Fatigue self-management strategies and reported fatigue in international pilots

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The use of strategies to manage fatigue associated with work was investigated in a sample of 253 pilots operating Air New Zealand regional and international routes. Overall, 13% of pilots responded that they experienced fatigue from their job as a pilot three times a week or more but no differences in overall fatigue levels were found by age, rank or fleet. The use of napping by pilots prior to an overnight duty was variable and 25% of pilots responded that they napped only a little of the time or not at all before such a duty. Pilots who routinely used daytime napping prior to overnight duties reported significantly lower levels of general fatigue. The use of the cockpit napping procedure was evenly split, with 52.5% of pilots reporting the use of cockpit napping over the previous 12 months. The use of the cockpit napping procedure was associated with lower levels of reported fatigue. Hypnotic medication use in the previous 2 months was reported by 19% of pilots mostly on an occasional basis. Melatonin and alternative medicine were used less frequently than hypnotics. This study highlights fatigue as a major problem for many pilots operating regional and international routes. The strategies used by international aircrew to manage fatigue are variable and provide support for the association between napping and lower reported fatigue.

1. Introduction

Aircrew operating irregular work hours and flying to international destinations frequently experience fatigue from their job (Samel et al. 1995, Winget et al. 1984). Often this is a result of the irregular pattern of work and sleep required to maintain round the clock flight schedules. Aircrew flying across time zones also have to adjust to the circadian disruption to sleep and work patterns, as they are often required to take rest periods at times disengaged from the demands of their own body clock (Lowden and Akerstedt 1998). The circadian disruption may also cause an impaired recovery of sleep and alertness levels when the pilot returns to home base. The difficulties in maintaining normal sleep patterns and circadian disruption can lead to reduced levels of well-being for crew and impaired performance on the flight deck (Haugli et al. 1994,
Wright and McGown 2001). A detailed analysis of confidential aviation incident reports suggests that approximately a fifth may be fatigue-related (Graeber 1988: 305–344).

Crew vary both in their ability to cope with fatigue and the strategies they use to manage irregular work schedules. There are strong individual differences in the amount of sleep loss aircrew accumulate over a trip, with greater sleep loss being associated with increased age (Gander et al. 1993). The coping strategies used prior to a duty vary considerably but often involve napping and conserving energy. While on the flight deck, the strategies pilots commonly use to manage fatigue include planning activity, mental withdrawal, communicating with other crew and increased caffeine intake (Petrie and Dawson 1997).

The use of daytime napping both prior to an overnight duty and during a flight is a strategy reported and observed in aircrew (Gander et al. 1991). In conditions of restricted sleep, napping has been shown to maintain alertness and performance in both laboratory and field trials (Rosekind et al. 1992). These data and others have prompted recommendations to aircrew to nap prior to overnight duty to reduce accumulated sleep debit and maintain alertness during the night. Some airlines, including Air New Zealand, have instituted formal cockpit napping procedures that can be used as an occasional short-term measure to alleviate unexpected fatigue and maintain alertness for the critical phases of the flight.

Air New Zealand operates approximately 40 jets (Boeing 737, 767 and 747) in a combination of domestic and international sectors. The international operation has a high proportion of long-haul flights around the Pacific rim and through to London. Sectors up to 13 h flight time are operated by three crew, and longer sectors have a fourth pilot. Most duties involve only one or two night layovers at destinations. Flights returning to New Zealand tend to be operated through the night.

The use of hypnotics in aircrew is a topic that has surprisingly received little attention in the scientific literature. Short acting hypnotics have been recommended on a short-term basis for aircrew adjusting to a new sleep-rest schedule such as those pilots flying transmeridian international routes (Caldwell 1997). However, caution has been suggested in their routine use, and it has been recommended that an interval of 24 h is employed between ingestion and commencement of flying duties (Nicholson et al. 1985). While considerable research has been conducted on military pilots (Paul et al. 2001, Ramsey and McGlohn 1997) very little is known about what proportion of international pilots take hypnotics and how often such sleep medication are used. The use of melatonin as a medication to improve recovery following flights involving circadian disruption has received support in a number of clinical trials (Herxheimer and Petrie 2001). However, the frequency of use of melatonin and alternative or homeopathic remedies in pilots is unknown.

The current study investigated the levels of reported fatigue in pilots operating regional and international routes. It also examined the effect of various fatigue related management strategies on overall fatigue levels. Data were collected on the frequency of napping prior to an overnight duty as well as how often pilots used the cockpit napping procedure. The study also investigated how often pilots used hypnotics, melatonin, and other alternative medicine in order to alleviate fatigue.
2. Method

2.1. Participants
All Air New Zealand pilots flying international routes on 747-400, 767, 737-300 aircraft were sent a questionnaire to complete anonymously as part of a survey of pilot fatigue \((n = 612)\). Overall, 251 pilots completed the questionnaire, representing a response rate of 41%, and the sample included 109 captains, 104 first officers and 38 second officers.

