Master thesis

A study into schedule characteristics of shiftworking across more than two time zones that negatively impact the health and work-life balance of cabin and cockpit crew members under contract of one of the world's largest airline



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Abstract

The unusual psychological and physiological demands cabin and cockpit crew members have to face are well-understood. The aviation industry became increasingly competitive resulting in a more aggressive profit making strategy and increased job demands at the detriment of cabin and cockpit crew members.

Studies among flight crew members have already provided evidence for health problems and the difficulty to manage multiple demands simultaneously. The accuracy and generalizability of those findings to today's world of aviation is questionable since studies are rather out-dated, and not reflecting modern aviation working conditions.

The objective of this research was to examine the effects of shift working across more than two time zones on health and work-life balance (WLB). The sample consists of cockpit and cabin crew members under contract of one of the world's largest airline company. Interviews were held with four cockpit crew members and 3 cabin crew members, followed up by a web survey which has been assessed by a total amount of 104 cabin and cockpit crew members. Analyses were conducted, utilizing frequencies, cross tabulations, linear and multiple regression as well as analyses of variances (ANOVA). The results found some evidence for the existence of long-, and short-term physical and mental health problems among cockpit and cabin crew members of one of the world's largest airline company when flying across more than two time zones. The study found significant differences in gender means with respect to the experience of physical and mental health issues and the perceptions of having control about own scheduling. Especially concentration problems were shown to be significant lesser among men. Mental health issues were also found to negatively affect private life. Men were shown to perceive greater control on own scheduling compared to women. Age was shown to be a significant predictor for physical health problems, sleep difficulties and contract type. A combination of gender and age was found to result in an even stronger predictor.

Keywords: fatigue, health, health problems, WLB, work-life balance, cabin crew, cockpit crew

1. Introduction

Commercial airline pilots and cabin crew staff are responsible for the safe carriage of thousands of passengers each day which requires a person to be both physically and mentally fit to perform the job (The British Psychological Society, 2017). While physical fitness is defined as 'a set of attributes that people have or achieve that relates to the ability to perform physical activity' (United States Department of Health and Human Services, 2018), mental fitness refers to 'a state of psychosocial well-being that goes beyond the absence of disease or sickness. It means having a positive sense of how we feel, think, and act, which improves our ability to enjoy life' (Province of New Brunswick, 2013, p.11). Through the years it has become clear that the mental health of aviation workers, and in particular that of cabin and cockpit staff, is a major concern for airlines, regulators and passengers since psychological problems among pilots and cabin crew are a threat to flight safety and the outcome of deteriorating mental health can be catastrophic (The British Psychological Society, 2017). Following the suicide of the Germanwings pilot who deliberately crashed the aircraft into the Alps and was thus responsible for the death of hundreds of people on board, the topic gained increased importance within the industry.

Aviation personnel and specifically cockpit and cabin crew members work in a unique environment and endure a range of different stressors, which may place them at increased risk of developing a mental or physical health condition. This unique environment is characterized as a safety-critical, high-performance work environment with issues of shift work. 'Shift work refers to a job schedule in which employees work hours other than the standard hours of 8 a.m. to 5 p.m.' (Grosswald, 2004, p. 414). Especially within the airline industry, shift working schedules include a range of characteristics that are found to have a negative impact on an individual's health and WLB. Examples are night shifts, flight-rest sequences and long-haul flights. Within this study, schedule characteristics are defined as the flight characteristic such as the type of flight, the duration of flight and/ or social characteristics that emerge as a result of the type or duration of the flight.

Working in shifts has been shown to contribute to a range of health problems such as fatigue due to night work, or a fairly innocuous cold. Physical and mental health problems associated with shift work are mostly related to the disruption of biological cycles keyed to daily periods of light and darkness. The wake-sleep cycle is the most apparent of these rhythms. These symptoms increase when flying across more than two time zones since flight crew members face these challenges over a longer period compared to flight crew staff who fly within one or two time zones and stay close to the normal biological rhythm. Also, the constant flying across several time zones and the fact that most parts of the job are being performed abroad, does suggest difficulty in maintaining a work-life balance (The British Psychological Society, 2017).

Some scholars have already provided evidence for the existence of physical and mental health issues among cockpit and cabin staff and some difficulties in maintaining a balance between work and private life have been revealed in several studies (Chung & Chung, 2009; Cho, Ennaceur, Cole & Suh, 2000; Caldwell, 2005). However, there is still little known about which schedule characteristics are major triggers for observing these different health issues or an imbalance between work and private life. Hence, this paper focusses on the specific schedule characteristics which are considered major triggers for health problems and an imbalance between work and private life by cockpit and cabin crew members of one of the world's largest airline company.

The next section presents an introduction of one of the world's largest airline company. It is followed by a description of the research problem, the company's problem and the objective of this study. Also, the research question is raised and the relevance for the practice and the academic field is revealed. This chapter ends with a further outline of the paper.

1.1 ONE OF THE WORLD'S LARGEST AIRLINE COMPANY

The company was founded in 1919. It is the world's oldest airline which still operates under its original name. The airline employs more than 34.000 employees which makes it the third largest employer in the Netherlands. In 2004, the company merged with Air France which resulted in doubled revenues and a major increase in the company's network. The company serves 83 Intercontinental and 113 European destinations. The company's fleet ranges from smaller aircrafts such as the city hopper to large aircrafts such as the Boing 747-400.

1.2 PROBLEM DESCRIPTION

With around 9.000 cabin attendants and around 2.700 pilots, the company's crew staff account for approximately one third of all employees. Flight attendants are the first and often only company representatives who have contact with customers. Therefore, performance must be maintained at a high level which requires being in a healthy condition both mentally and physically. A combination of working at irregular times and crossing several time zones makes it especially challenging for crew staff to keep up health and a satisfying WLB. This is shown in the absenteeism rate among flight crew which has been increasing over the last years.

Previous aviation studies have shown that fatigue is predicting long term as well as short term health related absence and predicts a poor work-life balance, caused especially by testiness and breakdown of social interactions (Janssen, 2003). Research by Nesthues & Scroeder (2007) revealed chronic fatigue, memory issues and a slow response as consequences of experiencing Jet Lags.

Besides that, many studies provided evidence that individual tolerance factors such as the age, the gender, the circadian rhythm and the personality of a person increase the likelihood of health issues to occur (Lagarde, Beaumont, Batejat, Catrycke, Van Beers & French, 1999; Rotenberg, Portela & Duarte, 2001; Nagda & Koontz, 2003; McLaughlin, Bowman, Bradley, & Mistlberger, 2008)

Health problems and a poor work-life balance have been found to result in a decrease in productivity (Rosekind, 2010). Studies show that just one employee who is low performing in an otherwise high-performing group can bring down productivity by as much as 30-40%. By bringing down productivity, weak cabin crew members may create customer dissatisfaction which is shown to double or triple their costs to a company (Wittbrodt, 2014).

To put this into numbers, the National Law Review reported that it can cost a company 5 times more to acquire new customers than to keep current ones (Webber & Alan, 2008). This shows that unhealthy cabin crews can create enormous financial as well as human costs which are not only costs due to productivity losses, but also absenteeism costs including costs of payments for non-work time of absentees which will cost the company 100% in the first year and still 70% in the second year, costs of managing absenteeism problems, costs of time for that replacement employee and any medical costs paid to cure the employee (Cascio & Boudreau, 2011). Lawrence and Cooper (2000) confirm the enormous financial expenses when ignoring unhealthy employees by adding that the collective cost of absenteeism, reduced productivity, compensation claims, health insurance and direct medical expenses are estimated at \$150 billion per year.

To increase the health and WLB of flight staff, the company uses two tools, namely the *RBTI* tool (abbreviated for Reams Biological Theory of Ionization) and the *FAST* scheduling tool. RBTI is applied to flight crew flying within one or two time zones only, while the FAST tool is

	Within one or two time	Across two or more time				
	zones	zones				
Health and	V using RBTI online	X				
WLB						
Fatigue	V using FAST scheduling	V using FAST scheduling				
	software	software				
TABLE I. APPLIED SOFTWARE						

additionally used for flight crew flying across more than two time zones (see table I).

The RBTI helps the company to analyse and identify previously unrecognized electro-biochemical dysfunctions taking place within the human body, thereby allowing the creation of a perfect set of personal life-style recommendations that will address and reverse those unrecognized dysfunctional patterns. What it is not capable of is diagnosing medical illness.

The 'FAST' tool is used by the company to combat fatigue. The tool predicts human reaction time, likelihood of lapsed judgement, and fatigue risk, allowing planners to identify areas of fatigue risk in schedule design. However, it became clear that applying both tools was not effective enough to reduce absenteeism among flight crew members. While the RBTI tool provides recommendations on how to combat health issues, it does not reveal why and through which schedule characteristics these health issues occur. The Fast software uses measures in compliance with the fatigue regulations and is thus not tailored to the perceptions of flight crew members of the company but rather to the regulations provided by law, which may differ from those of flight crew members. Hence, information about the impact of schedule characteristics for flights across more than two time zones on the company crew's health and WLB is lacking to detect harmful schedule characteristics which need to be taken into account to effectively increase employees overall health and WLB with the aim to finally decrease absenteeism.

1.3 RESEARCH PROBLEM

Many scholars have conducted studies into the effects of shift working across time zones on the health and WLB of flight crews. However, research into which schedule characteristics actually cause health problems and a difficulty to balance work and private life, has been found to be rather out-dated and limited. The aviation industry is characterized as a rapidly changing industry with customer demands that are ever changing and competition that is (KMPG, 2018). To keep up with these challenges, the business models of airlines have been shifted towards a more aggressive profit making strategy aimed at optimizing efficiency and profit (IATA, 2017). Airlines are increasingly trying to maximize the number of flights while reducing staff costs which has led to a reduction of crew members on board and shorter recovery periods between flights.

Previous studies do not reflect these challenges faced by modern day flight crew and in particular the additional strain and stress placed on an individual when working at irregular times and flying across more than two time zones.

Hence, the insights gained through previous studies are considered less representative for the circumstances that are faced in today's aviation. That is why an up-to date study which is representative for modern aviation working conditions is essential to investigate which schedule characteristics are affecting the health and WLB of cabin and cockpit crew members flying across

more than two time zones. By focussing on harmful schedule characterticstics, the company is able to enhance crew's well-being and consequently reduce absenteeism.

1.4 RESEARCH OBJECTIVE AND RESEARCH QUESTION

The aim of this research was to detect the effects of shift working across more than two time zones on cockpit and cabin crew's physical and mental health. In particular, the study aimed at investigating harmful schedule characteristics for health and WLB of flight crews, flying across more than two time zones. This study therefore sheds light into which schedule characteristics have been considered by the the company's crew to cause physical or mental health issues and/or which of those create difficulties in maintaining a balance between work and private life. Consequently, the insights may help the company to improve the crew's well-being in the long run by taking caution of schedule characteristics that have been revealed as major triggers for developing health conditions and/or an imbalance between work and private life. Thus, the research question that has been set up for this research is as follows: What are schedule characteristics of shift working across more than two time zones that negatively impact the health and work-life balance of cabin and cockpit crew members working for one of the world's largest airline company?

1.5 ACADEMIC RELEVANCE

Shift working and its effects on employees' health and work-life balance have been studied for a long time. However, shift working across time zones linked to the airline industry has barely been studied regarding its effects on health and work-life balance. There is little known about the consequence of schedule characteristics regarding shift working across more than two time zones for the health and WLB of flight crew. In addition, previous studies mainly addressed the existence of health issues, while failing to investigate the frequency to which a certain health issue is observed to determine its severity.

This study will therefore contribute to the existing knowledge pool and enrich the knowledge base on schedule characteristics that cause health and WLB issues. The focus is thereby led on flights across several time zones and working at irregular times. Harmful schedule characteristics

which are detected can be used as a starting point for further research within the aviation industry.

1.6 PRACTICAL RELEVANCE

The results of this research carried out on schedule characteristics and their impact on health and WLB are especially useful for the airline industry. Taking the schedule characteristics into account which have been considered as especially harmful for health and WLB by the company's crew may enable any other airline company to create healthier flight schedules. This in turn may enhance employee well-being while it at the same time helps to decrease the employee's absenteeism rate and allows the reduction of related absenteeism costs.

1.7 OUTLINE

The study consists of three main chapters namely introduction, research and advisory part. The research chapter includes the theoretical framework as well as the methodology, research results and a discussion of results. Within the theoretical framework a selection of relevant literature and concepts is made. The core concepts within this study are shift working across time zones as well as health and work- life balance.

This theoretical framework chapter is followed by the methodology chapter. In this chapter, the chosen research strategy is described as well as methods of data collection and the sampling applied within this study. The data collected from the interviews and surveys are then used to formulate an answer to the research question which is followed by a discussion. This is finally followed by the advisory chapter which provides practical recommendations for the company.

2. THEORETICAL FRAMEWORK

By setting up the theoretical framework, existing literature findings and theories were connected with gained insights through field research which built a proper base for giving applicable advice. In the following section, each key concept is presented and defined. Additionally, the sub aspects of the core concepts are studied in detail.

2.1 Shift working

To clarify the meaning of shift working, there have been three definitions studied for this research giving meaning to this term. These definitions are mentioned below and are compared with each other. Finally one definition is chosen which is most suitable for the purpose of this research.

The first definition is given by Costa (2003, p.264) within his framework about factors influencing the health of workers and their tolerance to shift work. The topic of the research published by Costa (2003) is closely connected to the core concepts of this study and this definition therefore regarded as relevant. The author states that "(...) the term 'shift work' is quite vague and includes any organization of working hours that differ from the traditional work period; sometimes it is a synonymous of irregular or odd working hours". One year later, a more detailed definition was published by Root (2004). Root (2004) clarifies the 'normal hours' whereby he states that "The standard workday unfolds during an 8-5 timeframe. We consider shift workers to be individuals who work nonstandard hours." While Root agrees with the previous definition on the fact that shift work is linked to working abnormal hours, he also mentioned a timeframe for the so called normal hours. This definition was given in Root's (2004) work on shift work and the effect on family satisfaction which is regarded as a relevant topic for this research as it falls under the core concept of work-life balance.

Another definition given by the Institute for Work & Health (2018) is the most informative one by adding different types of shift work. The definition is as follows: "...most studies on shift work classify shift workers as anyone working outside regular daytime hours (i.e. between approximately 7 a.m. and 6 p.m., Monday through Friday).

