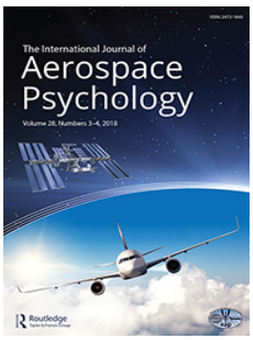

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Fit for Flight? Inappropriate Presenteeism Among Swedish Commercial Airline Pilots and Its Threats to Flight Safety

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ABSTRACT

Objective: The purpose of this cross-sectional survey study was to investigate the prevalence of presenteeism, attending work when ill, among Swedish commercial airline pilots and how presenteeism relates to mental health and flight safety.

Background: Pilots are regulated to refrain from duty when their mental or physical state could endanger safety. Still, the human factor is the greatest contributor to aviation accidents, and mishaps are attributed to human unfitness (physical or mental state of the operator), suggesting that pilots might engage in presenteeism. Presenteeism and its consequences have been studied across several occupational groups, but until now pilots have been neglected.

Method: Data were collected using an online self-report questionnaire (N = 1,133) consisting of items investigating presenteeism, mental health, and self-reported error rates.

Results: Results demonstrated that 63% of the pilots exhibited acts of inappropriate presenteeism in the past year. Inappropriate presentee pilots and pilots with poor recovery in terms of feelings of rest, physical and mental tiredness, and work-related worry, were also more likely to report committing 5 or more errors when on flight duty in the past 12 months. This relationship was not mediated by mental health, as shown in previous research.

Conclusion: This study indicates that pilots operate in states that could jeopardize flight safety and that current regulations might be insufficient to ensure safe flight operations.

> Captain … have you had any troubles at home lately?
> Well, no more than anyone else.
> And nothing that affected my work.
>
> —Eastwood et al. (2016)

The movie *Sully* (Eastwood et al., 2016) dramatizes Captain Chesley Sullenberger's water landing on the Hudson River. For the most part, the film is concerned with the aftermath and the investigation following the real-life flight accident, in which Captain Sullenberger is held responsible for decisions made prior to and during the flight. Although the movie has received criticism for depicting the investigation wrongfully (Negroni, 2016), it demonstrates how aviation accidents, also with technical failures, are attributed or considered to be attributed to human factors. This is a trend found in the aviation industry (Michaels, 2008). In 1991, Scandinavian Airlines Flight 751 was forced to make an emergency landing due to dual engine failure on takeoff. The pilots' actions during the short flight were reviewed and it was concluded that "the pilots separately and jointly contributed to the successful emergency landing" (Board of Accident

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Investigation, 1993). Another example of an occasion when the crew was credited for their actions is the crash of United Airlines Flight 232 in 1989 (National Transportation Safety Board [NTSB], 1990).

The reason for considering pilots as potentially causing or exacerbating flight accidents is that human factors do account for the majority of reported flight accidents (Shappell et al., 2007). Since the beginning of the aviation industry, technical failures have become less associated with aviation accidents and human factors a more prevailing potential cause. Overviews of causal factors in general aviation between 1984 and 2011 have shown 66% to 74% of the accidents to be associated with nonmechanical failures, such as human factors (Civil Aviation Authority, 2013; Federal Aviation Administration, n.d.).

Steps have been taken to reduce failures of this type; for example, pilots are regulated to refrain from flight duty on occasions when their physical or mental state could endanger safety (European Commission Regulation, No 216/2008). Still, accidents are attributed to human error and unfitness (physical or mental state that could jeopardize flight safety). Reviewing causes of aviation accidents from the NTSB and the National Aviation Safety Data Analysis Center (NASDAC) between 1990 and 2002 showed 13.3% of the accidents to be associated with the mental or physical condition of the operator (Shappell et al., 2007), suggesting that pilots might engage in what is called *presenteeism*, attending work in states when it would have been safer to refrain from flight duty as their condition, mental or physical, could be hazardous to flight safety.

In 2009, Colgan Air Flight 3407 bound for Buffalo crashed, killing all passengers and crew onboard. The final investigation concluded that the captain was significantly sleep deprived, which most likely impaired his performance in the cockpit and induced the crash. Rules regulating flight crew duty ordained that the captain should have refrained from flight duty on this occasion, with regard to the possible risks for flight safety (NTSB, 2010). Another salient example of presenteeism is Flight 9525, which was deliberately crashed into the French Alps due to pilot mental illness and suicide (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile, 2016). Although there are real-life examples describing the phenomenon of presenteeism as a causal or contributing factor to accidents, the research regarding pilots is scarce.