2.2. Procedure and measures
The questionnaire was mailed to each pilot and pilots were asked to return the questionnaire in a large locked mailbox provided for the survey at the crew service desk. The questionnaire gathered information on the pilot’s fleet, rank and age in three age bands—under 40, 40–49 and 50–60. The questionnaire collected information on the use of fatigue management strategies and fatigue measures as follows:

2.2.1. Fatigue management strategies: Pilots were asked to rate how often they napped prior to an overnight duty on a 6-point scale from ‘never’ to ‘always’ and how many times they had used the cockpit napping procedure in the previous 12 months. The frequency of use of hypnotic medication, melatonin and alternative medicines over the past 2 months in order to manage fatigue was also assessed.

2.2.2. Vitality scale: Overall fatigue was assessed by the Vitality Scale, a four-item scale from the SF-36 Health Survey designed to assess subjective fatigue and tiredness (Ware et al. 1993). The scale has high levels of reliability and validity in both general population and medical samples (McHorney et al. 1994, Scott et al. 1999). The Vitality Scale is measured in a positive direction with low scores indicating higher levels of fatigue.

2.2.3. Impact of work fatigue: The impact of fatigue was also assessed by two specific fatigue items. The first asked pilots ‘Looking back over the last two months at work, how often did you feel you experienced significant fatigue from your job?’. Pilots responded on a 7-point Likert scale from ‘three or more times a week’ to ‘never’. Pilots were also asked ‘During the past 4 weeks, to what extent has fatigue interfered with your normal social activities with family, friends, neighbours or groups?’ rated on a 5-point Likert scale from ‘not at all’ to ‘extremely’. Pilots also completed a single self-rated health item—‘Compared to the person in excellent health, how would you rate your health at the present time’ rated on a 7-point Likert scale from ‘terrible’ to ‘excellent’.

3. Results

3.1. Reported fatigue
Pilot responses to the question on how often they experienced fatigue from their job are presented in figure 1. Overall, 13% responded that they experienced significant fatigue from their job as a pilot three times a week or more and 17% reported experiencing fatigue only once every 2 weeks or less. There was no difference on the scores of this item by fleet \((F (2, 247) = 0.44, p = 0.64)\), age \((F (2,246) = 1.18, p = 0.31)\) or rank \((F (2,243) = 1.32, p = 0.27)\). Overall, 64% of pilots reported significant fatigue from their job once a week or more.
In response to how often fatigue had interfered with normal social activities in the past month, 6% of pilots stated that fatigue had interfered ‘extremely’, 23.9% responded ‘quite a bit’, 35.9% ‘moderately’, 30.7% ‘slightly’ and 3.6% ‘not at all’. There was no difference on the scores of this item by fleet (F (2,250) = 0.06, \( p = 0.95 \)), age (F (2,247) = 0.78, \( p = 0.46 \)) or rank (F (2,246) = 0.57, \( p = 0.56 \)). The overall pilot mean on the SF-36 Vitality Score was 43.9 (SD = 19.3). No difference was also found on this scale for fleet (F (2,248) = 0.66, \( p = 0.52 \)), age (F (2,245) = 0.03, \( p = 0.98 \)) or rank (F (2,244) = 0.53, \( p = 0.59 \)).

3.2. Personal fatigue management strategies

3.2.1. Napping prior to an overnight duty: In response to the question about daytime napping prior to starting an overnight duty, 19.4% of pilots responded that they napped all of the time, 26.2% most of the time, 29.1% a good bit or some of the time. However, 25% of pilots responded that they napped only a little of the time or not at all before such a duty.

Pilots were divided into two groups, representing those routinely using napping prior to an overnight duty and those using napping only a little or none of the time. There was no difference in the proportion of pilots using napping across the three fleets (\( \chi^2 (2, N = 248) = 4.60, p = 0.10 \)). However, napping prior to an overnight duty was used proportionately more by pilots aged 50–60 (92%) than by pilots aged 40–49 (67%) or pilots aged under 40 (67%), (\( \chi^2 (2, N = 246) = 15.95, p = 0.001 \)). Consistent with this finding, napping prior to an overnight duty was also used more by captains (82.4%) than first officers (72.8%) or second officers (58.8%), (\( \chi^2 (2, N = 245) = 8.2, p = 0.02 \)).

The relationship between napping prior to an overnight duty and general fatigue was analysed by comparing the mean fatigue scores in those pilots routinely using
napping prior to an overnight duty and those using napping only a little or none of the time. The data revealed that pilots who routinely used napping prior to overnight duties reported significantly lower levels of general fatigue on the SF-36 Vitality scale ($t(246) = 2.49$, $p = 0.01$).