Under these definitions, shift workers include all people working evening shift, night shift, rotating shifts, split shifts, irregular or on-call schedules both during the week and on weekends".

It is striking that all definitions agree on the fact that shift workers work during abnormal hours which are not any hours between 7 a.m. and 6 p.m. from Monday to Friday. As the last definition is adding the types of shift work and for the rest confirms what was published by Root (2004) and Costa (2003), it seems to be the most appropriate and informative one for this research. Therefore the definition further used within this research is as follows: *Shift workers work outside regular daytime hours (i.e. between approximately 7 a.m. and 6 p.m., Monday through Friday). Under these definitions, shift workers include all people working evening shift, night shift, rotating shifts, split shifts, or irregular or on-call schedules both during the week and on weekends.*

2.2 SCHEDULE CHARACTERISTICS OF SHIFT WORKING ACROSS TIME ZONES

After clarifying the term *shift working*, this section presents shift work schedule characteristics of flights across more than two time zones that are found to have a negative impact on the health and WLB of flight crew members.

Rotation

Shift work scheduling can encompass a variety of approaches such as altering the direction of shift rotations (clockwise vs. counter clockwise), rapid vs. slow rotations, differing start times and duration of time between rotations. Each of these approaches leads to different effects on the physiological factors. A clockwise shift rotation for instance involves a phase delay which is in synchrony with the normal circadian pattern, while a counter clockwise rotation involves a phase advance which is contrary to the usual pattern of the circadian clock (Rocco, 1999). Understandably, rotating shift workers, such as cabin and cockpit crew members are more likely to suffer from circadian disruption and sleep disturbances as a consequence of the misalignment between sleep-wake cycle and light-dark exposure (Grajewski, Nguyen, Whelan, Cole, & Hein, 2003). The severity of circadian disruptions were especially greater with an increased number of time zones crossed.

Control

Flight attendants often bid between geographic place and control in an attempt to receive greater control over their own spatial movements. Noticeably, flight attendants who are mothers were found to face difficulties in balancing work and private life (Whitelegg, 2007). As well as flight attendants with a child, also other flight attendants revealed struggles to pursue private free time activities such as attending festivals or meeting up with friends. It has shown to be difficult to maintain social interactions and keep relationships alive as the schedules are ever changing while there is just little control. As reported by flight attendants, especially night flights increase the risk to suffer from exhaustion which then makes it difficult to take care of the child on the day after the nightshift (Whitelegg, 2007).

Workload

In recent years, there have been many changes in commercial aviation which have affected duty cycles and workload. One present concern is that the associated regulations designed to manage flight crew fatigue have not kept pace with these changes (Caldwell, 2005). A variety of studies have proven that the amount of walking during duty hours has been shown to be related to workload intensity and duration.

Fatigue has shown to be positively related to workload by 58% of flight attendants (Smolinsky et. al., 1982). In a study conducted by Morley-Kirk and Griffiths (2003), high workload demands were experienced by 83% of flight attendants. On-duty walking distance has been positively correlated with length of the duty day, the end-of-duty stress level and fatigue.

Another study found that the length of duty day showed significant effects on end-of-duty sleepiness and upon fatigue levels in both international and domestic flight attendants (Galipault, 1980).

Number of time zones

the degree of deterioration in sleep duration, sleep quality and performance efficiency is

dependent upon the number of time zones crossed. Samel et. al (1995) found that fatigue levels increase to critical levels during 9-time zone flights after eight hours of flight time. However, performance deterioration can also occur in response to only a one-hour time change (Monk, 1980). The quality of sleep and the resulting recovery is also dependent upon the number of time zones crossed. Sleep quality, adaption and days needed for recovery was found to be significantly worse after crossing more than 10 time zones (Suvanto & Ilmarinen, 1987). Flights across nine time zones with short layovers resulted in poor sleep quality during layover, characterized by short sleep and disturbed awakenings. The recovery sleep during four post-flights were also characterized by issues of waking up and feelings of not feeling refreshed (Lowden & Åkerstedt, 1998).

Duration

The duration of the flight is assumed to have an influence on how shift work across time zones is perceived. Simonson (1984) found that the majority of flight attendants experience feelings of fatigue somewhere between 6 and 10 hours. Only 21% were not fatigued until completing an 11-15 hours shift. In a second study conducted by Galipault (1980) it was found that the majority of flight attendants do encounter tiredness after a shift of 5 to 6 hours.

International and domestic: In general, MacDonald, Deddens, Grajewski, Whelan, and Hurrell (2003) found that international flight attendants experience less fatigue than domestic flight attendants. Those domestic flight attendants experienced very high correlations of fatigue with age, start and end-of-duty stress, sleepiness and pulse rate. In terms of age, older flight attendants on domestic flights were found to have greater fatigue effects resulting from multiple flight legs than younger flight attendants (MacDonald et. al., 2003).

A survey of 211 female flight attendants assigned to nonstop international flights (Ono, Watanabe, Kaneko, Matsumoto, & Miyao, 1991) revealed that fatigue increased after 7 to 10 hours after take-off.

In general, differences in fatigue levels were related to the duration of the flight, the number of time zone, and the possibility for adequate rest during the layover.

Long Haul vs. Short Haul: A survey of 190 flight attendants (Nagda & Koontz, 2003) mirrors previous insights by stating that tiredness and lack of energy were highest for long- haul flights than for short-haul flights. The most common reported issue with long-haul flying was sleep disturbances, including difficulty falling asleep, spontaneous night awakening and early morning awakenings (Samel & Wegmann, 1989).

Finally, five schedule characteristics of aviation shift working have been found to impact health and WLB of flight crew flying across more than two time zones:

- ➢ Rotation
- ➢ Control
- > Workload
- > Number of time zones
- > Duration of the flight

2.3 HEALTH

After clarifying the first core concept 'shift working across more than two time zones', this section presents the second core concept, which is health.

Health is defined as the level of functional and metabolic efficiency of a living organism. The World Health Organization (as cited in Grad, 2002) proposed a definition whereby it states that health is 'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (p.981).' However, this definition has been subject to controversy, due to its operational value, the ambiguity in developing cohesive health strategies, and due to the problem created by use of the word 'complete', which makes it practically impossible to achieve (Jadad et. al., 2008; Callahan, 1973 & Taylor & Marandi, 2008). Other definitions have been proposed whereby the aspects health and personal satisfaction correlate underlying the necessity to investigate health in combination with WLB (Bellieni & Buonocore, 2009). An alternative approach focuses on avoiding definitions that demand precise descriptions of health. Instead, following a three-year global conversation, convened by Jadad et. al. (2008), health has been conceptualized as the ability to adapt and self-manage when individuals face physical, mental or social challenges. Since this last framework includes mental, physical health and social challenges which can be linked to WLB, it is most suitable for this research. Thus, the definition used within this thesis defines health as *the ability to adapt and self-manage when individuals face physical, mental or social challenges.*

2.4 WORK LIFE BALANCE

After clarifying the definition of shifworking across time zones and health, this section deals with the definition of the third core concept, namely work-life balance.

McCartney (2002) describes the concept in a broader way by stating 'Work/Life balance can be described as the 'fit' between multiple roles in a person's life. Lockkett (2008) gives a more detailed definition by talking about 'the need of all individuals to achieve and maintain the balance between their paid work and their life outside of work'. While Lockkett (2008) and McCartney (2002) refer to balance between different roles of an individual, Clarke (2011) argues that the meaning and definitions may vary but that work-life balance is generally associated with maintaining an overall sense of harmony in life. Clark (2000) specifies this by defining work-family balance as "satisfaction and good functioning at work and at home, with a minimum of role conflict" (p. 751).

Comparing those definitions, it is striking that all studies of work-life balance consider an individual's ability to be able to manage the multiple demands of life (job and personal) simultaneously while maintaining a harmony for oneself. Therefore, the definition further used within this research is as follows: *Work-life balance can be described as the 'fit' between multiple roles in a person's life by facing a minimum of role conflict and by maintaining an overall sense of harmony.*

2.5 EFFECTS OF SHIFT WORKING ACROSS TIME ZONES ON HEALTH

Health is gaining an essential role within companies. Not least because companies are aware of the enormous financial costs related to unhealthy employees.

Having presented major schedule characteristics of shift working across time zones, the sections below present the effects of flying across time zones on health by categorizing health into two sub-categories, namely, physcial and mental health.

2.5.1 PHYSICAL HEALTH

Physical health is defined as 'a set of attributes that people have or achieve that relates to the ability to perform physical activity' (United States Department of Health and Human Services, 1996 as cited in Suma, 2017). Experiencing physical health issues are one of the most common results of shift working across time zones. Research conducted by the Gezondheidsraad (2017) in the field of effects of shift working on health revealed that shift workers are at high risk for experiencing physical health problems. The study emphasizes that night workers especially, have a higher risk of becoming physically ill compared to day workers. The risk of suffering from diabetes mellitus (type 2) as well as suffering from heart diseases and sleepiness has been shown to increase with the amount of years working night shifts.

In line with the research by the Gezondheidsraad (2017), a study conducted by the California Department of Health Services Occupational Health Branch (2001) which reviewed reports from over 100 flights to Australia from January 1990 to September 2000 confirmed symptoms observed by flight attendants such as headache, sore throat, difficulty in breathing, and sinus problems. The authors further noted an increase of symptoms over the 10-years period.

In addition to these physcial health issues, research among flight attendants (Nesthues & Schroeder, 2007) has shown that fatigue is a major issue when shift working across time zones

for which Borbély (1982) mentions two main causes, namely sleep loss and desynchronization of circadian rhythms with schedule activity and sleep.

Nesthues & Schroeder (2007) add that both sleep loss and circadian rhythms interact dynamically with the aim to regulate changes in alertness and performance. The authors stress the connection between jet lag and fatigue by pointing out that the 'circadian rhythms contribute to fatigue when there is a conflict between environmental cues and one's biological clock. Jet lag and shift work are such causes of circadian lack of synchrony, both of which are found to occur with operational flight attendant scheduling' (as cited in Nesthues & Schroeder, 2007, p.20). Among flight attendants who suffered from fatigue, testiness and a breakdown of social interactions were commonly reported (Nesthues & Schroeder, 2007).

Besides experiencing fatigue, a study conducted by Winget, DeRosha, Markley & Holley (1984) showed that sleep disturbances have been reported in 78% of study subjects during the first night after a transmeridian flight that is a flight across more than two time zones, whereby 30% of subjects still report sleep disturbances after three nights. In line with Winget et. al's study (1984), Wright et. al (1983) report that after a transmeridian flight, especially symptoms of fatigue and weakness were being experienced. The authors report that 50% of subjects reported fatigue and sleep disturbances while 40% reported subjective weakness. A study on flight attendant fatigue which has been conducted by Roma, Mallis, Hursh, Mead & Nesthus (2010) revealed that flight attendants working on international flights slept significantly less (4.9 hrs. vs. 5.9 hrs. respectively) and also less efficiently (75% vs. 79% respectively) in comparison to their colleagues in domestic operations. Sleepy people were also shown to suffer from confusion, anger, tension, a decrease in vigor and depression.

Besides aforementioned health issues, it is striking that several studies which are based on samples consisting of feminine flight attendants working night shifts report increased risk to suffer from breast cancer as a result of doing shift work [Mawson, 1998; Rafnsson et. al., 2001 ;Megdal, 2005]. The risk of suffering from breast cancer was most prominent 15 years after recruitment which has also been confirmed by Rafssnon et al's (2001) study among 1532 feminine cabin crew members in Iceland.

In explaining the reason for being at high risk to suffer from breast cancer, the authors refer to melatonin deficiency resulting from work-associated interruptions in sleep-waking cycles which is also called 'jetlag' and the existence of electromagnetic fields in the ethology as potential threats to get breast cancer.

Van Drongelen et. al (2014) confirm the negative effects of shift working across time zones and physcial health by categorizing short and long term effects: Short term effects of shift working across times zones include fatigue, impaired performance capability and sleep loss. Long term effects however, have shown that fatigue and circadian disruption are associated with disturbed WLB, metabolic disturbances, cardiovascular diseases gastrointestinal diseases and cancer.

2.5.2 Mental health

Mental health is a topic in aviation which gains a lot of interest in today's world, especially following the recent Germanwings crash, which has been reported as suicide, and is just one phenomena that shows the importance of mental fitness. Mental health refers to 'a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (WHO, 2004, p. 10).'

Cockpit and Cabin crew need to face unusual physiological challenges when flying across different time zones, ranging from experiencing jet lag and sleeping difficulties to limited recovery periods and exceeding shifts of more than 12 hours in a row. Those psychological challenges are likely to result in mental health problems.

In terms of jet lag, research has suggested that chronic jet lag might speed up cognitive decline. When crossing several time zones in a short period, increased levels of the hormone cortisol will show negative effects on cognitive functioning. A study by Cho et. al (2000) on flight crews found that individuals who worked international long-distance flights had higher cortisol levels on average, compared with staff working on the ground.

Within this group of international flight crew members, those who had worked as cabin crew for years tended to score lower on memory tests compared with members working on the a ground and their flight colleagues with fewer years of experience.

The researchers thus note that chronic international flying could possibly increase the cortisol level the body produces and that higher cortisol levels may actually be the cause of worse memory test results. In the following, three mayor mental disorders are studied in more detail.

ADJUSTMENT DISORDER

Adjustment disorder is assumed to be the most common mental disorder among pilots. It is characterized by the development of behavioural and intense emotional symptoms in response to an identifiable stressor such as relationship difficulties, career issues or occupational stress (Morse ad Bor, 2006).

Adjustment disorders are associated with fictional impairment which is the result of for example decreased concentration, anxiety, depression, fatigue, inattention, problems in decision making or temporary changes in social relationships.

MOOD DISORDERS

The American Psychiatric Association (2013) distinguishes mood disorders by creating two sections, namely depressive related disorders, and bipolar related disorders. A study conducted by BALPA reported a higher number diagnosed with depression among pilots than expected (BALPA, 2017). The surveys indicated that 40% of all 490 participating pilots suffered from symptoms that are typical for depression disorders. These symptoms are irritability, fatigues, and

a loss of motivation, sleep disturbance, decreased concentration or a lack of pleasure, whereby sleep problems and fatigues are assumed to be the main causal factors for depression.

