerbini, G., & Winnebeck, E. C. (2019). Chronotype and social jetlag: A (self-) critical review. *Biology*, 8(3), 1–19.
<https://doi.org/10.3390/biology8030054>
- Sallinen, M., & Kecklund, G. (2010). Shift work, sleep, and sleepiness - differences between shift schedules and system. *Scandinavian Journal of Work, Environment & Health*, 121–133.
- Schernhammer, E. S., Razavi, P., Li, T. Y., Qureshi, A. A., & Han, J. (2001). Rotating night shifts and risk of breast cancer in the nurses' health study. *Journal of the National Cancer Institute*, 93(20), 602–606. <https://doi.org/10.1093/jnci/djr044>
- Schmitt, R., Levandovski, R., & Hidalgo, M. P. L. (2013). Relations between social rhythm, sleep phase, and minor psychiatric symptoms in healthy workers. *Biological Rhythm Research*, 44(3), 403–409. <https://doi.org/10.1080/09291016.2012.692256>
- Shan, Z., Ma, H., Xie, M., Yan, P., Guo, Y., Bao, W., Rong, Y., Jackson, C. L., Hu, F. B., & Liu, L. (2015). Sleep duration and risk of type 2 diabetes: A meta-analysis of prospective studies. *Diabetes Care*, 38(3), 529–537. <https://doi.org/10.2337/dc14-2073>
- Sheaves, B., Porcheret, K., Tsanas, A., Espie, C. A., Foster, R. G., Freeman, D., Harrison, P. J., Wulff, K., & Goodwin, G. M. (2016). Insomnia, nightmares, and chronotype as markers of risk for severe mental illness: Results from a student population. *Sleep*,

- 39(1), 173–181. <https://doi.org/10.5665/sleep.5342>
- Sinval, J., Queirós, C., Pasian, S., & Marôco, J. (2019). Transcultural adaptation of the Oldenburg Burnout Inventory (OLBI) for Brazil and Portugal. *Frontiers in Psychology, 10*(MAR). <https://doi.org/10.3389/fpsyg.2019.00338>
- Söderström, M., Jeding, K., Ekstedt, M., Perski, A., & Åkerstedt, T. (2012). Insufficient sleep predicts clinical burnout. *Journal of Occupational Health Psychology, 17*(2), 175–183. <https://doi.org/10.1037/a0027518>
- Spaeth, A. M., Dinges, D. F., & Goel, N. (2014). Sex and race differences in caloric intake during sleep restriction in healthy adults. *American Journal of Clinical Nutrition, 100*(2), 559–566. <https://doi.org/10.3945/ajcn.114.086579>
- Thorpy, M. (2017). International classification of sleep disorders. In *Sleep Disorders Medicine: Basic Science, Technical Considerations and Clinical Aspects: Fourth Edition*. https://doi.org/10.1007/978-1-4939-6578-6_27
- Trigo, T. R., Teng, C. T., & Hallak, J. E. C. (2007). Síndrome de burnout ou estafa profissional e os transtornos psiquiátricos. *Archives of Clinical Psychiatry (São Paulo), 34*(5), 223–233. <https://doi.org/10.1590/s0101-60832007000500004>
- Van Cauter, E.a , Spiegel, K.b, Tasali, E.a, Leproult, R. . (2008). Metabolic consequences of sleep and sleep loss Sleep Medicine 2008 Vol 9. *Sleep Med, 9*(suppl 1), S23–S28.
- Vanttola, P., Puttonen, S., Karhula, K., Oksanen, T., & Härmä, M. (2020). Employees with shift work disorder experience excessive sleepiness also on non-work days: A cross-sectional survey linked to working hours register in finnish hospitals. *Industrial Health, 58*(4), 366–374. <https://doi.org/10.2486/indhealth.2019-0179>
- Vetter, C., Fischer, D., Matera, J. L., & Roenneberg, T. (2015). Aligning work and circadian time in shift workers improves sleep and reduces circadian disruption. *Current Biology, 25*(7), 907–911. <https://doi.org/10.1016/j.cub.2015.01.064>
- Vidotti, V., Ribeiro, R. P., Galdino, M. J. Q., & Martins, J. T. (2018). Burnout syndrome and shift work among the nursing staff. *Revista Latino-Americana de Enfermagem, 26*. <https://doi.org/10.1590/1518-8345.2550.3022>
- Vilas-Boas, M., & Cerqueira, A. (2017). Assessing stress at work: The Portuguese version of the Job Content Questionnaire. *Avaliacao Psicologica, 16*(1), 70–77.