Sickness presenteeism

Sickness presenteeism's most prevailing and contemporary definition is attending work while ill (Aronsson & Gustafsson, 2005; Hansen & Andersen, 2008; Johns, 2009). Measures of sickness presenteeism vary. In one of the first studies on the topic by Aronsson, Gustafsson, and Dallner (2000), 17% to 48% of the Swedish respondents reported that they had attended work while ill on more than one occasion during the past 12 months. Levels of sickness presenteeism in Sweden have later been shown to range from 53% to 75% (Aronsson & Gustafsson, 2005; Gustafsson Sendén, Løvseth, Schenck-Gustafsson, & Fridner, 2013).

The growing amount of research on sickness presenteeism has discovered several parameters associated with the phenomenon. Personal, financial, and organizational factors have all been objects of interest (Aronsson et al., 2000; Claes, 2011; Hansen & Andersen, 2008; Leineweber et al., 2011; Miraglia & Johns, 2015). Work conditions and work culture, such as perceived job demands, job control, job support, and job attitude are among the parameters with established relationships with presenteeism (Hansen & Andersen, 2008; Kittel & Braeckman, 2016; Miraglia & Johns, 2015; Pohling, Buruck, Jungbauer, Leiter, & Leiter, 2015). Sickness presenteeism can affect the individual and the workplace in several ways. A negative correlation between health and sickness presenteeism has been established (Gustafsson & Marklund, 2014; Miraglia & Johns, 2015) and on several occasions a correlation between sickness presenteeism and absenteeism has been identified (Gustafsson & Marklund, 2014; Janssens, Clays, De Clercq, De Bacquer, & Braeckman, 2013; Miraglia & Johns, 2015). Hansen and Andersen (2009) reported a 74% increased risk of becoming sick-listed for more than 2 months following at least six instances of presenteeism in the previous year.

Recovery is essential for both health and sickness presenteeism. Cooper and Lu (2016) emphasized the importance of recovery after an episode of presenteeism to avoid further deterioration of health. Recovery is also of utmost importance when insufficient recuperation is offered during work hours (Suzuki, Miyaki, Song, Tsutsumi, & Kawakami, 2015). Aronsson, Svensson, and Gustafsson (2003) showed that teachers with difficulties winding down after work demonstrated higher levels of sickness presenteeism and absenteeism.

Being at work despite being sick has also been associated with depression (Miraglia & Johns, 2015). The stigmatization of depression might account for this correlation as depression generally is considered a less legitimate reason for sickness absenteeism (Buck, Porteous, Marsh, Phillips, & Main, 2011). A systematic review by Skagen and Collins (2016) confirms that sickness presenteeism is related to future sickness absenteeism and poor health.

Sickness presenteeism has in some studies been associated with errors and impairment in judgment (Gustafsson Sendén et al., 2013; Niven & Ciborowska, 2015). For example, pharmacists engaging in sickness presenteeism were shown to commit more severe errors with possible negative consequences for patient safety (Niven & Ciborowska, 2015). Their results showed increased anxiety at the workplace due to presenteeism to partly account for the relationship (Niven & Ciborowska, 2015).

Pilot health and presenteeism

For safety reasons, airline pilots are not certified for flight duty until passing recurrent medical examinations and receiving certification of their medical fitness. On these occasions, pilots must demonstrate that they do not suffer from any chronic physical or mental disease or disability that might impair their ability to perform their duties satisfactorily (European Commission Regulation, No 216/2008). Among the stated conditions that require extensive psychiatric examination are mood disorders (European Commission Regulation, No 1178/2011), which are disqualifying conditions for flight duty (European Aviation Safety Agency, 2013).

Depression and anxiety among pilots could have a great impact on flight safety as it might impair performance (Bor, Field, & Scragg, 2002) by interfering with necessary cognitive functions (Tobias, 1985). However, recognizing depression among patients is known to be challenging (Cepoiu et al., 2008) and Jones, Katchen, Patterson, and Rea (1997) discovered that pilots tend to be unwilling to discuss mental issues with health professionals (as cited in Bor et al., 2002). Thus, psychiatric limitations and diagnoses tend to be underreported among pilots (Lollis, Marsh, Sowin, & Thompson, 2009; Parker, Stepp, & Snyder, 2001).