ANXIETY

Generalized anxiety disorder (GDA) is considered one of the most common mental disorders. GDA is characterized by persistent, excessive, and unrealistic worry about everyday things. It is shown by symptoms such as muscle tension, restlessness, fatigue or sleeping difficulties. Next to the Generalized anxiety disorder (GDA), there are other types of anxiety such as Social Anxiety Disorder, depression, panic disorder, Agoraphobia, Post-Traumatic Stress Disorder (PTSD), Specific Phobia and Obsessive Compulsive Disorder (OCD) (Human Development & Stress Management Center, 2018).

Although each type of anxiety has its own set of physical, emotional and cognitive impairment, there are still several general symptoms namely increased worry, interpretations, irritability, restlessness, increased palpitations, sweating, tingling, sensations, and hyperventilation, racing minds, nausea or dizziness.

Different studies have revealed that anxiety, flight phobias, and post-traumatic stress among air crew members are especially occurring after flight incidents (Marks, Yule & De Silva, 1995). However, a study among more than 3,000 American cabin attendants reported that 14 % usually felt anxious before a flight and 37 % felt this way at least sometimes even with the absence of prior incidents happening (Smolensky, Lee, Mott & Colligan, 1982).

According to Suvanto & Ilmarinen (1989), especially cognitive as well as physical job demands are triggers for stress among flight attendants. These are for example demands for foreign language skills and the need to make decisions rapidly.

2.5.3 EFFECTS OF SHIFT WORKING ACROSS TIME ZONES ON WORK-LIFE BALANCE

Many scholars have already theorized about the way in which people manage the conflicting demands between work and private life. One hypothesis which is linked to these conflicting demands is the role scarcity hypothesis. It assumes that people possess limited and fixed amounts of resources (e.g. time and energy) (Edwards & Rothbard, 2000). Managing multiple roles such as being employee, spouse and parent is problematic as they draw on the same scarce resources. Consequently, the work-family conflict has been defined as 'a form of interrole conflict in which role pressures from the work and family domains are mutually incompatible in some respect' (Greenhaus & Beutell, 1985, p. 77). Previous research has demonstrated that especially time- and strain-based conflicts (i.e. fulfilment of demands in one domain is difficult owing to the time devoted to and strain produced in the other domain) are associated with various negative work-, family- and stress-related outcome variables such as health and well-being (Allen, Herst, Bruck, & Sutton, 2000).

During the years, there have been several studies executed on the work-home conflict of cabin crew members. By determining women's experiences of work and family conflict in a Chinese airline, Ren and Foster for example a (2011) found that female air staff experienced a moderate level of work – family conflict (WFC) while flight attendants experienced a greater degree of conflict compared to those on the ground. The study further revealed that married women were affected more than single women. The study also showed that work rather than family characteristics had a greater impact on work–family conflict for the females in this case study. Female flight attendants mainly suffered from isolation, solitude, fears of being inadequate partners and mothers due to the job demands of a cabin crew member, passenger demands and a lack of protection by employers in terms of workplace exposures or violent passengers. Flight attendants are barely at their home destination which includes being far away from loved ones. In cases in which the increasing job demands take control, stress can emerge which again decreases the perception of life quality. A study by Chin-Fu Chen and Ya- Ling Kao (2012) found that burnout mediates the relationship between job demands and health problems.

High job demands such as suffering from heavy workloads, emotional demands related to the service or working non-standard hours, were shown to be key contributory factors. A later study by Foster and Ren (2015) among flight attendants of three Chinese airlines confirmed these

findings by uncovering negative relations between WFC and job type, inflexibility, shift work, work pressures, leave and gendered organizational culture. The authors additionally revealed that women who experienced a lot of support at home and outside work were significant in mitigating WFC.

Another study by Sonnetag and Natter (2004) among forty-seven flight attendants shed light into the perception of well-being while being in the work and family domain. The authors found that spending time on work-related activities during off-job time is resulting in decreased well-being, whereas spending time on physical activities (i.e., sports) and experiencing off-job time activities as recovery, improved well-being. All studies show a clear negative relationship between WLC and well-being.

2.6 INDIVIDUAL TOLERANCE FACTORS OF SHIFT WORK

Many studies provided evidence that individual tolerance factors such as the age, the gender, the circadian rhythm and the personality of a person increase the likeness for health issues to occur (Lagarde, Beaumont, Batejat, Catrycke, Van Beers & French, 1999; Rotenberg, Portela & Duarte, 2001; Nagda & Koontz, 2003; McLaughlin, Bowman, Bradley, & Mistlberger, 2008). Therefore, it is essential to study the impact of schedule characteristics of shiftwork across time zones on health and WLB by taking indivdual tolerance factors into account.

For the purpose of this thesis, shift work tolerance is defined as working irregular shift patterns without encountering any problems such as digestive troubles, fatigue and sleep alteration (Andlauer et. al, 1979). There have been four variables found which may have some tolerance for shift work, namely age, gender, circadian rhythm and personality.

2.6.1 Age

The importance and impact of age on shift work gained more and more importance today, especially due to the aging of the population and the retirement age which is been increasing. Rosekind (1994) conducted research in the field of aviation and found that a worker's tolerance to shift work declines with advancing age. That is why difficulties may arise in employees older than 40 years, even if the worker previously tolerated shift work. This age category mirrors the insights gained by Lagarde et al. (1999) on the impact of age and gender on Jet lag whereby it has been found that at an age less than 35 years, employees showed more tolerance towards Jet lag than older ones.

However, Rosekind (1994) also stresses that individuals vary in their ability to adjust to shift work whereby many individuals suffer few or transient problems. Some, however, are unable to adjust at all which is the contradiction to shift work tolerance.

Moline et al's (1992) study on age-related differences in recovery from jet lag confirmed the difference in tolerating shift work between young and middle-aged employees. For the first 4-day interval after the shift, middle-aged employees had larger increases of waking time and earlier termination of sleep than young employees. They also reported larger decreases in alertness while they also reported larger decreases in wellbeing which went hand in hand with larger increases in sleepiness, weariness and effort required to perform daily functions. These insights are consistent with previous mentioned studies which reported that young employees are more tolerant towards shift work although this tolerance has been found to decrease with age.

2.6.2 Gender

Next to age, gender is assumed to have an impact on the tolerance towards shift work. Many studies report that female shift workers have more sleep related problems than men (Marquiè & Foret, 1999; Rotenberg et. al, 2001 & Rouch et. al, 2005). Marquiè & Foret (1999) found that female shift workers experience more frequent difficulties falling asleep and use more hypnotics to facilitate falling asleep than male shift workers. These insights have been confirmed by a recent study that compared self-reported health information for flight attendants for two U.S. airlines with that of the general U.S. population (McNeely et al, 2014) revealing that male flight attendants reported sleep problems nearly 4 times the general population and their female colleagues were diagnosed at a rate that was nearly six times the general population.

Overall, research has shown that women suffer more from shift-work intolerance than men. Typical symptoms which have been encountered more among women are psychoneurotic, digestive, circulatory and chronic fatigue. Moreover, it was shown that women experienced more drowsiness during shift work than men did. More than a dozen studies have reported the risk for female flight attendees to suffer from breast cancer, and that this risk is increasing when working nightshifts (Megdal et al, 2005).

2.6.3 CIRCADIAN RHYTHM

Due to working at irregular times, cabin crew staff often face disruption within their cardiovascular cycles. The standard 24-hour clock on which human bodies are set, is called the biological clock which we refer to as our circadian rhythm. The circadian rhythm regulates the body's functions such as: sleep/wake episodes, core body temperature, digestion, neurological and physical performance, and hormone secretion. A normal sleep/wake pattern is 16 hours awake before having about 8 hours of sleep. A human body is expected to be at rest between the hours of 02:00–06:00 (Flight Safety Foundation, 2005 as cited in Fare, 2013). This so called

circadian low is thus the time period when our bodies want to be at a restful state, i.e. asleep. The circadian rhythm knows two time periods of sleepiness on the 24-hour cycle. The first period of sleepiness will be between the hours of 02:00 and 05:00 body adjusted time and the second is 12 hours opposite between the bodies' adjusted hours of 15:00–17:00 (Civil Aviation Authority, 2007 as cited in Fare, 2013).

Pilots and flight attendants crossing multiple time zones and changing work schedules were shown to experience a disruption to the circadian rhythm. Nagda and Koontz' research (2003) adds that the frequency of symptoms related to circadian rhythms increased with an increase in length of flights, rapid changes in time zones, and early morning or late night flights.

2.6.4. PERSONALITY

Personality type was shown to be the fourth tolerance factor of shift working. Most studies about the relationship between personality and shift work tolerance find that internal focus of control, extraversion and self-esteem are all positively related to shift work tolerance (McLaughlin et. al, 2008; Smith et. al, 2007 & Seo et. al, 2005). Studies show that flight attendants who tend to have high scores on extraversion, openness, and neuroticism are more likely to tolerate shift work (MacDonald, 2008). In an inconsistence with previous studies, three other studies revealed that neuroticism and related traits such as anxiety, repressive emotional style or negative mood are related to low tolerance to shift work (McLaughlin et. al, 2008 & Tamagawa et. al, 2007).

Based on the studies presented within the theoretical framework, the following schedule characteristics have been found to have a negative impact on flight crew's health and WLB when shift working across more than two time zones:

- ✓ Rotation
- ✓ Control about own schedule
- ✓ Workload
- Number of time zones crossed
- ✓ Duration of the flight
- ✓ Night shifts
- ✓ Short rest period

3. METHODOLOGY

The following chapter represents the setup of the research. For this research, a mixed method research design was applied: Previous studies which found schedule characteristics that negatively impact flight crew's health and WLB were rather out-dated and thus not reflecting today's challenges. Especially job demands for cabin and cockpit crew members have been increasing over the years. Consequently, the severity of specific schedule characteristics of shift working across time zones may have changed over the years. Also, shorter recovery periods between flights and less staff occupation on flights were found to be two major changes within today's aviation. Therefore, interviews as an explorative method were chosen to gain insights into relevant characteristics which negatively impact health and WLB that are most representative for today's working conditions.

After conducting interviews to detect current harmful schedule characteristics, an online survey was set up capturing the schedule characteristics detected through the literature review and interviews. The web survey was chosen as it was aimed to capture the frequency in which these harmful schedule characteristics were observed to then investigate their relative severity. Frequencies are best to assess using Likert scales which allow the researcher to set up standardized response categories which in turn allows for comparisons between respondents. In addition, the survey increased the sample size to 104 respondents which is beneficial for increasing reliability and generalizability of results.

Finally, advice is given on how to use the insights from this study to create a healthier flight schedule and thus decrease absenteeism. Also harmful schedule characteristics and their effects on health and WLB are described and practical recommendations for the company are provided (figure I).

Interviews

Which schedule characteristics are there that negatively impact the health and WLB of flight crew working across more than two time zones?

Surveys

What is the frequency to which those schedule characteristics are being observed relative to others?

Designing the tool

Giving results and advice on how to adapt the current scheduling tool with the aim to decrease negative health issues and enhancing the crew's well-being in the long run.

FIGURE I. OVEVIEW OF RESEARCH PROCESS

3.1 DATA COLLECTION METHOD

The chosen data collection method for this thesis has primarily been face-to-face interviews which were held using a semi-structured interview guide. The use of semi-structured interviews allows the researcher to prepare questions ahead of time, so that questions could be sent beforehand to participants. That way, proper preparation can be ensured which further increases the depth within the interview and therefore enhances the data quality. Also, semi structured interviews allow for comparisons between data gained by different participants since the same main questions have been asked to all participants, while it further allows for additional questions that arise during the interview (Baarda, 2009).

However, after conducting four face-to-face interviews, it appeared that the participants were rather reserved in giving detailed and in-depth answers, which stayed the same even after further questioning. Especially with regards to physical and mental health problems, participants appeared to be very reticent to share. To be able to still gain valuable insights, the researcher consequently switched to phone interviews, especially due to the benefit of anonymity which should make participants feel more comfortable in sharing their opinions. An increase in in-depth answers was observed, which further enhanced the value of given answers.

To begin the interviews, the researcher started with an introduction communicating the objective of the interview. Each participant was informed of the anonymous nature of the interview and asked for permission to record. Then, each participant was asked to briefly describe his or her function within the company and to indicate the years of experience.

After these formal questions, the first question was focussed on the type of schedules they experience now and in the past. Any differences and similarities were discussed. The following questions were to assess which parts of the schedule were causing fatigue, mental and physical health problems and a difficulty to obtain a satisfying WLB. All characteristics that came up were discussed. At the end of each interview, respondents were encouraged to share any additional relevant information helping the researcher to deepen the knowledge. Interviews lasted for an average of 45 minutes.

The qualitative research method has been chosen to explore schedule characteristics considered harmful for health and WLB. Therefore, non-standard measures are appropriate to investigate underlying beliefs rather than giving the respondent answer categories beforehand (e.g. providing Likert sales). This would limit the availability of new, uncovered structures that could be detected by using interviews (Kaiser, et. al. 2010).

Next, to the interviews, a follow-up survey has been conducted. The quantitative research method has been chosen as it enables a gathering of insights from a larger sample which increases the generalizability and reliability of this research (Baarda, 2009). Furthermore, it allows for comparisons between respondents due to the ability to standardise answer categories using Likert scales. For the survey, an online survey was chosen as it is user friendly and enabled respondents to participate whenever they found free time to do so. Moreover, the costs are less compared to paper surveys and the duplication effect is much bigger, since a link to a survey makes it easier for participate. This process is also labelled under democratization of the survey (Couper, 2000). Appendix I. shows an overview of advantages and disadvantages of surveys. An amount of at least

100 surveys were set to be the objective and a Likert scale has been used to generate the answers. The Likert Scale is the most used scale by researchers as it allows the individual to express how much they agree or disagree with a particular statement (Likert, 1932). The online survey was finally distributed through different social media channels such as LinkedIn, Facebook and the company's internal forum Yammer. For collecting the data, the program Qualtrics was used which allows for setting up Likert scales. It is also considered user friendly and allows for exporting data into SPSS. The survey included general questions about age, gender and work experience as well as questions relating to physical and mental (physio-social) health. The frequency to which specific health issues (e.g. fatigue) have been observed, was assessed by linking them to the schedule characteristics detected through the interview. The answer categories were; 'Never', 'Several times per year', 'Monthly', 'Several times per month', 'Weekly', 'Several time per week', and 'daily'.