<https://doi.org/10.15689/ap.2017.1601.08>

- Waage, S., Moen, B. E., Pallesen, S., Eriksen, H. R., Ursin, H., Åkerstedt, T., & Bjorvatn, B. (2009). Shift work disorder among oil rig workers in the North Sea. *Sleep*, *32*(4), 558–565. <https://doi.org/10.1093/sleep/32.4.558>
- Watanabe, M., Kikuchi, H., Tanaka, K., & Takahashi, M. (2010). Association of short sleep duration with weight gain and obesity at 1-year follow-up: A large-scale prospective study. *Sleep*, *33*(2), 161–167. <https://doi.org/10.1093/sleep/33.2.161>
- Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., Buysse, D., Dinges, D. F., Gangwisch, J., Grandner, M. A., Kushida, C., Malhotra, R. K., Martin, J. L., Patel, S. R., Quan, S. F., Tasali, E., Twery, M., Croft, J. B., Maher, E., Barrett, J. A., ... Heald, J. L. (2015). Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult: Methodology and Discussion. *Journal of Clinical Sleep Medicine*, *11*(8), 931–952. <https://doi.org/10.5664/jcsm.4950>
- Williams, S. J. (2013). Sleep and society: Sociological ventures into the un(known). In *Sleep and Society: Sociological Ventures into the Un(known)*. <https://doi.org/10.4324/9780203000885>
- Wisetborisut, A., Angkurawaranon, C., Jiraporncharoen, W., Uaphanthasath, R., & Wiwatanadate, P. (2014). Shift work and burnout among health care workers. *Occupational Medicine*, *64*(4), 279–286. <https://doi.org/10.1093/occmed/kqu009>
- Wittmann, M., Dinich, J., Mellow, M., & Roenneberg, T. (2006). Social jetlag: Misalignment of biological and social time. *Chronobiology International*, *23*(1–2), 497–509. <https://doi.org/10.1080/07420520500545979>
- Wong, P. M., Hasler, B. P., Kamarck, T. W., Muldoon, M. F., & Manuck, S. B. (2015). Social Jetlag, chronotype, and cardiometabolic risk. *Journal of Clinical Endocrinology and Metabolism*, *100*(12), 4612–4620. <https://doi.org/10.1210/jc.2015-2923>
- World Health Organization. (2018). *ICD-11 for Mortality and Morbidity Statistics (ICD-11 MMS)*.
- Wright, K. P., McHill, A. W., Birks, B. R., Griffin, B. R., Rusterholz, T., & Chinoy, E. D.

- (2013). Entrainment of the human circadian clock to the natural light-dark cycle. *Current Biology*, 23(16), 1554–1558. <https://doi.org/10.1016/j.cub.2013.06.039>
- Youngstedt, S. D., & Kripke, D. F. (2004). Long sleep and mortality: Rationale for sleep restriction. *Sleep Medicine Reviews*, 8(3), 159–174. <https://doi.org/10.1016/j.smr.2003.10.002>
- Zee, P. C., Attarian, H., & Videnovic, A. (2013). Circadian rhythm abnormalities. *CONTINUUM Lifelong Learning in Neurology*, 19(1), 132–147. <https://doi.org/10.1212/01.CON.0000427209.21177.aa>
- Zerbini, G., Kantermann, T., & Merrow, M. (2020). Strategies to decrease social jetlag: Reducing evening blue light advances sleep and melatonin. *European Journal of Neuroscience*, 51(12), 2355–2366. <https://doi.org/10.1111/ejn.14293>

V - Annex A - Ethical Committee Approval Document



CENTRO ACADÉMICO
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Lisboa, 14 de Maio de 2019

Nossa Ref. Nº 190/19

Assunto: Projeto "Sono e saúde de técnicos de manutenção de aeronaves"

Relator - Prof. Doutor Mário Miguel Rosa

Pela presente informamos que o projeto citado em epígrafe, a realizar no âmbito do Programa de Doutoramento do EnviHealth&Co (Environmental Health Doctoral Programme), cofundado e financiado pela Fundação para a Ciência e a Tecnologia, IP (FCT), obteve, na reunião realizada em 7 de Maio de 2019, parecer favorável da Comissão de Ética, considerando-se observados os imperativos que fundeiam as Boas práticas clínicas, os preceitos internacionalmente reconhecidos de qualidade ética e científica que devem ser respeitados na conceção e na realização dos estudos clínicos que envolvam a participação de seres humanos.

No uso das competências próprias constantes do disposto no Decreto-Lei. N.º 97/95 de 10 de Maio, e no exercício das suas funções em observância do deliberado na Lei n.º 21/2014 de 16 de Abril, que aprova a lei da investigação clínica, revista pelo Decreto-Lei n.º 80/2018 (DR n.º 198-2018, Série I de 2018/10/15) que reforça o papel das comissões de ética no contexto da instituição em que se integram nas diversas vertentes relevantes, nomeadamente, assistencial, institucional de investigação e de formação, e ainda em cumprimento dos regulamentos internos do CHULN, dos códigos deontológicos, das convenções, declarações e diretrizes internacionais, a Comissão de Ética avaliou o estudo, que considera obedecer aos requisitos éticos fundamentais que devem ser respeitados, refletindo o primado da dignidade e da integridade humanas

Encontra-se assegurado o direito à integridade moral e física do participante, cumpre as precauções essenciais tendo como designio minimizar eventuais danos para os seus direitos de personalidade, bem como o direito à privacidade e à proteção dos dados pessoais que lhe dizem respeito, em harmonia com o respetivo regime jurídico.

Com os melhores cumprimentos,

O Presidente da Comissão de Ética do CHULN e CAML

Prof. Doutor José Luís B. Ducla Soares

COMISSÃO DE

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