Long weekly working hours have been associated with increased risks of depression and anxiety among pilots (O'Hagan, Issartel, Nevill, & Warrington, 2016). Not feeling fatigued during duty mitigated the risk of depression and anxiety in relation to those who did report feeling fatigued during active duty (O'Hagan et al., 2016). Being at work for long hours while feeling fatigued seems to be a risk factor for future depression and anxiety (O'Hagan et al., 2016).

A study conducted in Australia showed that 1% of the pilots reported intake of antidepressants (Ross, Griffiths, Dear, Emonson, & Lambeth, 2007) and Aljurf, Olaish, and BaHammam (2017) demonstrated that 34% to 40% of Gulf Cooperation Council pilots had abnormal depression and anxiety scores. Investigating pilot suicide intention demonstrated 13.5% of the sample experienced clinical depression and 4.1% disclosed suicidal thoughts (Wu et al., 2016).

Because medical examinations in the aviation industry are not without error (Bor et al., 2002) actions have been taken to secure safe flight operations and minimize the risk of human transgressions. European Commission Regulation [EC] No. 216/2008 clearly states, "A crew member must not perform allocated duties on board an aircraft when under the influence of psychoactive substances or alcohol or when unfit due to injury, fatigue, medication, sickness or other similar causes." The U.S. Federal Aviation Regulations (Federal Aviation Administration, 2018) convey a similar directive regarding crew members' self-regulation of fitness. Operating an aircraft under unfit conditions leaves pilots open to legal actions (European Cockpit Association, 2012). Unlike several other professionals, pilots are legally required to stay at home when unfit for duty; that is, in Sweden they are required to take sick leave when physically

unfit or report themselves unfit for flight when feeling unfit for other reasons (i.e., tiredness, fatigue, or other reasons with possible impact on flight safety). Going to work under any physical condition that could endanger flight safety can be referred to as sickness presenteeism.

This article introduces the term *inappropriate presenteeism*, which refers to attending work in spite of having poor mental health, feeling tired, or being unfit for other reasons (e.g., personal life stressors). The Pilot Fatigue Barometer confirmed that being at work when fatigued is prevalent and unreported in European aviation (European Cockpit Association, 2012). Eighty-nine percent of Swedish pilots reported that they had to cope with fatigue in the cockpit and 50% replied that it impaired their flight ability. However, no previous study was concerned with inappropriate or sickness presenteeism among pilots stemming from reasons other than fatigue, such as mental health issues. Generally, the recommended solution to fatigue is recuperation (European Cockpit Association, 2012), but unfitness from mental health issues might require other measures.

Purpose and research question

Pilots, as an occupational group, are in the top job category in Sweden with the greatest increase in sick leave during recent years (Försäkringskassan, 2014). Given the correlation between absenteeism and presenteeism (Gustafsson & Marklund, 2014; Janssens et al., 2013; Miraglia & Johns, 2015), the frequency of pilots operating aircraft in states of illness might also have risen. Among high-risk professions, presenteeism might represent greater risks and costs than absenteeism (Goetzel et al., 2004). Because pilots do not always self-declare their unfitness (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile, 2016; European Cockpit Association, 2012) and mental health issues that might reduce cognitive capacity (Tobias, 1985) and induce failures (Niven & Ciborowska, 2015) are seen as a less legitimate reason for absence (Buck et al., 2011), recognizing whether or not inappropriate pilot presenteeism presents an actual threat to flight safety is important.

The aim of this study was to investigate the prevalence of sickness presenteeism and inappropriate presenteeism among Swedish commercial airline pilots. This study was also concerned with how inappropriate presenteeism relates to mental health and flight safety. No study has so far investigated whether presenteeism might influence flight safety negatively, in the form of committed errors in the cockpit, through mental health issues and impaired performance. This knowledge has the potential to add to a thin research database and hopefully be of aid to safety efforts in the airline industry.