Physical health items were taken from the Physical Health Questionnaire (PHQ) (Schat, Kelloway & Desmarais, 2005) while psycho-social items were taken from the Utrechtse Burnout Schaal (Van Zwieten et. al., 2013). The list of characteristics was expanded by relevant items which emerged from the interviews. The WLB topic has been assessed by using the negative work-home interaction items from the SWING scale developed by Geurts et. al (2005). All items were portrayed as statements which were evaluated by answer categories where participants rate the sequence of the event by assessing answer categories such as 'never, 'barely, 'sometimes,' 'often and 'always'. The results of a validation study for the SWING showed that the questionnaire reliably measured four empirically distinct types of work-home interaction, and that this four-dimensional structure was largely invariant across the five samples and relevant subgroups. Besides, Validity evidence was provided based on the relations with external (theoretically relevant) variables which were measured by using Liker scales.

3.2 DATA ANALYSIS METHOD

The data analysis method depends on the chosen data collection method, which means that the data analysis methods for quantitative and qualitative data differ (Brotherton, 2008).

To analyse the interviews, comprehensive notes of the answers were taken and transcribed into an interview report immediately after each session. Follow-up questions were asked by telephone and/or e-mail when clarification was necessary.

In order to receive a better overview of the information gathered, the summaries were categorized by applying labels (open coding). Consequently, all labels used were further categorized which is known as 'axial coding' (Baarda, 2008). An overview of labels can be found in appendix IV.

The surveys were set up by using the program Qualdrics and analysed by using SPSS. SPSS allows for descriptive and inferential statistics by using multiple comparisons, regression and ANOVA. ANOVA was conducted to compare variances between different group means and predictive analysis (regression analysis) was used to show any predictions of experienced problems with e.g. advanced age.

3.3 SAMPLING

Sampling is defined as 'a smaller version of the whole population it is obtained from that reflects the same characteristics as those of the whole' (Brotherton, 2008, p.164). Quantitative sampling describes a probability-based sampling whereby each element has a non-zero, equal chance to be selected for the sample (Brotherton, 2008). Qualitative sampling by comparison is a data sampling which is known as non-probability-based sampling, but is also used in order to collect quantitative data where generalization is not the primary concern (Brotherton, 2008).

In total, 7 participants, of which 4 were cockpit staff and 3 cabin staff, were interviewed. Interviews were held until no novel insights emerged. Participants were selected through purposive sampling. Since literature suggests a difference in coping with time zones when age increases as well as differences for gender, the sample includes participants of both genders as well as participants of different age categories. Methodologists recommend such an approach in this exploratory stage of research to reveal contrasts (Yin, 1994). In order to trace suitable participants, a collaboration between the Health and Safety Department of the company and the researcher was created. Potential candidates were asked for their participation in the interview.

To ensure that social desirability was kept in check the importance of honest answers for their own benefit as well as the strict handling of information were explicitly communicated to all participants before the interviews.

The survey sample consisted of 104 flight crew members. The survey was first distributed via the company's internal forum Yammer. After observing a fairly low response rate, there were other measures taken aiming to improve the response. Consequently, there were 127 flight crew members issued via individual message on LinkedIn from which 16 have filled in the survey. Also, the survey was re-posted on Yammer to increase attention. The response rate was 12, 6%. The actual response rate however, may differ from the here provided response rate since there might have been people filled in the survey without sending the necessary confirmation that they had done so. Proving the accurate response rate is further impossible since the survey was additionally spread out on the company's internal forum (Yammer) which makes it impossible to indicate the amount of staff members who have observed the survey on Yammer, and the amount of those who have actually filled in the survey.

In terms of gender, the sample shows rather equal contributions with a percentage of 53% being male and 47% being female. In terms of position, the stake in the sample is 38% cockpit crew members and 62% cabin crew members which is fairly representative for the population (31% and 69% respectively).

4. RESULTS

The following chapter reflects the results of the field research. The analyses combined with the literature review provide necessary insights to answer the research questions. The results of the survey allow an examination of which schedule characteristics are observed by the flight crew to cause physical and mental health issues and which are observed to have a negative influence on the work-life balance of cabin and cockpit crew. Moreover, the results provide a first picture of the possible influence of individual tolerance factors on experiencing health problems. The interview guide that has been used for the research can be found in appendix II.

4.1 INTERVIEWS RESULTS

Respondents

In total, seven flight crew members have been taken part in the interviews. The sample consists of four cockpit and three cabin crew members. To be more concrete, from the four cockpit crew members, there were two people with the function 'Captain on Boeing 777/787 and 747', one with the function 'Co-Pilot on Boeing 777/787' and one with the function 'Pilot on Boeing 747'. All cockpit crew respondents were male, aged between 40 and 60. The amount of years worked 'in the air' differed from 21 to 35 years. From the three cabin crew members, there were two people working as' Cabin attendant éénbander' and one person working as 'Senior Purser'. The two cabin attendants were female while the senior purser was male. Age ranged from 25 up to 50 years; the amount of work experience differed from 14 months up to 25 years. (For an overview, see table II)

	Age	Gender	Function	Work	Contract
				experience	type
1	between 40	male	Co Pilot 777/ 787	21 years	80%
	and 60 years				
2	Between 55	male	Pilot 747	33 years	80%
	and 60 years				
3	Between 40	male	Captain 777-787	25 years	80%
	and 50 years		Dreamliner		
4	Between 50	male	Captain 747 long-haul	27 years	80%
	and 60 years				
5	Bewtween	female	Cabin attendant	14 months	100%
	20 and 30		éénbander		
	years				
6	Between 50	male	Senior Purser	15 years	100%
	and 60 years				
7	Between 40	female	Cabin crew	1 year	100%
	and 50 years		éénbander		

Table II. Characteristics of interview participants

Schedule characteristics observed to cause sleep issues and fatigue

Most interview respondents revealed that they experienced fatigue while being on duty as well as while being at home. The respondents mentioned several reasons and triggers for feeling fatigue. Three major schedule characteristics that were considered by the respondents to increase the level of fatigue have been found to be 1) the lack of rotation in the cockpit, 2) the duration of the flight and 3) the number of time zones crossed.

Lack of rotation

Most respondents agreed that the tight occupation in the cockpit increases the level of fatigue. The respondents explained that this is contributed to the lack of rotation which restricts recuperation on board due to the impossibility to rotate. In the case of only 2 pilots being scheduled for the flight, there is no rotation taking place. The respondents further clarified that the occupation depends on the amount of time zones crossed, indicating that for longer flights, such as flights over 12 hours, the occupation will increase to four pilots. An example of flights operated with 4 cockpit crew members has been stated to be Singapore-Amsterdam taking up to 13 hours; an example for flights operated with only 2 cockpit crew members has been stated to be Amsterdam -New York, taking up to 6 hours. Among participants, there was agreement that operating the 2 pilot policy is enhancing tiredness while decreasing concentration during the flights. Some respondents explained that the company is steadily decreasing the 4 pilot's occupation to a three or even two pilot's occupation although people have expressed their frustration since fatigue may increase:

'A few flights are only with two pilots and at a certain point I had 5 of these flights in a row, and with the fifth flight in a row, I was so tired I almost fell asleep' (Pilot 747)

'Some flight with 2 pilots, they feel heavier (...) compared to flights with three or 4 pilots, cause with 2 pilots obviously you can't rest in the bed in the back, so that makes a big difference'. (Captain on Boeing 777/747)'

'And then you have flights with 4 pilots that is a treat.' (Co Pilot Boeing 777/787)

'On the intercontinental flight for instance, the 12 hours flight, (...) you get some rest (..) and that makes the tiredness level go down, not to zero but it will go gown' (Senor Purser)

Respondents further revealed that each pilot is allowed to take a 15 minutes nap ('nasa nap') whereby he must remain seated in the cockpit.
It was interesting to find that the general recover period provided on board is combating fatigue only to certain extent and does not result in a full recovery:

'After a night flight, if I skip a night, of course you sleep on board like 2or 3 hours, but still you skip a night, so that makes me really tired' (Cabin attendant éénbander)

The vast majority of respondents observe sleep problems. While some respondents stated to observe a success in decreasing sleep problems by taking melatonin pills, some others questioned the success since their struggles of falling asleep on board still exited even after using specific medication.

'I went to work still quite tired' (Pilot 747)

'I got some melatonin from the doctor and slowly I was coming back in the normal rhythm and I could sleep again' (Pilot 747)

It was also interesting to detect consequences that arose from developing fatigue during flights. One pilot for example stated that fatigue is contributing to develop a low self-esteem and limits a pilot's self-confidence to safely execute the his function, in particular with regards to high-risk conditions such as landings in bad weather. Also, mood disorders have been observed as a consequence of feeling fatigue:

'I had a colleague, (...) the co-pilot, that time, he was the pilot flying, (...) and I was a little tired as well, and then he asked, well I would prefer that you do the landing because I think I am too tired to do it myself in this bad weather' (Pilot 747).

'With the landing in bad weather,(...) it's a challenge (...) but I can understand that when you're tired and not feeling that good your confidence in making a good landing is low and your stress will building up' (Pilot 747) 'Sometimes could be a situation that my colleague got a little agitated due to my behaviour and my behaviour was a result of being tired, (...) I was missing small things such as radio calls' (Pilot 747)

'You have less time to listen to others and you get more agitated when you're tired'

Duration of flight

The next major trigger to feel fatigue has been found to be long haul flights which are operated by night. The interviewees expressed the struggle of skipping a night and the difficulty to adapt the biological clock to the local time at the destination:

'The most problematic flights are the flights back to Amsterdam, most of the time you fly through a night, and also you have a lot of time zones' (Co Pilot Boeing 777/787)

'When you fly back from Kuala Lumpur to Amsterdam the flight time is longer due to the wind and you depart in the dark and you land in the dark. When I talk to colleagues of mine, everyone says that is a tough schedule.' (Co Pilot Boeing 777/787)

'Your biological clock says that you want to sleep and you need your sleep plus the fact that it is dark outside makes it hard to stay awake' (Co Pilot Boeing 777/787)

'Flying back to Amsterdam is against your nature' (Co Pilot Boeing 777/787)

'Everyone is tired after the flight' (Co Pilot Boeing 777/787)

From the difficulty to adapt the biological rhythm to the local time, a participating pilot also revealed the negative effect of working up to 5 European night flights in a row. He explained that with each start and landing the energy level decreases while strong feelings of tiredness are being experienced. This has been underlined by another pilot, highlighting the danger of short nodding in the cockpit:

'I was so tired I almost fell asleep, and I looked to the right and my co-pilot was already sleeping, so that gave me an extra boost to stay awake' (Captain long-haul 747).

Besides these, it was especially interesting to detect the side effects of operating night shift that emerge when being off duty. One cabin attendant for example expressed the difficulty to safely drive home after operating this type of duty:

> 'After a flight, it's like I am so tired, I can't think clearly. And I have to drive home so that's sometimes a little bit hard because you have to stay awake but you really want to go to bed.' (Cabin attendant éénbander)

While the cabin attendant expressed the struggle to stay awake, a pilot described a situation in which he was required to take a break from driving home due to strong feelings of fatigue and the risk to not be capable of driving home safely:

'I had it once going back from the airport to home that I was so tired and for me it's only 20 minutes' drive back to my home but within 5 minutes I was almost sleeping so I put the car off the road and I sat there for about 10-15 with my eyes closed to get enough energy back to do the last 5 minutes back home because I thought, well if I go on like this, I might be in a car accident. (...). I couldn't keep my eyes open.' (Pilot 747)

Number of time zones crossed/ East west- mix

Apart from night flights and the tight occupation in the cockpit, the majority of participants agreed on the point that the constant change between flying east and flying west is a major trigger for feeling tired. According to the respondents, this has especially been contributed to the huge difference between a) the local time at the destination with respect to the local Dutch time and b) between the local time in the east and the local time in the west. Some interviewees stressed that fatigue has been experienced as a common result of operating the so called east-west mix which has also been shown to have a negative influence on the private life:

'I had too many changes from going to the west then next flight to the east and then next flight, then west again and then to the east (...). And then my body was so mixed up that I was so tired at home but I couldn't sleep, walking around at 3,4,5 in the morning going out, drink something walk with the dogs, I tried everything and I couldn't sleep. ' (Pilot 747)

Furthermore, one respondent mentioned concentration problems and ineffective decision making in the cockpit as a well-observed side effect of operating this type of duty:

'I was totally surprised that I was losing my sight, my concentration'. (Captain 747 longhaul)

'You start missing small things' (Pilot 747)

'Your decision making is of a poor quality' (Captain 777/747)

Schedule characteristics causing physical health issues

Apart from schedule characteristics which cause fatigue, there have been further schedule characteristics detected which are observed to cause physical health problems, namely 1) workload 2) duration of the flight and 3) the number of time zones crossed.

Duration of the flight and workload

In general, it was interesting to find that the amount of physical health problems that have been reported were rather low especially compared to insights from previous literature reviews. The most reported issues were heavy feet, back and neck pain which were all observed among cabin crew staff.

'The feet and the legs are tired'. (Senior Purser)

The reason for these problems have been found in the way of working, which greatly differs between cockpit and cabin crew member.

While pilots mostly remain seated during the whole flight, cabin crew members are required to serve the customers, implying walking, bending over, going up and down, and assisting customers to store heavy luggage into the overhead bins. These activities have been reported to be the reason for developing back and neck pain.

Besides these, some participants revealed to be suffering from headaches due to the dry climate on the aircraft. How serious those symptoms are, has been shown by two respondents who revealed that an operation was required to continue working as a cabin attendant.

Number of time zones crossed

Apart from cabin crew members, also cockpit crew members have shown to observe physical health problems. One pilot for example admitted to be suffering from a heart rhythm distortion and consequently developed the diabetes Type II which however, he has under control by using suitable medication. According to the pilot himself, these two diseases are a result of a combination of factors, namely a) flying across several times zones and the difference in biological rhythm and the local time at the destination which is often contradicting and b) the consumption of excessive sugar (due to sweets handed over by cabin attendants). Furthermore, the interviewee observed a development of these issues with advanced age. The relevance of these issues and their connection to the pilot job has been underlined by the interviewee who further revealed that there have been 9 to 10 colleagues undergoing an operation to solve similar heart problems, of which one was aged 36 when having the first operation.

However, it was interesting to find that some other respondents with advanced age who worked in a different function before, did not observe any lack in physical fitness at all, instead they observed an increase in well-being:

'I never felt so fit before'

(Cabin crew éénbander, aged between 40 and 50 years)

Schedule characteristics causing mental health problems

Apart from schedule characteristics which are observed to cause fatigue and physical health problems, there have been several mental health problems reported which have been linked to the lack of control on individual schedules.