3.2.2. Use of Cockpit Napping Procedure: The number of times pilots used the cockpit napping procedure in the previous 12 months is shown in figure 2. As can be see from the graph, 47.5% of pilots responded that they had not used cockpit napping in the previous 12 months. There was no difference in the use of the cockpit napping procedure by fleet ($\chi^2 (2, N = 240) = 2.34$, $p = 0.31$), age ($\chi^2 (2, N = 238) = 2.56$, $p = 0.28$) or rank ($\chi^2 (2, N = 237) = 1.78$, $p = 0.41$). However, there was a trend for pilots who used the cockpit napping procedure to report lower levels of fatigue (higher vitality) $M = 46.07$, $SD = 17.87$ compared to pilots who reported never using the procedure ($M = 41.44$, $SD = 20.81$, $t(238) = -1.85$, $p = 0.06$).

3.3. Medication use
The use of prescription hypnotics, melatonin and alternative medicines to manage fatigue is presented in table 1. Eighty-one per cent of pilots reported that they had
not used hypnotic medication at all in the previous two months with a further 6.4% reporting that they had used the drugs 1–2 times. Two per cent of pilots reported using prescribed hypnotics on more than 10 occasions. The use of melatonin and alternative medicine to manage fatigue was lower than hypnotics with 7.2% of pilots using melatonin in the previous 2 months and 10.4% using alternative medicines to manage fatigue.

As would be expected, the use of sleeping tablets was more common in the oldest age group of pilots with 15% of pilots aged under 40 reporting using hypnotics compared to 14.7% for pilots aged 40–49 and 29.2% for pilots aged 50–60 ($\chi^2 (2, N = 248) = 6.89, p = 0.03$). Hypnotic use was also more common in captains (26.6%) than first officers (13%) ($\chi^2 (2, N = 247) = 7.27, p = 0.007$). There were no significant differences in the use of melatonin or alternative medicines for managing fatigue by age or rank. There was no significant difference in levels of general fatigue on the SF-36 vitality scale between those pilots who had used sleeping tablets and those who had not in the previous two months ($t(249) = 1.31, p = 0.19$). However, pilots who used sleeping tablets did have lower levels of self-rated health ($M = 4.81, SD = 1.14$) compared to pilots who did not use hypnotics ($M = 5.16, SD = 1.04, t(249) = 2.04, p = 0.04$).

### 4. Discussion

The results of this study show fatigue to be a problem for a significant percentage of pilots flying regional and international routes. Approximately 30% pilots report that fatigue interferes noticeably with their normal social life and 13% of pilots report significant fatigue from their job three times a week or more. The mean score of pilots on the SF-35 Vitality scale is considerably lower than the norms for the New Zealand general population (43.9 versus 65.6, Scott et al. 1999). However, there is a considerable range in the levels of reported fatigue, with 17% of pilots reporting that they only experience work related fatigue once every 2 weeks or less. These results suggest that individual differences and personal strategies in the management of fatigue are important in minimizing the effects of irregular work hours and circadian disruption which are part of the commercial pilot job demands.

Data from the survey support the use of napping as a beneficial fatigue countermeasure. Those pilots who napped prior to an overnight duty reported significantly lower levels of fatigue. Prior napping was more likely to be adopted by older pilots who have previously been found to have more difficulty adjusting to routine schedules (Gander et al. 1993). Interestingly, the use of the cockpit napping procedure over the previous 12 months was also associated with lower fatigue scores and this may reflect a general propensity by some pilots to use countermeasures to manage fatigue.
There is very little data available on the use of hypnotics in commercial aircrew. The current study suggests that the level of hypnotic use may be higher than expected with 19% of crew using hypnotics over the previous 2 month period. Most of the use appears to be occasional and in line with previous recommendations (Nicholson et al. 1985) but a small group of pilots appear to be more frequent users of hypnotic medication. It was not possible in this study to discover if there were other contributing factors to explain this level of use. The use of melatonin in crew was relatively low and this may be due to the fact that, unlike passengers, crew have only short time periods in overseas destinations and therefore the medication may only be successfully used for adjusting to home base (Suhner and Petrie 2001: 403–408).

It should be acknowledged that this study is limited by its cross-sectional nature and therefore the causal direction of the associations found in the data cannot be established with any certainty. The anonymous and self-report nature of the questions means that the representativeness of respondents to the survey cannot be established, furthermore, the checking of the veracity of responses was not possible. Bearing these limitations in mind, the study suggests that a large proportion of pilots are significantly affected by fatigue. The study also highlights the large range of personal coping strategies such as the use of napping and medication to manage fatigue from flying duties.

References