We expected Swedish commercial airline pilots to report significantly more acts of inappropriate presenteeism than acts of sickness presenteeism in the past 12 months as mental health is seen as a less legitimate reason for absence than poor physical health (Buck et al., 2011). Swedish commercial airline pilots with a history of inappropriate presenteeism in the past 12 months were also predicted to report significantly more errors committed in the cockpit than nonpresentees, due to additive strain (i.e., mental health) impeding performance (Niven & Ciborowska, 2015).

Method

Participants

Participants in this study were pilots with Swedish pilot licenses. The inclusion criteria were holding a Commercial Pilot License (CPL), an Airline Transport Pilot License (ATPL), or a Multicrew Pilot License (MPL) and currently working as a pilot at a commercial airline. The Swedish Transport Agency (Transportstyrelsen) maintains a national license database that was used to reach out to pilots with these types of licenses (N = 2,989, CPL = 1,295, ATPL = 1,640, MPL = 54). In total, 1,300 pilots completed the survey (female = 89, male = 1,211). Some of the dropout consists of people whose addresses are unknown or whose letters were returned to us for other reasons, which resulted in a total of 43 returns. A dropout analysis showed that 67 people were aged 60 years or older (for pilots, 60 is the typical retirement age). Excluding these individuals from the initial sample resulted

Table 1. Demographic characteristics of the sample (N = 1,113).

	n	%
Gender		
Female	80	7.1
Male	1,053	92.9
Age (years)		
≤ 33	239	21.1
34–45	347	30.6
46–54	375	33.1
≥ 55	171	15.1
Education (years)		
Compulsory school (1–9)	5	0.4
Secondary school (10–12)	466	41.1
University education (13–16)	631	55.7
Higher university education (≥ 16)	12	1.1
Marital status		
Married/partnership/domestic partnership	894	78.9
Single	170	15.0
Live apart	68	6.0
License type		
Airline Transport Pilot License	779	68.7
Commercial Pilot License	317	28.0
Multicrew Pilot License	37	3.3

in an answer frequency rate of 46%. After excluding respondents not currently working as pilots, answers from 1,133 (38%) pilots were available for analysis (see Table 1 for participant demographics). Responding to the survey did not yield any compensation for the participating pilots.

Materials

Measures and instruments that were of relevance to the study were obtained from a Swedish self-report questionnaire of a longitudinal research project. Several well-reputed questions have been modified to improve their validity with regard to Swedish airline pilots. The questions were reviewed and modified by a pilot reference group and the Swedish Transport Agency before being included in the final questionnaire.

Demographic information

In the self-report questionnaire, demographic variables were collected. Participants were asked to give information regarding age, gender, highest level of education, flight experience (flight hours), and marital status.

Presenteeism

The items measuring presenteeism were derived from a well-recognized single question (Aronsson et al., 2000; Hansen & Andersen, 2008, 2009; Niven & Ciborowska, 2015). The original item by Aronsson et al. (2000) has been demonstrated to have a 6- to 12-month test–retest reliability of .58 or higher (Demerouti, Le Blanc, Bakker, Schaufeli, & Hox, 2009). Two questions were used to capture presenteeism stemming from unfitness. One question concerned the frequency of sickness presenteeism stemming from unfitness when it would have been reasonable to take sick leave ("How many times during the last 12 months have you begun a flight even though your health status made it reasonable to take sick leave?"). The second question regarded inappropriate presenteeism due to unfitness stemming from other reasons ("How many times during the last 12 months have you begun a flight in spite of feeling tired, fatigued, or unfit for other reasons?"). The questions were modified to measure the active decision of flying. The questions had a fill-in-the-blank response, as recommended by Johns (2009, 2011).

Health factors

Health-related factors under investigation were the perception of recovery and self-rated anxiety and depression.

Recovery. Assessing recovery was accomplished by eight items previously used in research (Gustafsson, Lindfors, Aronsson, & Lundberg, 2008). The questions aim at investigating feelings of rest, sleep disturbances, physical and mental tiredness, and work-related worry (Gustafsson et al., 2008). Responses are given on a 5-point scale ranging from 1 *(rarely or never*) to 5 (*often or all the time*). The internal consistency of the scale has been shown to range from .83 (von Thiele, Lindfors, & Lundberg, 2006) to .85 (Gustafsson et al., 2008). In this study, a Cronbach's alpha of .82 was measured.