Control about own schedule

The main mental health issue which have been observed by participants was stress emerging from short notice changes in scheduling. These have been experienced by many participants and have been described as 'quite frustrating.' The uncertainty of the schedule and the often non-compliance with the union agreement are considered a major obstacle to a) plan a social life and b) to maintain the given recovery period since days off are taken away. Participants stated that the constant uncertainty about the accuracy of the current schedule leads to mental stress. It was interesting to find that there is a difference between the scheduling after calling in sick between cockpit and cabin crew. Respondents working in the cabin expressed their frustration about the fact that the schedule will be completely rearranged for the next weeks after calling in sick.

'If you called in sick then you lost your schedule' (Senior Purser)

The respondents explained that this indicates the need to reschedule all appointments made for that period. Especially cabin crew members with parental demands have been observed to face abnormal levels of stress and pressure, due to the fact they constantly need to plan ahead to pursue their parental obligations. One participant clarifies this by describing a situation in which a female cabin attendant misread her schedule indicating that she would be abroad for longer than planned. Consequently, panic was observed since she was forced to coordinate and reschedule all appointments made from thousands of kilometres away.

Duration of the flight

Apart from this parental stress, sleep issues have been reported as major issue observed on longhaul flights. Especially the forced need to sleep at a specific time has been experienced as major mental stress: 'That's what you feel, you feel torture because you cannot sleep' (Captain 747 long-haul)

'The only mental problem I had at a certain point was that I was unable to sleep'. (Pilot 747)

Next to parental stress and the difficulty to fall asleep, one pilot expressed a difficulty with social stress, which emerged from constant responsibility and required interaction with customer and colleagues:

'There is some pressure on your work because you always are in contact with other people. (...) like 300-400 passengers, (...) often our have issues or people talk to you but also your colleagues on route. If you are away for two or three days, it has a social effect on your work cause you try to interact, arrange things, ask how people are doing and all this kind of things, and afterwards sometimes you feel, ok, now it's time to do something else, go back to my family not being busy with asking how everyone is doing.' (Captain B777/ 747)

It was also interesting to discover that, especially on long-haul flights, some unforeseen incidents can happen which increases the stress level of pilots. One pilot for example described a situation in which he received a notification from an airport that landing was not permitted due to a recent earthquake. By receiving this notification and the need to immediately set up a Plan B, he admitted to have observed higher stress levels while getting rest to recover was impossible.

Apart from stress, some respondents observed concentration problems as another mental issue. One cabin attendant for example revealed that they had forgotten one point on the beforeflight check list. Even after being cross-checked by a colleague, neither of them realized the mistake. As a reason for this, she referred to the fact that she was operating the 4th flight in a row. Besides cabin crew members, cockpit staff also has observed concentration problems: 'We always sometimes miss the radio call from air traffic control, but that time it was the fifth time I missed it until my colleague made me aware of it' (Pilot 747)

Schedule characteristics affecting WLB

The schedule characteristics that have been found to negatively affect the WLB was 1) crew rotation, 2) Duration of flight and 3) control about the own scheduling.

Crew rotation

The tight occupation in the cockpit and the lack of rotation that comes with it are revealed to negatively affect private life after the flight, due to the increase in fatigue. Most respondents, especially respondents working in the cockpit, have expressed the consequences of flying duties with only 2 pilots instead of 4. Developing mood swings and a disinterest in others, have been reported as side effects, negatively influencing their private life.

Duration of flight

Especially night flights are experienced as tiring by the vast majority of respondents. A night flight in combination with a tight occupation in the cockpit has been particularly found to increase fatigue. Consequently, respondents stated they needed a longer recuperate period when being at home which limited the time available to spend with loved ones. Long-haul flights followed by short flight-rest sequence of 2 days were found to be a risk for health and well-being:

'If the computer schedules you to Accra, you have two days of leave, and back to Akra, I think that people will call in sick', 'people are like: oh my goodness'. (Co Pilot 777/ 787)

Control about own schedule

With respect to schedule control, it was interesting to see that some participants were perceived to have a great amount of control on the individual schedule whereas some others expressed the limitation of attending free time activities due to short notice periods of scheduling and their perceived lack of control:

'If you want to be off every weekend, you can so much influence it!' (Cabin crew éénbander) 'Cabin and cockpit crew have a well-balanced 'days off schedule', much more than Ryanair or Air France' (Co Pilot 777/ 787)

'With four weeks ahead, normally that's OK, but if you want to go to a concert in July, that's not enough 4 weeks. (...).Sometimes I have to take the risk of buying the ticket and then selling it later on'

Many participants complained about the non-compliance with the union agreement shown in the short notice changes in scheduling. According to the participants, this negatively affects private life while it shortens the recuperate period at home. The frustration which has been developed among cockpit and cabin crew member is shown in the statement made by one participant: 'Some people are really fed up- they think enough is enough. They don't pick up the phone anymore'.

The vast majority of respondents however, agreed that there are some possibilities to control the schedule.

'You can put in 10 requests a year for a day and then the computer is trying to arrange something that you are off that period (...) and you have 10 requests a year for destination.' (Co Pilot 777/ 787)

Besides the possibility to make a wish for destination and days off, the respondents stated they were only allowed to choose to either work 67%, 80% or 100%. The vast majority of respondents currently work in an 80% function. The advantage of this type of contract has been stated to lie in the fact that the amount of days off at home is higher compared to flying 100%. Respondents started to observe an increased fitness by gaining a longer recuperate period:

'You can recuperate more if you have more days off' (Co Pilot 777/787)

' I have too many hobbies and I have four kids I am busy with, I like the days off and also get a little more rest. I am 55 now and I feel that I need it'. (Pilot 747)

'You are more rested when you have more days at home' (Co Pilot 777/787)

Another interesting finding was that respondents who work in a 100% function consider the amount of days off as acceptable to pursue hobbies, while some others working less, have been found to consider the amount of days off as too little to still be able to pursue hobbies and enjoy the time at home.

'I fly 100% and I have still enough days off'. Other people fly 67% and they don't have enough days off for their feeling' (Senior Purser)

Most respondents stated they were able to pursue hobbies when flying part-time although the execution of those cannot be maintained at full-time level.

"If you fly 80%, you have more days at home, so the chance that you can do a sport within a team is greater"(...). 'But maybe you cannot attend every training session' (Co Pilot 777/ 787)

'Like with the city council, I cannot attend every meeting. Because sometimes there are so many meetings which makes it impossible to attend them all. (Co Pilot 777/ 787)

Individual t

Apart from the aforementioned schedule characteristics and health issues observed, the interviews also revealed some differences in observing health issues influenced by individual tolerance factors such as age, gender, circadian rhythm and personality.

Age

It was interesting to find that fatigue has been observed by respondents of each age category. However, respondents above 40 years started to see an increase in the level of fatigue and the need for a longer recover period compared with younger years.

'In the beginning, I didn't care about the time differences, I never had problems sleeping, I never felt tired, only sometimes with the really long flights with the really big time differences, but slowly when I grew older, I found out, I need to have some time for myself to recover.' (Pilot 747)

With regards to physical and mental health issues, the older the respondent was, the more serious issues were developed. However, there were also some senior respondents who did not experience any development in physical or mental health issues throughout their career.

'I don't feel a difference, but everybody else around me says it is like this' (Co Pilot 777/ 78, aged 40-60 years)

Gender

In terms of gender, there was no difference observed in the amount of health issues experienced or the perception of WLB between male and female staff.

Circadian rhythm

All respondents agreed they experienced disruptions in the circadian rhythm. These are specially occurring during night flights when the body is used to rest and sleep and has been shown to result in physical symptoms such as fatigue and tiredness. After recuperating at home for a day, most

respondents experienced improved functioning of the circadian rhythm, observed by gaining back motivation and developing a feeling of physical and mental fitness.

Personality

With regards to personality, some respondents seemed to prefer flying to the west since they are a morning person, while other revealed preferring flying to the east, since they are a night person.

'If you would be sent back every time back to the west, that would work well for me. But I know from some colleagues, who like to go out in the evening and go late to bed also in the Netherlands, so they prefer eastern flights' (Captain on Boeing 777/787)

Interestingly, one cabin attendant stated that a positive mind-set and an optimistic personality can enhance the chances to combat sleep issues. Hence, a positive attitude and a rather extrovert character is assumed to better cope with time differences and shift work.

4.2 SURVEY RESULTS

After presenting the interview results, this section consequently provides an overview of the results gained by means of an online survey. An overview of the survey can be found in appendix III; the dataset and SPSS output can be found on the enclosed USB stick.

Collected Responses

In total, there have been 107 responses collected. From these, an amount of three respondents and belonging responses have been eliminated since the respondents executed functions on the ground and were thus not considered relevant for the purpose of this research. Consequently, 104 responses were kept for analysis after controlling for missing values.

Response rate

The observed response rate was 12, 6%. The rate has been calculated from a) the amount of people issued via individual message on LinkedIn (n=127) and b) the amount of people who

replied stating they had filled in the survey (n=16). The actual response rate however, may differ from the provided response rate here, since there might have been people who filled in the survey without sending a confirmation they had done so.

Besides that, the fact that the survey was additionally spread out on the company's internal forum (Yammer) and the impossibility to indicate the amount of staff members who have observed the survey on Yammer, and the amount of those who have actually filled in the survey, makes it difficult to provide the true response rate. That is why the given response rate should be understood and taken as an indication.

Segmentation of Respondents

The average age of the sample lies between the age categories 35-44 years and 45-54 years. More than 50% of the sample is aged 45 and older, while respondents aged between 18 and 24 are least represented (roughly 6%). In terms of gender, the sample shows rather equal contributions with a percentage of 53% being male and 47% being female. Furthermore, there were 39 responses collected by cockpit crew members, with function 'captain' having the biggest share, and there were 65 cabin crew members' responses collected, with function 'cabin crew éénbander' having the biggest share. 60% of respondents need to take care of someone at home (e.g. parents or children) while 40% do not have any such obligations. To be more concrete, from the female respondents (n= 49), there are 28 having private obligations, while from the male respondents (n=55), there are 37 having private obligations. The biggest share of people who need to take care of someone at home (n= 40), there are 28 having private obligations, while from the male respondents (n= 55), there are 37 having private obligations. The biggest share of people who need to take care of someone at home make up respondents aged between 45 and 54. The vast majority executes a full time function (flying 100%) and also shows to have the most private obligations. 40% of all respondents fly either 80% or less, showing less private obligations.

More than 80% of respondents fly across more than two time zones either 'always' or 'most of the time'. Only 1% (n=1) 'never' fly across more than two time zones. Roughly 50% of respondents have worked 'in the air' for at least 22 years, while one quarter has done so for up to 6 years.

Effects of flying across more than two time zones on physical health

The frequency to which physical health issues are observed was indicated by the overall mean score of 2.42 and a standard deviation of 0.80 (table III). Tiredness and sleep issues show the highest mean (4.15 and 3.19 respectively) while illness caused by poisonous or contaminated food and respiratory infections show the smallest mean (1.31 and 1.39 respectively). Some respondents experience tiredness, sleep issues and shoulder pain on a 'daily' basis, indicated by a maximum score of 7. On average, shoulder pain and headache have only been observed 'several times per year', however, some respondents indicated to experience these types of physical health issues on a 'weekly 'or even 'daily' basis (Table III). The highest standard deviation has been shown in the item 'sleep issues'.

	Valid	Missing	Scale	Min	Max	Mean*	SD
Tiredness	104	0	1-7	2	7	4.15	1.544
Sleep issues	104	0	1-7	1	7	3.19	1.817
Headache	104	0	1-7	1	6	2.16	1.278
Illness caused by poisonous or contaminated food	104	0	1-7	1	4	1.31	0.541
Respiratory Infections	104	0	1-7	1	4	1.39	0.565
Heavy feet	104	0	1-7	1	6	2.36	1.427
Shoulder pain	104	0	1-7	1	7	2.15	1.525
Overall mean						2.42	0.80767

Table III. Descriptive statistics on the frequency to which physcial health problems are observed.

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

Effects of flying across more than two time zones on mental health

The overall mean score describing the frequency to which mental health problems have been observed is 1.93, the standard deviation 1.02 (table IV). The items concentration problems and morning tiredness show the highest mean scores (2.50 and 2.67 respectively) while anxiety gives the smallest mean (1.49). Several mental health issues have been experienced on a 'daily' basis

indicated by a maximum score of 7. However, the amount of respondents facing mental health issues on a 'daily' basis is fairly low.

Although, on average, all items presented in table IV show a low mean score, they all include scores of 6 and 7. Hence, for all item listed, at least one respondent indicated to experience mental and/ or psycho-social health issues on a 'weekly' or even 'daily' basis (Table IV). The highest standard deviations are provided for the items concentration problems and morning tiredness (1.552 and 1.548 respectively).

Table IV. *Descriptive statistics of the frequency to which mental and psycho-social health problems are observed.*

	Valid	Missing	Scale	Min	Max	Mean*	SD
Anxiety	104	0	1-7	1	6	1.49	1.024
Concentration problems	104	0	1-7	1	7	2.50	1.552
Mental exhaustion	104	0	1-7	1	7	2.22	1.368
Feeling an inner emptiness after a working day	104	0	1-7	1	7	1.90	1.485
Feeling tired when getting up in the morning and there is another working day for me	104	0	1-7	1	7	2.67	1.548
Feeling a heavy burden due to working with people		0	1-7	1	6	1.57	1.086
Feelings of being overloaded by my work	104	0	1-7	1	6	1.62	1.117
Feelings of frustration with my job	104	0	1-7	1	7	1.81	1.239
Feelings of too much dedication myself	104	0	1-7	1	7	1.82	1.440
Feelings of being at the end of my latin	104	0	1-7	1	7	1.68	1.064
Overall mean						1.9279	1.02137

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

Comparing the frequency of both types of health, the tables show a slightly higher overall mean for physical health problems compared to mental health problems (2.42 and 1.93 respectively). With respect to the maximum score given, each mental/ psycho-social health problem listed has been observed by at least one respondent on an either weekly or daily basis while this only counts for 5 out of 7 items on the physical health scale.