Depression and anxiety. The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is frequently used in research and has adequate validity and good reliability (van Ballegooijen, Riper, Cuijpers, van Oppen, & Smit, 2016). The HADS consists of 14 items, divided equally between questions dealing with depression (HADS–D) and anxiety (HADS–A; Stern, 2014). For every question, the respondent chooses the most suitable answer on a 4 point-scale, ranging from no symptoms to maximum impairment (Sagen et al., 2009). Cutoff values vary (Bjelland, Dahl, Haug, & Neckelmann, 2002) but the diagnostic threshold is generally set at ≥ 8 for each of the subscales, indicating mild (Stern, 2014) or doubtful cases (Sagen et al., 2009). In a literature review by Bjelland et al. (2002) the subscales have been shown to correlate from .40 to .74 and Cronbach's alpha values for the scales are similar, with means of .82 to .83. In this study, Cronbach's alpha for HADS–A was .80 and for HADS–D was .82.

Errors committed in the cockpit

Committed errors were measured by asking participants if it had happened in the past 12 months that they, due to tiredness, fatigue, or flying in other unfit states, had made errors in the cockpit while on duty. If participants claimed that they indeed had made such errors, they were asked to specify on how many occasions during the past 12 months.

Confounding variables

Absenteeism and the number of unfit for flight reports in the previous year were measured as controlling variables. The respondents were asked to approximate, by a fill-in-the-blank response, on how many occasions they had taken sick leave (Aronsson & Gustafsson, 2005; Aronsson et al., 2000; Hansen & Andersen, 2008) or reported unfit for flight during the past 12 months.

Participants were also asked a single question as to how they perceived their general health. Responses were rated on a 5-point scale ranging from 1 (*very poor*) to 5 (*very good*).

Procedure

Data were procured from a longitudinal research project concerned with the new working conditions for Swedish airline pilots and the consequences for their health and well-being. The project was approved by The Regional Ethical Review Board in Stockholm (Dnr 2016/250- 31/2) prior to data collection. Data were collected with a questionnaire, starting May 30, 2016 and ending August 30, 2016.

Before participants responded to the questionnaire, their informed consent was obtained, and respondents received information that participation was optional. The participants were assured of their anonymity and the protection of the research data.

Questionnaire

First, participants were sent an invitation to complete an online survey. Those who had not responded received the questionnaire in hard copy by mail. Finally, a second invitation was sent

with the goal to encourage pilots to complete the online questionnaire. The survey consisted of items covering demographic variables, work conditions and climate, safety, organizational changes, and health. Completion time was between 25 and 40 min.

Design

This study is a cross-sectional survey study consisting of data from the first collection of the longitudinal research project.

Statistical analyses

SPSS Statistics Version 23 was used to analyze data. Analysis revealed some data to be nonnormally distributed and not having homogeneity of variance. Parametric analyses have been argued to be usable even for nonnormal data (Clark-Carter, 2010; Vickers, 2005). Thus, both parametric and nonparametric tests were performed.

As the presenteeism and the committed errors variables did not fulfill assumptions qualifying them for parametric analysis, they were dichotomized. Presenteeism was dichotomized into presentee and nonpresentee pilots. The variable concerned with errors was dichotomized into zero to four errors and five or more errors in the past year. This division was derived based on scales from previous research (Niven & Ciborowska, 2015) and dichotomized to provide sufficient sample sizes for analysis. Alpha level was set at .05.

Wilcoxon signed ranked and Mann–Whitney U tests were used to analyze differences within the sample and the dichotomized subgroups of presenteeism. Additionally, logistic regression was used to analyze the relationship between presenteeism and reported errors committed in the cockpit. Mediation was also analyzed by logistic regression using established procedures (Baron & Kenny, 1986). Collinearity was checked for using Pearson and Spearman correlations.

With errors as the dependent variable, the direct effect between inappropriate presenteeism and reported errors was estimated in Model 0. Mediators were added in Model 1 and 2.

Results

Of the participants, 54% stated that they at least on one occasion in the past 12 months had started flying despite it being legitimate to take sick leave (i.e., they engaged in sickness presenteeism). Sixty-three percent disclosed actions of inappropriate presenteeism in the past year as they had begun flying on at least one occasion in spite of feeling tired, fatigued, or unfit to fly for other reasons. Sixty-nine percent claimed to have made mistakes associated with tiredness, fatigue, or flying in other unfit states in the past year, but only 25% had reported themselves unfit for flight on a minimum of one occasion in the past year. Fifty-seven percent among those who stated that they had not reported unfit for flight in the last 12 months did, however, state they had begun flight duty on at least one occasion in the last year when regulation obliged them not to do so, $\chi^2(1, N = 1{,}047) = 37.64$, $p < .001$. Results indicated that inappropriate presenteeism declined with flight experience, χ (2, N = 1,050) = 12.71, $p = .002$, and age, $\chi^2(3, N = 1{,}055) = 15.61$, $p = .001$.

Levels of sickness presenteeism (54%) were lower than absenteeism, as 65% had taken sick leave in the past year. Twelve percent of the sample were classified as doubtful cases with regard to the diagnostic threshold for anxiety. Ten percent were identified as possible subjects suffering from depressive symptoms above the diagnostic threshold.

The Wilcoxon signed ranked test indicated the frequency of inappropriate presenteeism (Mdn = 2) was, as hypothesized, statistically significantly greater than the frequency of sickness presenteeism (Mdn = 1), $Z = -14.84$, $p < .001$. A Mann–Whitney U test indicated that the number of self-reported errors was significantly higher among inappropriate presentee pilots (Mdn = 6) than among nonpresentee pilots (Mdn = 0), U = 45140.5, $p < .05$, also in line with expectations.

Table 2. Association between self-reported inappropriate presenteeism and self-reported errors (0–4, 5+) in the cockpit, using logistic regression analysis.

	Model 0[a]		Model 1[b]		Model 2[c]	
N = 784	OR	95% CI	OR	95% CI	OR	95%CI
IP						
No	1		1		1	
Yes	4.33*	[3.18, 5.90]	4.00*	[2.92, 5.49]	3.03*	[2.18, 4.22]
Anxiety						
< 7	1		1		1	
8+	2.52*	[1.59, 4.02]	1.44	[0.83, 2.48]	1.12	[0.64, 1.97]
Depression						
< 7	1		1		1	
8+	2.80*	[1.70, 4.62]	1.46	[0.83, 2.57]	1.16	[0.65, 2.09]
Recovery						
Poor	1				1	
Good	0.22*	[0.17, 0.30]			0.32*	[0.23, 0.44]

Note. IP = inappropriate presenteeism; OR = odds ratio; CI = confidence interval.
[a]Crude model demonstrating direct effects. [b]Testing mediation (mental health). [c]Testing mediation (recovery).
*$p < .001$.

It was hypothesized that a relationship between inappropriate presenteeism and reported errors was mediated by mental health. Performing logistic regression showed no support for the hypothesis (Table 2). Neither depression nor anxiety mediated the relationship between inappropriate presenteeism and self-reported errors. In a post hoc analysis, adding recovery to the model demonstrated recovery to change the odds ratio of inappropriate presenteeism on committing errors in the cockpit more than 10%, from 4.00 to 3.03. Further analysis did not demonstrate any significant interaction between inappropriate presenteeism and recovery, suggesting only direct effects on self-reported errors and possibly moderation. Nagelkerke R^2 for the final model was .228 with an overall classification of 67%.

Controlling for age, gender, flight experience, and general health did not change the relationship between mental health, recovery, and errors. Nonetheless, it did show flight experience to have a significant relationship with reported errors. The two groups of pilots with the most experience in flight hours had an elevated risk of reporting five or more committed errors in the cockpit in the previous year, with the pilots with 10,000 or more flight hours at the greatest risk, $OR = 2.57$, 95% CI [1.46, 4.52], $p < .001$, $OR = 3.75$, 95% CI [1.87, 7.51], $p < .001$.

Discussion

The purpose of this cross-sectional survey study was to investigate the prevalence of sickness presenteeism and inappropriate presenteeism among Swedish commercial airline pilots, and how inappropriate presenteeism relates to mental health and flight safety. Key findings demonstrated inappropriate presenteeism to be common among Swedish commercial airline pilots. Pilots with inappropriate presenteeism and incomplete recuperation were also shown to be at greater risk of reporting five or more committed errors when on flight duty in the previous year, suggesting inappropriate presenteeism to be a threat to flight safety.