The influence of schedule characteristics on the observation of fatigue

The overall mean for the frequency to which fatigue is obseverd based on the schedule characteristics illustrated in table V. is 2.64 (s= 0.91055). The schedule characteristic night shifts show the highest mean with a score of 3.77, followed by long-haul flights of more than 10 hours (\bar{x} = 3.08), east-west mix (\bar{x} =3.06) and international flights across five to nine time zones (\bar{x} =3.02). The smallest mean score is displayed for short haul flights to the east between two and five hours with a score of 1.72. The descriptives further show that the minimum score of '1' as well as the maximum score of '7' has been chosen at least once for each of the schedule characteristics listed. This indicates that for all characteristics, there are respondents who 'never', but also some who, 'daily' observe fatigue. The greatest standard deviation score is presented for short rest period (s= 1.704)

Table V. Descriptive statistics of the influence of schedule characteristics on the observation of fatigue.

	Valid	Missing	Scale	Min	Max	Mean*	SD
Night shifts (more than 50% of the flight is operated by night)	104	0	1-7	1	7	3.77	1.395
Flight between 2-5 hours	104	0	1-7	1	7	1.85	1.392
Flight between 5-10 hours	104	0	1-7	1	7	2.91	1.330
Long-haul flights >10 hours	104	0	1-7	1	7	3.08	1.290
International flights across 2-5 time zones	104	0	1-7	1	7	2.69	1.359
International flights across 5-9 time zones	104	0	1-7	1	7	3.02	1.336
International flights across >9 time zones	104	0	1-7	1	7	2.54	1.494
Short haul flights to the east between 2-5 hours	104	0	1-7	1	7	1.72	1.000
Middle long flights to the east between 5-10 hours	104	0	1-7	1	7	2.44	1.164
Long-haul flights to the east >10 hours	104	0	1-7	1	7	2.64	1.299
Short haul flights to the west between 2-5 hours	104	0	1-7	1	7	1.86	1.257
Middle long flights to the west between 5-10 hours	104	0	1-7	1	7	2.66	1.334
Long-haul flights to the west >10 hours	104	0	1-7	1	7	2.77	1.456
Flying to the east	104	0	1-7	1	7	2.64	1.173
East-west mix	104	0	1-7	1	7	3.06	1.487
Flying to the west	104	0	1-7	1	7	2.93	1.409
Short rest period	104	0	1-7	1	7	2.41	1.704
Overall mean						2.64	0.91055

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

The influence of schedule characteristics on sleep problems

The overall mean for the frequency to which sleep problems are obseverd is 2.41 (s= 1.20679). In total, there is little spread between the means. The highest mean is displayed for night shifts with a score of 2.99, indicating that on average, flight crew members do experience sleep problems on a 'monthly' basis as a result of flying at night. Besides that, flying the east-west mix has been rated to contribute to 'monthy' sleep issues, shown in the mean score of 2.89. The smallest mean score is displayed for northern flights (\bar{x} = 1.70) and short flights between 2 and 5 hours (\bar{x} = 1.78). Furthermore, the minimum score of '1' as well as the maximum score of '7' was assessed for each schedule characteristic so that at least one respondents of each item category is facing sleep issues 'never' and 'daily'. The greatest standard deviation score is presented for short rest period (s=1.746).

Table VI. Descriptive statistics of the influence of schedule characteristics on the observation of sleepproblems.

	Valid	Missing	Scale	Min	Max	Mean*	SD
Night shifts (more than 50% of the flight is operated by night)	104	0	1-7	1	7	2.99	1.592
Flight between 2-5 hours	104	0	1-7	1	7	1.78	1.329
Flight between 5-10 hours	104	0	1-7	1	7	2.48	1.407
Long-haul flights >10 hours	104	0	1-7	1	7	2.70	1.441
International flights across 2-5 time zones	104	0	1-7	1	7	2.23	1.456
International flights across 5-9 time zones	104	0	1-7	1	7	2.80	1.477
International flights across >9 time zones	104	0	1-7	1	7	2.69	1.643
Short haul flights to the east between 2-5 hours	104	0	1-7	1	7	1.85	1.342
Middle long flights to the east between 5-10 hours	104	0	1-7	1	7	2.53	1.468
Long-haul flights to the east >10 hours	104	0	1-7	1	7	2.59	1.505
Short haul flights to the west between 2-5 hours	104	0	1-7	1	7	1.95	1.437
Middle long flights to the west between 5-10 hours	104	0	1-7	1	7	2.64	1.507
Long-haul flights to the west >10 hours	104	0	1-7	1	7	2.76	1.530
Flying to the north	104	0	1-7	1	7	1.70	1.253
Fyling to the south	104	0	1-7	1	7	1.92	1.204
South-North mix	104	0	1-7	1	7	1.79	1.320
Fyling to the west	104	0	1-7	1	7	2.75	1.531
Flying to the east	104	0	1-7	1	7	2.59	1.398
East-west mix	104	0	1-7	1	7	2.89	1.642
Short rest period	104	0	1-7	1	7	2.51	1.746
Overall mean						2.41	1.20679

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

The influence of schedule characteristics on psycho-social problems

For the frequency to which psycho-social problems are obseverd, an overall mean of 1.77 (s= 1.03945) was displayed. This indicates that, on average, respondents experience psycho-social problems somewhere between 'never' and 'several times per year'. However, table VII. displays next to the minimum score of '1' as well the maximum score of '7' for each schedule characteristic. Hence, at least one respondent per item category observes psycho-social problems on a 'daily' basis, although the amount of respondents who 'daily' observe social problems is fairly small. The highest mean is displayed for night shifts with a score of 2.13, indicating that, on average, flight crew members experience psycho-social problems on a 'monthly' basis due to flying at night. The smallest mean score is displayed for short flights between 2 and 5 hours (\bar{x} = 1.34). The greatest standard deviation score is presented for night flights (s=1468).

Table VII. Descriptive statistics of the influence of schedule characteristics on the observation of psycho-social problems.

	Valid	Missing	Scale	Min	Max	Mean*	SD
Night shifts (more than 50% of the flight is operated by night)	104	0	1-7	1	7	2.13	1.468
Flight between 2-5 hours	104	0	1-7	1	7	1.34	0.866
Flight between 5-10 hours	104	0	1-7	1	7	1.81	1.262
Long-haul flights >10 hours	104	0	1-7	1	7	1.95	1.332
International flights across 2-5 time zones	104	0	1-7	1	7	1.57	1.130
International flights across 5-9 time zones	104	0	1-7	1	7	1.90	1.296
International flights across >9 time zones	104	0	1-7	1	7	2.00	1.386
Short haul flights to the east between 2-5 hours	104	0	1-7	1	7	1.41	0.951
Middle long flights to the east between 5-10 hours	104	0	1-7	1	7	1.79	1.112
Long-haul flights to the east >10 hours	104	0	1-7	1	7	1.89	1.269
Short haul flights to the west between 2-5 hours	104	0	1-7	1	7	1.45	1.042
Middle long flights to the west between 5-10 hours	104	0	1-7	1	7	1.94	1.350
Long-haul flights to the west >10 hours	104	0	1-7	1	7	2.02	1.379
Flying to the north	104	0	1-7	1	7	1.40	1.084
Fyling to the south	104	0	1-7	1	7	1.52	1.088
South-North mix	104	0	1-7	1	7	1.48	1.123
Fyling to the west	104	0	1-7	1	7	2.01	1.369
Flying to the east	104	0	1-7	1	7	1.92	1.228
East-west mix	104	0	1-7	1	7	1.99	1.333
Short rest period	104	0	1-7	1	7	1.86	1.375
Overall mean						1.77	1.03945

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

The influence of schedule characteristics on physical health

The overall mean for the frequency to which physical health problems are obseverd based on the schedule characteristics illustrated in table VIII is 1.92 (s= 1.06355). This indicates that, on average, respondents experience physical health problems 'several times per year'. However, table VIII also displays a score of '7' for each schedule characteristic. Hence, at least one respondent experiences physical problems on a 'daily' basis. The highest mean is displayed for night shifts with a score of 2.22, indicating that, on average, flight crew members experience physical health problems on a 'monthly' basis as a consequence of flying at night. The smallest mean score is displayed for short flights between 2 and 5 hours (\bar{x} = 1.43). The greatest standard deviation score is presented for short rest period (s=1543).

Table VIII. Descriptive statistics of the influence of schedule characteristics on the observation of physcial health problems.

	Valid	Missing	Scale	Min	Max	Mean*	SD
Night shifts (more than 50% of the flight is operated by night)	104	0	1-7	1	7	2.22	1.507
Flight between 2-5 hours	104	0	1-7	1	7	1.43	0.932
Flight between 5-10 hours	104	0	1-7	1	7	1.97	1.242
Long-haul flights >10 hours	104	0	1-7	1	7	2.19	1.442
International flights across 2-5 time zones	104	0	1-7	1	7	1.77	1.240
International flights across 5-9 time zones	104	0	1-7	1	7	2.09	1.330
International flights across >9 time zones	104	0	1-7	1	7	2.13	1.435
Short haul flights to the east between 2-5 hours	104	0	1-7	1	7	1.51	0.955
Middle long flights to the east between 5-10 hours	104	0	1-7	1	7	2.03	1.265
Long-haul flights to the east >10 hours	104	0	1-7	1	7	2.18	1.406
Short haul flights to the west between 2-5 hours	104	0	1-7	1	7	1.50	1.005
Middle long flights to the west between 5-10 hours	104	0	1-7	1	7	2.01	1.273
Long-haul flights to the west >10 hours	104	0	1-7	1	7	2.18	1.440
Flying to the north	104	0	1-7	1	7	1.49	0.975
Fyling to the south	104	0	1-7	1	7	1.64	1.033
South-North mix	104	0	1-7	1	7	1.57	1.104
Fyling to the west	104	0	1-7	1	7	2.12	1.409
Flying to the east	104	0	1-7	1	7	2.12	1.382
East-west mix	104	0	1-7	1	7	2.11	1.386
Short rest period	104	0	1-7	1	7	2.08	1.543
Overall mean						1.92	1.06355

Note. * 1= never; 2= several times per year; 3= monthly; 4= several times per month; 5= weekly; 6= several times per week; 7=daily

Effects of flying across more than two time zones on cabin and cockpit crew's WLB

After presenting the findings on health, the below findings describe how the respondents perceive their work-life balance within the company. First, a factor analysis has been performed to check for underlying dimensions and to ensure that all items actually measure the overall construct WLB. The analysis show that items 1-3 (table IX) load high on factor A and items 4 &5 load high on factor B. The two factors explain 69% of the variance and all items show high correlations with each other. Besides that, the KMO test for sample accuracy shows high values of 0.640, underlined by the Bartlett's test of Sphericity which shows significant values of p>0.001.

	Do you feel to have control about your schedule (e.g. having a say in giving pre	eferences fo	or destinatio	n or dates) ?	
				(Cumulative
	Fre	equency	Percent	Valid Percent	Percent
Valid	1	18	17,3	17,3	17,3
	2	32	30,8	30,8	48,1
	3	24	23,1	23,1	71,2
	4	17	16,3	16,3	87,5
	5	13	12,5	12,5	100,0
	Total	104	100,0	100,0	

 Table IX. Descriptive statistics on the control on own schedule.

Note. * 1= definitely yes; 2= probably yes; 3= might or might not; 4= probably not; 5= definitely no

The average respondent ² stated to 'barely' find himself in a situation in which he is unable to enjoy the company with loved ones ³ because of worrying about work. However, since the maximum score of '5' has been given, there are still respondents who 'always' face the struggle to enjoy the company because of

worries regarding work.





Figure 2. Perceived difficulty to fulfil domestic obligations



Figure 3. The need to take care of someone at home

Statistics reveal that more than half of respondents who indicated the need to take care of someone at home either 'sometimes', 'often' or 'always face difficulties in fulfilling private obligations. This difficulty in fulfilling private obligations differs by contract type (figure 2). People who fly 100% observe greater struggles to fulfil obligations next to work, compared with their counterparts who only fly 80% or less. However, there are still almost 50% of respondents who rated to have some influence on their own scheduling (table IX). Besides that, statistics show that almost half of all respondents who indicated the need to take care of someone at home still fly 100% (figure 3). In terms of atmosphere, the results show that respondents only 'sometimes' see the atmosphere at home enhancing due to a good day at work (x= 2.84).

The influence of individual tolerance factors on health and WLB

After running several descriptive analyses, the section now describes possible differences in means between 'gender' and 'age'. Therefore, ANOVA and Linear Regression analyses have been performed.

Gender

The first tolerance factor that has been assessed was gender. Therefore, an analysis of Variance, short ANOVA, was performed. The aim was to detect possible differences in the mean scores of female and male respondents with respect to the observation of physical and mental health issues, their possible increase by age as well as females and males' perception of the balance between work and private life. Prior to each analysis, a Levene test was executed to ensure that the homogeneity assumption of equal variances across groups is met.

By controlling for gender, only the frequency to which female and male respondents observe physical health issues has been found to be significantly different (p<0.001%). Female respondents indicated to observe physical health problems more often than their counterparts (x= 21.55 and 17.42 respectively). For psycho-social problems and sleep issues, there have been found to be a higher mean for female respondents, even though the difference is shown to be insignificant (0.407 > 0.05% and 0.447 > 0.05% respectively). With respect to the observation of fatigue and a good WLB, male respondents show slightly higher mean values, which however have been indicated as insignificant (0.272 > 0.005%). Furthermore, there was no significant difference found whether women and men experienced an increase of psycho-social problems by increased age.

By further comparing the different gender groups concerning the extent to which they feel to have control about their own schedule, it was revealed that men rate their control about their schedule significant higher than their female counterparts.

Age

After controlling for gender, age has been used as the independent variable to predict health issues and WLB perceptions. Prior to each analysis, several assumptions have been checked to ensure normality, linearity, homoscedasticity, and the absence of multicollinearity.

In general, age has been shown to predict physical health problems as well as sleep issues, although only to a small extent (R^2 = 7, 8%, and 5, 6%). Hence, the older a respondent got, the more often he observed physical health, - and sleep issues.

When using gender and age as a combination of predictors for physical health issues, r-Square has been shown to increase to 15, 7%, indicating that both variables together form an even stronger predictor for physical health issues. It was interesting to find that age was found to be an insignificant predictor for both, fatigue and psycho-social problems, only explaining 0, 1% and 2, 7% of the variance. The statistics further show that mostly younger crew members fly 100%, while senior crew member fly either 80% or less than 80%. For example, within the age category of younger crew members aged between 18 and 34, there are 27 out of 32 people in total who fly 100%. Within the age category of senior crew members aged between 56-64, there are only 18 out of total 54 people in total who fly 100%.