Inappropriate presenteeism, mental health, and reporting unfit

Levels of sickness presenteeism were within the range of that observed in the general population (Aronsson & Gustafsson, 2005; Gustafsson Sendén et al., 2013), which is noteworthy, as it could have been expected that regulations would make sickness presenteeism less common among pilots as an occupational group. The high number of pilots who had begun flights in spite of feeling tired,

fatigued, or unfit for flight duty for other reasons (63%) speaks to pilots operating aircraft in states that might affect flight safety to be of substantial prevalence among Swedish commercial airline pilots. The relatively low frequency of pilots who had reported themselves unfit for flight on at least one occasion in the past year (25%), compared with the frequency of pilots who had taken sick leave in the past year (65%), indicates a greater resistance to reporting unfit for flight than to take sick leave.

Rates of depression and anxiety were relatively low, but notable as pilots recurrently undergo medical examinations (European Commission Regulation, No 216/2008). The findings of this study are in line with previous research suggesting that pilots are as prone to mental illness as the general population (Bor et al., 2002), as the prevalence of anxiety and depression was similar to that of the general Swedish population (Lisspers, Nygren, & Söderman, 1997).

Finally, the high frequency of inappropriate presenteeism demonstrates that tiredness, fatigue, and unfitness for other reasons might not only happen during flight, but could already be manifested before takeoff. This recognition enables interventions on two levels: working with reducing pilot tiredness, fatigue, and unfitness, and facilitating the decision of reporting unfit for flight on these occasions. Fatigue and unfitness for flight are generally combatted using contra measures focusing on improved recovery (European Cockpit Association, 2012; Hartzler, 2014), but reasons for presenteeism and unfit for flight reporting among pilots are mostly unknown.

Threats to flight safety

Pilots with acts of presenteeism reported committing significantly more errors than pilots with no acts of presenteeism in the previous 12 months. Logistic regression demonstrated that pilots with acts of inappropriate presenteeism also were more likely to report a history of five or more committed errors in the cockpit in the previous year. This relationship was not mediated by mental health, contradicting previous research (Niven & Ciborowska, 2015) and the hypothesis. Remaining at work despite feeling unfit for flight duty does not seem to add to mental strain among Swedish commercial airline pilots, but rather has a direct effect on self-reported errors. Recovery was demonstrated to be related to reported errors; pilots with good recovery were less likely to report committing five or more errors at work. This is interesting with regard to research pointing out that inflight rest (i.e., napping on the flight deck) is common among commercial pilots (European Cockpit Association, 2012). It is plausible that inflight rest is reducing the safety risk for pilots taking off in unfit states. A literature review by Hartzler (2014) showed strategic naps to be beneficial to pilot fatigue, but not to make up for sleep loss prior to flight duty. Nonetheless, these pilots are still a potential risk to safety, as microsleep might not always have been agreed on beforehand (European Cockpit Association, 2012), resulting in the risk of both pilots dozing off. One third of a sample of UK pilots who reported dozing off during flight also stated they had woken up to find their pilot colleague asleep as well (European Cockpit Association, 2012).

The results were also variable regarding flight experience. Pilots with more flight hours were less likely to exhibit acts of inappropriate presenteeism but also more likely to report five or more errors when on flight duty in the past 12 months. It is plausible that less experienced pilots face more barriers to reporting errors than experienced pilots, which could explain these contradicting results.

As the question regarding inappropriate presenteeism did not include that being in an inappropriate state for flight duty should have led to unfit for flight reporting it is possible that pilots might have reported acts of inappropriate presenteeism on occasions when they still would not have reported unfit for flight. Hence, the results of this logistic regression show that regardless of pilots considering their state as a potential hazard to flight safety, attending work in these states increased the odds of also reporting five or more committed errors in the past 12 months. This assumption suggests that pilot-reported subjective ratings might not be the best measure of unfitness, which

could also be supported by previous research. Monk (1987) demonstrated a discrepancy between subjective and objective measures of sleepiness.

The commercial aviation industry has established means to prevent inappropriate presenteeism from causing accidents, such as two-pilot operations. The risk of dual pilot failure and fatal accidents has been quantified and generally accepted (Evans, 2016). Nonetheless, these analyses are limited, only including the risk of physical unfitness, neglecting the risk of pilot mental unfitness and inappropriate presenteeism.

Methodological concerns and limitations

Inappropriate presenteeism was introduced in this study as a term in the research field of sickness presenteeism. To our knowledge, this is the first study concerned with inappropriate presenteeism as a phenomenon and the first to investigate it among pilots. Previous research has examined sickness presenteeism among other occupational groups (Aronsson et al., 2000) and related it to mental strain and negative outcomes (Niven & Ciborowska, 2015). Nevertheless, research of this kind is scarce, and this is the first study to examine the relationship between pilot inappropriate presenteeism and flight safety. In this study several types of inappropriate presenteeism were grouped together and it is therefore possible that different groupings would have altered the results.

In today's competitive flight industry, creative solutions have emerged to reduce costs (Jorens, Gillis, Valcke, & De Coninck, 2015; Steer Davies Gleave, 2012). Airlines might operate in one country but be registered in another. This means that the inclusion criteria of holding an MPL, CPL, or ATPL excluded pilots who were working within Sweden but who held their commercial license in another country. The large sample size (N = 1,133) makes generalizability possible. However, the nonresponse rate was high, questioning the external validity.

One of the main limitations of this study was the cross-sectional, correlational design and self-report, with the various weaknesses it entails of subjective interpretations, biases, and uncontrolled environments during completion (Gawron, 2016). These weaknesses could potentially pose a threat to the validity and reliability of the results and prevent causal explanations without confounding variables. Nonetheless, most of the measures used in this study have been aggregated from well-reputed questionnaires with established psychometrics. Additionally, all questions were reviewed and modified by pilots before inclusion in the final questionnaire, improving their validity. Future research should be longitudinal, to be able to confirm mediation, and concerned with more objective measures of inappropriate presenteeism, its different types, and committed errors, to capture more accurately these variables.

A strength of this study is that it controlled for the effects of gender, age, flight experience, and general health on the outcome variables.

Conclusions and future research

This study showed inappropriate presenteeism to be of substantial prevalence among Swedish commercial airline pilots and provides a starting point for future research concerning inappropriate presenteeism among Swedish commercial airline pilots. Results also indicate insufficient recuperation and inappropriate presenteeism to be potential hazards to flight safety. Consequently, the current regulation stating that pilots should not engage in flight duty on occasions when it could endanger flight safety might be insufficient to ensure safe flight operations.

Causse, Dehais, and Pastor (2011) put forward that cognitive ability (i.e., calculation and problem solving) have the greatest predictable value on pilot simulator operating performance. A recent review has shown shift work and subsequent sleep debt among air traffic controllers to significantly compromise their cognitive performance (Nealley & Gawron, 2015). Subsequently, research could explore what cognitive functions might be greatly affected by pilot inappropriate presenteeism to be able to target these factors and fully comprehend why inappropriate presenteeism and poor recovery might cause mishaps among pilots. As this study also showed that inappropriate presentee pilots, without regard to them considering their state as qualifying for reporting unfit for flight, do have

a greater risk of reporting five or more committed errors, it could be of interest to develop an objective scale concerned with feelings of fatigue or unfitness stemming from other reasons. Pilots use technical checklists every day; however, no checklist is concerned with the mental and physical state of the pilot. Currently, an intervention study of this kind is underway.

Future research could investigate what makes pilots attend work in spite of feeling fatigued, tired, or unfit for other reasons, to increase the likelihood of pilots reporting unfit for flight rather than flying in states that could jeopardize flight safety. Traditional factors associated with presenteeism might not be applicable to pilots, as they cannot themselves determine their pace of work or adapt their work to their current mental or physical state. Previous research has shown fear of disciplinary actions or stigmatization to be the primary reasons for pilots not declaring themselves unfit for flight (European Cockpit Association, 2012). In recent years, deregulation of the aviation industry has changed the terms of employment radically (Steer Davies Gleave, 2012, 2015). Market liberalization has created a quest for enhanced effectiveness and competitiveness, leading to increased work demands for employees in the aviation industry (Jorens et al., 2015; Steer Davies Gleave, 2012). The new challenging terms and conditions in the aviation business have brought with them a new safety focus at airlines, investigating the impact of work conditions and organizational culture (International Civil Aviation Organization, 2013). Results indicate that safety climate can affect safety behavior (Bronkhorst, 2015) and could explain why some pilots take off in states of unfitness with the risk of accident causation.

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