Reliability analysis

After conducting the analyses displayed above, the table below presents the results of the reliability analysis. It contains the values of the Cronbach's alpha for each latent construct that has been measured using sub-groups. All values, apart from the construct 'Work-Life Balance' show relatively high values, indicating that the sub groups properly measure the overall construct.

Latent variable/ construct	Cronbach's alpha	Reliability
Physical health	.737	Acceptable
Psycho-social health	.928	Excellent
Work-Life Balance	.653	Questionable

5. Conclusion and discussion

This chapter contains the discussion of the empirical findings by linking them to previous research results. Besides that, the research question is answered and limitations are discussed. The chapter ends with an outlook for further studies.

One of the major changes in today's aviation is the increase of job demands for flight crew members. The airline industry became increasingly competitive and as a result, companies started to shift towards executing a more aggressive profit making strategy. Consequently, recovery periods have been shortened and the amount of labour on flights has been minimized.

This paper aimed to contribute to the literature on the negative impact of schedule characteristics of shift working on the health and WLB of flight crew members under contract of one of the world's largest airline companies. Explicitly, this study focused on cabin and cockpit crew members who constantly fly across more than two time zones since this has received far less attention to date. It further shed light into the severity of specific schedule characteristics relative to others which also has barely been studied so far.

The research question that was set up for this research was: What are schedule characteristics of shift working across more than two time zones that negatively impact the health and work-life balance of cabin and cockpit crew members working for one of the world's largest airline companies?

This research differs from previous work regarding its focus on harmful schedule characteristics which may impact health and WLB rather than solely discovering the existence of health problems. Schedule characteristics as reason for developing health problems or an imbalance between work and private life have received little attention within aviation to date, which is surprising given the change in job demands and the relevance of healthy crew members to ensure safety.

Most harmful schedule characteristics

Drawing on a literature review, in-depth interviews and a follow up survey, four major schedule characteristics have been identified that negatively impact crew's health and WLB. These are:

- tight occupation of labour on the flight
- Iong-haul flights across multiple time zones
- night shifts and
- constant changes between flying eastern and western directions

The study revealed these four schedule characteristics as major triggers for developing a physcial and mental health issue. Especially the constant flying between east and west and the combination of a tight occupation of labour in the cockpit and night shifts across multiple times zones have been found to increase fatigue and sleep disturbances. This is because schedule characteristics such as night flights or the flying across multiple time zones were shown to result in a misalignment between sleep-wake cycle and light-dark exposure which in turn was found to increase fatigue and sleep disturbances gained by previous studies that revealed night flights as major reason for developing fatigue and difficulties to fall asleep (e.g. Whitelegg, 2007 & Nagda, & Koontz, 2003).

Health conditions as concequence of combined schedule characteristics

The study further revealed the existence of physcial health conditions such as heavy feet, shoulder pain and headache, as well as short-term mental health issues and symptoms such as mood swings, increased irritability, decreased capability to make efficient decisions and concentration problems. Hereby, the interview participants and survey respondents specially raised awareness about the observation of concentration problems, when flying across several time zones and having multiple changes between flying to the eastern and western side of the world. Especially night flights to the west of more than 10 hours have been found to result in psycho-social problems. This may be contributed to the greater disruption in biological clock since these flights are operated against the rotation of the earth.

Besides fatigue and sleep disturbances, the study further provides evidence for the development of more severe physcial health problems as a possible consequence of a combination of schedule characteristics. Especially night flights operated by crossing up to 8 time zones have been shown to have the potential to result in physcial health issues. Most common health issues resulting from these duties have been revaled to be disruptions of the circadian rhythm, heart rhythm distortions and sufferig from Diabetes Type II. These insights gained by means of the interview are in consistence with previous studies (e.g. Mawson, 1998; Institute for Work & Health, 2018.; Winget, et. al., 1984). Several studies have added that the frequency of symptoms related to circadian rhythm distortions was found to be even greater with increased length of flights and rapid changes in time zones (Grajewski et. al, 2003 and Nagda and Koontz, 2003).

Frequency of observed health problems shown to be rather low

It was surprising that within this study, the frequency to which health issues or symptoms of health issues, such as fatigue or sleep disturbances, have been observed was much lower compared to previous studies. This may be contributed to a) a maintained healthy lifestyle of participants next to work or b) to the company's policy and regulation which may differ significantly from those of other airlines. Especially the possibility to hand in 10 requests for destinations and special days off was considered unique and rare by interview respondents.

Further research could therefore investigate if the frequency to which health issues are being experienced by flight crew members who fly across multiple time zones indeed differ significantly between airlines supporting different policies. Studies could detect if the company's policies are a predictor for the frequency to which a health issue is observed.

Satisfying balance between work and private life

One of the most striking result this study delivered is the evidence for a healthy work-life balance among cabin and cockpit crew members who constantly fly across more than two times zones which is contradicting to most studies conducted within aviation.

Literature has especially stressed the work-family conflict, emerging among flight crew staff. For example a study by Ren & Foster (2015) among Chinese flight attendants found negative work-family conflicts due to inflexibility and shift work. The reasons why the addressed sample within this research may not face this conflict may lie in the company's decentralised organisational structure which is characterized by the highly flexible nature of changing contract types and the possibility to hand in various requests for destinations and special days off. On the other hand, China's state-owned airline enterprises are more likely to be viewed as being hierarchical and centralized, which may prevent flight crew from experiencing such flexibility.

Further studies could shed more light into this possible cultural difference by addressing airline companies in different cultures. Further studies may shed light into the relationship

between a company's organisational structure and a satisfying WLB. More concretely, studies could detect if the organisational structure supported by an airline is a predictor for perceiving a satisfied WLB.

As another conclusion of this research, the surveys report that almost half of all participants perceived some control about their own scheduling which is in line with the insights given by the vast majority of interviewees. Crew staff working part-time showed to face less difficulties in fulfilling domestic obligations compared with their counterparts working full-time. However, the study provided evidence that also full time staff was able to successfully manage domestic obligations next to work. This is in line with the overall WLB satisfaction perceived by crew and implies that the amount of days off provided is considered as adequate to still manage and maintain a private life. This is further aligned with the result this study provides for the relation between the contract type and the obligation to take care of someone at home: There has been no difference observed between the contract types of someone who has private obligations, and someone who does not. This may also imply that the provided amount of days off between flights is experienced as acceptable to ensure a successful management of private obligations. However, to find more evidence for this assumption, further studies should investigate if the amount of days off between flights are a predictor of being successful in managing private obligations.

Age predicts contract type

Although, there was no pattern recognized between the contract types and the struggle to maintain private obligations, this research however found a significant negative relation between age and contract type. That is, with advanced age, respondents were more likely to switch to lower contract types such as working part-time. This study specially found that age predicts physical health and sleep issues, although only to a small extent which is in consistence with many studies that have already provided evidence that individual tolerance factors such as the age and the gender of a person may increase the likeness for health issues to occur (Portela & Duarte, 2001; Nagda & Koontz, 2003; McLaughlin, Bowman, Bradley, & Mistlberger, 2008). These

insights may imply that older crew members are trying to save themselves from developing serious health issues which this study found to be highly dominant among senior flight crew members. Furthermore, interview respondents have revealed the need for an increased recovery period since the adaption of the biological clock is taking longer compared to younger years. Flying part-time will allow for increased free time to enable maximum recuperation.

Women shown to suffer more from physcial and mental health problems

In terms of gender, this study detected two significant differences between both gender types. First, the extent to which physical health problems have been experienced, was significantly higher among females compared to their male counterparts. And second, the perception to which female and male respondents feel to have control about their schedule has been rated significant higher by men than by women.

The study further showed that in general, female flight attendants were shown to observe physical as well as mental health problems to a higher extent than their male counterparts. Female participants within this study were especially found to show increased concentration and sleep problems which is in line with previous research which has already found that female shift workers observe more physical health problems than men, such as more sleep problems, chronic fatigue or breast cancer (Rouch et. al, 2005; Rotenberg et. al, 2001).

These alignments of results suggest that there may are some general genetics responsible for a difference in the capability to cope with time differences and shift work between genders and that these contribute to an increase in symptoms when operating duties such as night shifts across multiple time zones. To shed more light into this issues, further studies could investigate differences in gender by assessing different combinations of schedule characteristics rather than solely focusing on individual schedule characteristics. As a concluding remark, this study has provided proof for the development of negative health effects as a possible consequence of increased job demands. Especially fatigue, sleep problems, and concentration issues have been found to be common symptoms arising from minimizing labor on flights. The WLB however is perceived as well-balanced since the amount of days off for recovery is considered adequate to successfully fulfil side work obligations and maintain a social life.

5.1. LIMITATIONS AND FURTHER RESEARCH

This study also has some limitations. First of all, the generalisation of the results is a major concern. This is due to the small sample size of only 104 respondents. There may still be a chance that other cabin or cockpit crew members would have given different answers which could have led to different results. However, the fact that there is in generally high consensus among answers, indicated by the rather low standard deviations may even level out this limitation. Further research could increase the sample size to enhance generalisation. This could either be done by increasing the sample within the company or to increase the sample to other airlines to gain an even better picture of relevant schedule characteristics and their effect on health and WLB within today's world of aviation.

A second limitation of this study is the possible social desirability. With regards to questions about an individual's physical or mental health, respondents were reluctant to share problems they encountered. Especially with the current lack of data security respondents may have doubted the anonymity of the web survey even if it has been said to be handled as such. In addition pilots, especially, may be highly sensitive to confirming any health issues due to being afraid of losing their license, since mental health issues may restrict a pilot in executing his job. A further study could use a paper survey instead of an online survey to address these questions in high anonymity. That way, respondents could fill in the survey at home and hand it in into a post box at the crew centre. Staff may feel more comfortable in sharing their problems when there is no social web involved. A third limitation of this study is the research type which is cross-sectional in nature. This Cross sectional research design only provides a snapshot of the frequency of a health issue in the population at a given point in time. It is also difficult to assess whether the exposure or outcome came first, since there might be reverse causality. It is further not assessable if exposures will change over time or remain constant which makes it difficult to assess long-term health issues.

Further research may address the frequency to which health issues are observed in order to increase the knowledge base on the severity of specific schedule characteristics that have been detected.

The sample size should be enhanced to ensure generalisation of results. Besides that, further research, especially within the company may analyse the Home-Work interaction rather than the Work-Home interaction in order to detect possible obstacles which negatively influence the work performance, such as being fatigued when starting the duty. Relevant interventions could be discussed between the company and its employees to prevent a home-work-conflict. This is especially advised for further research since the mean scores concerning the frequency to which a specific health condition had been observed as a result of a listed schedule characteristic were rather low, although interviews showed some evidence of the frequent occurrence of these conditions. This indicates that there may be different schedule characteristics than those used within this study which better predict e.g. fatigue. Furthermore, studies may investigate the effect of several combinations of schedule characteristics rather than assessing each individually to detect possible effects on health and WLB especially since most flights make up a combination of several schedule characteristics.

6. PRACTICAL RECOMMENDATIONS

Eventually this research yields some practical recommendations.

The first recommendation is aiming to decrease physcial and mental health issues of flight crew members by particularly aiming to prevent major issues such as fatigue and concentration issues. Therefore, it is recommended to overthink the ongoing abolition of the four pilot's policy. This research found negative effects on physical and mental health of cockpit crew members by especially operating night flights with a tight occupation of labour on board. In particular, concentration problems and increased levels of fatigue have been proven to be a result of operating a two or three pilot duty. Since the company operates within a highly-critical environment, physical and mental health must be maintained at all time. Hence, it is advised to weigh the costs of new hires, or costs that occur when further operating the 4 Pilot policy, against the costs of short and long term sick employees. Especially fatigue, which was confirmed as a result of operating this type of duty has been revealed as being a predictor for long term as well as short term health-related absence (Janssen et. al, 2003). Sick cabin or cockpit members can create enormous financial as well as human costs which are not only costs due to productivity losses, but also absenteeism costs including costs of payments for non-work time of absentees which will cost the company 100% in the first year and still 70% in the second year, costs of managing absenteeism problems, costs of time for that replacement employee and any medical costs paid to cure the employee (Cascio & Boudreau, 2011).

Apart from predicting health related absence, fatigue has further been shown to result in more severe health condition such as depression. The recent Germanwings crash which is described as suicide of the pilot, stresses the importance of taking care of staff that operates in a highly risk-environment and has the responsibility of thousands of people each day. How common and recent such phenomena are in today's world of aviation is revealed by a recent survey, conducted by the British Airline Pilots Association (BALPA, 2017) which indicates that 40% of all 490 participating pilots suffered from symptoms typical for depression disorders. The second recommendation provided is to allow cabin and cockpit crew members aged 45 and above to decide which direction, that is either east or west, they want to fly, therefore decreasing fatigue, sleep problems and other possible resulting diseases such as heart rhythm distortions or disruptions to the circadian rhythm. The age category has been chosen since both, previous studies and this study found that especially senior flight crew members above 45 are more likely to face shift work intolerance while being at increased risk to develop health conditions. This study especially revealed that cabin and cockpit crew staff observe increased health problems by increased age. Especially the huge difference in time zones and the slower adaption to the local time, has been shown to result in heart rhythm distortions and diabetes over the years. By allowing older staff to make their own choice, the company may enhance or at least maintain the well-being of staff in the long run. With regards to the increased pension age in the Netherlands, it is especially important for a company to ensure the maximum well-being of staff to maintain their performance to the company moving forwards.

The third recommendation given to the company is to integrate a flexible sport team. This is advised since many respondents expressed the difficulty of taken part in team sports as a consequence of the flexible character of their job.

The impossibility to attend training sessions have been expressed by various respondents. By realising this, the company may enhances staffs' overall well-being and fitness which is a pre-requirement to successfully execute the job and combat fatigue. There is barely no industry where being mentally and physically fit is of so much importance than it is within the airline industry. Each smallest mistake has the potential to result in a catastrophic event at the expense of hundreds of passengers.

Team sports have been proven to successfully prevent or cure mental and physical health issues such as depression, difficulties to sleep or concentration problems.

The strength of sport and especially physical activities in combating mental and physcial health issues have been reported in various studies (e.g. Wegner,

Helmich, Machado, Nardi, Arias-Carrion & Budde 2014). Physical activity was found to bring about various changes in the brain which are otherwise achieved only through drugs. Sport acts on the brain's capacity to absorb serotonin and strengthens the epinephrine activity which ensures the release of various factors for nerve growth. Consequently, cell growth in the brain can be realized preventing the death of cells in the hippocampus which is otherwise caused by depression. Together with these changes, sport and in particular physical activities lead to reduced stress and enhanced concentration due to reduced activity of the stress hormone cortisol which has an effect similar to psychotropic drugs (Wegner et. al., 2014). To realise this recommendation, the company may send out a survey to investigate the three most wanted team sports to get to know the preferences of staff. The coordination may be enhanced by means of what's app group and attendance of training is rather flexible than mandatory. This recommendation is highly cost-effective while it may naturally enrich staff's overall well-being by preventing mental and physical diseases, which potentially could lead to losing a pilot's license.

7. LITERATURE

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8. APPENDICES

Appendix I. Overview of advantages a and disadvantages of surveys (Baarda, 2009)

Yes: V No: X

	Face to face survey	Survey sent by post	Telephone survey	Online survey
Respondents	x	v	х	v
have time to think				
about the answer				
Respondent	v	x	v	х
friendly				
Possibility of	v	More or less	x	v
complex				
questions				
Anonymity	x	v	More or less	v
Preparation time	Much time in case of	Much time for	Little time for	Little time when
	interviews	setting up the survey	training the	using web
			interviewer, more	surveys, more
			time for setting	time for
			up a	preparation
			questionnaire	
Influence	v	x	v	x
respondent				
Controlled	v	x	Partially	v
answering				
process				
Amount of time	Much time	little time to carry	Limited when	Little time
complete process		out the survey,	using CATI	
		analysing the results		
		takes more time		
Possibility for	V, but high travel	V, but high postage	V, but high	V, costs stay the
International	costs	costs	telephone costs	same
research				
Costs	High	Little	Less high in	Little
			comparison to	
			face to face	
			surveys	
Non-response	Low	High	High	High

Appendix II. Interview guide

- 1. WHAT IS YOUR POSITION WITHIN THE COMPANY?
- 2. How many years have you been working 'in the air'?
- 3. Which schedule characteristics cause fatigue? Why?
- 4. Which schedule characteristics cause physical health issues? Why?
- 5. Which schedule characteristics cause mental health issues? Why?
- 6. How do you rate your WLB? Why?
- 7. Which schedule characteristics cause a good WLB? Why?
- 8. Which schedule characteristics cause a good WLB? Why?

Appendix III. Survey setup

Welcome to my survey about the effects of flying across more than two time zones on health and Work Life Balance of cabin and cockpit crew members.

The survey is set up within the frame of my Master graduation project and contributes to detecting specific schedule characteristics that result in a bad/poor health condition or Work Life Balance (hereafter 'WLB').

It will take you approximately 15-20 mins to fill in the survey. All surveys will be kept confidential, so you are really encouraged to give honest answers!

The survey is split into three categories, background information, health and WLB. Thank you very much for taking your time to participate!

For any questions, please feel free to contact me: JuliaTegelmann (j.tegelmann@student.utwente.nl)

What is your gender?

Male

Female

What is your age?

- 0 18-24
- 0 25-34
- 35-44
- 0 45-54
- 0 55-64
- 64+

Do you have to take care of someone at home (e.g children, grandparents, partner)?

- yes
- 🔍 no

How often do you fly across more than 2 time zones per month?

- Always
- Most of the time
- About half the time
- Sometimes
- Never

What is your position?

- Captain
- Pilot (first officer)
- Pilot (second officer)
- Cabin crew (eenbander)
- Cabin crew (tweebander)
- O Cabin crew (Purser)
- O Cabin crew (Senior Purser)
- Other

For how many years have you been working 'in the air'?

- 0-6
- 0 7-14
- 0 15-21
- 0 22-28
- 0 29-35
- 36-42
- 43+

What is your current contract type?

- I fly <80%</p>
- I fly 80%
- I fly 90%
- I fly 100%

The first set of questions is related to physical health problems To which degree have you observed the following condition?

	Never	Several times per year	Monthly	Several times per month	Weekly	Several time per week	daily
tiredness	0	0	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc
sleep problems	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
headache	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Illness caused by poisonous or contaminated food	0	\odot	\odot	0	\bigcirc	•	\bigcirc
Respiratory Infections	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
heavy feet	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
shoulder pain	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
back pain	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc

Did you observe an increase in physical health problems for yourself by increased age?

- O Definitely yes
- Probably yes
- Might or might not
- Probably not
- Definitely not

To which degree have you observed the following psycho-social problems?

		Several		Several		Several	
	Never	year	Monthly	month	Weekly	week	daily
Anxiety	0	0	0	0	\bigcirc	0	0
Concentration problems	\bigcirc						
mental exhaustion	\bigcirc						
feeling an inner emptiness after a working day	0	0	\odot	\odot	\bigcirc	0	\bigcirc
feeling tired when getting up in the morning and there is another working day for me	0	0	0	0	0	0	
feeling a heavy burden due to working with people	0	0	\odot	0	\odot	0	\bigcirc
feelings of being overloaded by my work	0	0	\odot	0	\bigcirc	0	\bigcirc
feelings of frustration with my job	0	\odot	\odot	0	0	0	\bigcirc
feelings of too much dedication myself	0	•	\bigcirc	0	\bigcirc	0	0
feelings of being at the end of my Latin	0	0	0	\bigcirc	\bigcirc	0	\bigcirc

Did you observe an increase in psyco-social problems with increased age?

- O Definitely yes
- Probably yes
- Might or might not
- Probably not
- Definitely not

Do you feel to have control about your schedule (e.g. having a say in giving preferences for destination or dates) ?

- Definitely yes
- Probably yes
- Might or might not
- Probably not
- O Definitely not

Please rate the following schedule characteristics due to the extent to which they cause you fatigue.

	Never	Several times per year	Monthly	Several times per month	Weekly	Several time per week	daily
Night shifts (more than 50% of the flight is operated during night)	0	۲	۲	۲	0	۲	
flights between 2-5 hours	0	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\odot
flights between 5 -10 hours	0	\bigcirc	\bigcirc	\odot	\bigcirc	\bigcirc	\bigcirc
long haul flights > 10 hours	0	\bigcirc	\bigcirc	\odot	\bigcirc	\bigcirc	\odot
International flights across 2 to 5 time zones	0	0	0	•		•	\bigcirc
International flights across 5 to 9 time zones	•	•		•	0	•	\odot
International flights across > 9 time zones	۲			•	0	•	\bigcirc
short haul flight to the east between 2-5 hours	•	•		•	\bigcirc	•	\bigcirc
middle-long flight to the east between 5-10 hours	•	•	\odot	0	0	0	0
long haul flights to the east >10 hours	0			•		•	
short flight to the west between 2-5 hours	•	•		•	\odot	•	\odot
middle-long flight to the west between 5-10 hours	•	•		•	\odot	•	\odot
long haul flights to the west >10 hours	0	•		•	\odot	•	\odot
Flying to the east			\bigcirc		\bigcirc		\bigcirc
East-west mix			\bigcirc		\bigcirc		\bigcirc
Flying to the west			\bigcirc	\bigcirc	\bigcirc	\odot	\bigcirc
Short rest period (e.g. last flight back home ended at night, next flight will be one day later early in the morning)	۲	۲	0	۲	0	۲	۲

Please rate the following schedule characteristics due to the extent to which they cause you sleep problems.

	Never	Several times per year	Monthly	Several times per month	Weekly	Several time per week	daily
Night shifts (more than 50% of the flight is operated during night)	0	0	0	0	0	0	0
flights between 2-5 hours	0	0	0	\odot	\circ	0	0
flights between 5 -10 hours	0	\odot	\odot	\odot	0	0	\odot
long haul flights > 10 hours	\odot	\odot	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
International flights across 2 to 5 time zones	\bigcirc	0	\odot	0	\bigcirc	\bigcirc	\bigcirc
International flights across 5 to 9 time zones	0	0	\odot	0	\bigcirc	0	\bigcirc
International flights across > 9 time zones	0	0	\odot	0	\bigcirc	0	\bigcirc
short haul flight to the east between 2-5 hours	0	0	\odot	0	\bigcirc	0	\bigcirc
middle-long flight to the east between 5-10 hours	0		0	•	0	•	0
long haul flights to the east	-				-		-
>10 hours	\bigcirc	\odot	\odot	\odot	\odot	\bigcirc	\bigcirc
short flight to the west between 2-5 hours	\odot	\odot	\odot	\bigcirc	\odot	0	\odot
middle-long flight to the west between 5-10 hours	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
long haul flights to the west >10 hours	\bigcirc	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	0
Flying to the north	\bigcirc	\bigcirc	\bigcirc	\odot	\bigcirc	\bigcirc	\bigcirc
Flying to the south	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
south north mix (flying to the south and north alternately)	0	0	0	0	0	0	0
Flying to the west	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Flying to the east	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
East-west mix	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Short rest period (e.g. last flight back home ended at night, next flight will be one day later early in the morning)	0	0	0	•	0	0	•

Please rate the following schedule characteristics due to the extent to which they cause you psychosocial problems.

		Several times per		Several times per		Several time per	
	Never	year	Monthly	month	Weekly	week	daily
Night shifts (more than 50% of the flight is operated during night)	0		0	0	0	0	0
flights between 2-5 hours	0	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
flights between 5 -10 hours	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
long haul flights > 10 hours	\bigcirc	\bigcirc	\odot	\odot	\bigcirc	\bigcirc	\bigcirc
International flights across 2 to 5 time zones	0	0	\odot	0	\odot	0	\bigcirc
International flights across 5 to 9 time zones	0	0	\bigcirc	0	\bigcirc	0	\bigcirc
International flights across > 9 time zones	0	0	0	0	\bigcirc	0	•
short haul flight to the east between 2-5 hours	0	0	\bigcirc	0	\bigcirc	0	•
middle-long flight to the east between 5-10 hours	0	0	\odot	\odot	\odot	0	0

long haul flights to the east >10 hours	0	0	•	0	0	0	0
short flight to the west between 2-5 hours	0	0	•	0	0	•	0
middle-long flight to the west between 5-10 hours	0	0	•	0	0	•	0
long haul flights to the west >10 hours	0	•	•	•	•	•	0
Flying to the north	0	•	0	0	0	0	0
Flying to the south	0	•	0	0	0	0	0
south north mix (flying to the south and north alternately)	0	0	0	0	0	0	0
Flying to the west	•	\odot	0	0	\odot	0	0
Flying to the east	•	\odot	0	0	0	0	\odot
East-west mix	0	0	0	0	0	0	0
Short rest period (e.g. last flight back home ended at night, next flight will be one day later early in the morning)	0	0	0	0	0	0	0

Please rate the following schedule characteristics due to the extent to which they cause you physical health problems.

	Never	Several times per vear	Monthly	Several times per month	Weekly	Several time per week	dailv
Night shifts (more than 50% of the flight is operated during pight)	0	0	0	0	0	0	0
flights between 2-5 hours							
flights between 5 -10 hours		ě		ě		ě	ě
long baul flights > 10 hours			~				~
International flights across 2 to 5 time zones	0	0	0	0	0	0	0
International flights across 5 to 9 time zones	•	•	•	0	0	•	0
International flights across > 9 time zones	0	0	•	•	0	0	0
short haul flight to the east between 2-5 hours	0	•	0	0	0	0	0
middle-long flight to the east between 5-10 hours	0	•	۲	0	0	0	0
long haul flights to the east >10 hours	0	•	•	0	0	0	0
short flight to the west between 2-5 hours	0	۲	0	•	0	0	۲
middle-long flight to the east between 5-10 hours	0	0	0	0	0	0	0
long haul flights to the east >10 hours	0	0	•	•	•	•	0
short flight to the west between 2-5 hours	0	0	0	0	0	0	0
middle-long flight to the west between 5-10 hours	0	0	0	0	0	0	0
long haul flights to the west >10 hours	0	0	0	0	0	0	0
Flying to the north	\odot	0	\odot	\odot	\odot	\odot	\odot
Flying to the south	0	0	0	0	0	0	0
south north mix (flying to the south and north alternately)	•	0	0	•	0	•	•
Flying to the west	0	0	0	0	0	0	0
Flying to the east	0	0	\odot	0	\odot	0	0
East-west mix	\odot	\odot	\odot	0	\odot	\odot	\odot
Short rest period (e.g. last flight back home ended at night, next flight will be one day later early in the morning)	0	0	0	0	0	0	0

The last block of questions/ statements deals with the topic Work-Life Balance

How often did it happen that...

	1 Never	2 Barely	3 Sometimes	4 Often	5 Always
you do not fully enjoy the company of your spouse/family/friends because you worry about your work.	0	0	0	0	0
you find it difficult to fulfill your domestic obligations because you are constantly thinking about your work.	0	0	0	0	0
your work schedule makes it difficult for you to fulfill your domestic obligations?	0	0	0	0	0
after a good day at work, you come home in a good mood which possibly influences the atmosphere at home.	0	0	0	0	0
you really want to catch up with family / friends or relatives after your working day.	0	0	۰	•	•

Please fill in any additional notes you would like to share.

If you would like to receive a copy of results, please provide your email address.

Appendix IV. Axial coding interviews

Axial codes - Interview I:

- Function: Co Pilot 777/787
- ✤ Years in function: 21 years
- ✤ Age: between 40 and 60
- ✤ Gender: male
- Contract type: 80%





Axial codes - Interview II:

- Function: Pilot 747
- ✤ Years in function: 33 years
- ✤ Age: between 50 and 60
- ✤ Gender: male

Contract type: 80





Axial codes - Interview III:

- Function: Captain 777-787 Dreamliner
- ✤ Years in function: 25 years
- ✤ Age: between 40 and 50
- ✤ Gender: male
- ✤ Contract type: 80%





Axial codes - Interview IV:

- Function: Captain 747 long-haul
- ✤ Years in function: 27 years
- ✤ Age: between 50 and 60
- ✤ Gender: male
- Contract type: 100% and 80%





Axial codes - Interview V:

- ✤ Function: Cabin attendant
- Years in function: 8 months (in total 14 months)
- ✤ Age: between 20 and 30
- ✤ Gender: female
- ✤ Contract type: 100%





Axial codes - Interview VI:

- ✤ Function: Senior Purser
- Years in function: 3 months (in total 15 years)
- ✤ Age: between 50 and 60
- ✤ Gender: male
- ✤ Contract type: 100%





Axial codes - Interview VII:

- Function: Cabin crew éénbander
- ✤ Years in function: one year
- ✤ Age: between 40 and 50
- ✤ Gender: female
- ✤ Contract type: 100%



