WORKING HOURS AND FATIGUE OF JAPANESE FLIGHT ATTENDANTS (FA)

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Recent problems of working hours and their effects on fatigue symptoms of flight attendants (FA) were studied. The international flight timetable of Japan Air Lines (JAL) departing Narita International Airport was analyzed. Complaint rates of fatigue symptoms were surveyed in 211 female FA assigned to the long daily nonstop flights. It was found that many FA worked in the night and early morning and that flight hours were often very long and time difference between Japan and destinations might adversely affect biological rhythms of workers. Fatigue complaint rates became abruptly higher after the second meal service when flight duties had been performed for 7 through 10 hr after taking off on every route. Factors suspected to elevate fatigue complaint rates were length of working hours, length of night work duties and time differential between Japan and destinations. Female FA working the domestic flights of four Japanese airlines (JAL, ANA, JAS and ANK; n = 3,111) were subjected to a questionnaire survey. They kept a daily log on showing up and debriefing hours together with fatigue symptoms. Some 1,317 (42.3%) valid responses were analyzed. Early morning show-up and late night debriefings were often observed, reflecting the extreme irregularity of FA time schedule. By statistical analyses, some factors including long working hours, frequent landings and late debriefing hours were considered to contribute significantly to higher fatigue complaint rates, together with other factors such as the order of the day among a series of days on duty and short intervals for taking rest between two consecutive work days.
From the viewpoint of occupational health, many issues have been raised concerning the work of flight attendants (FA). These problems have first of all been related to working hours including time differential, long working hours, irregular working times, and night work (PRESTON et al., 1973; MATSUMOTO et al., 1990). Secondly, work environment issues have been indicated such as atmospheric pressure and irradiation during flights, and climate and cultural differences between, for example, Japan and other countries (ILO, 1977). Thirdly, the stressful nature of FA work and biomechanical issues have been pointed out, including specific tasks such as waiting on customers, unnatural working postures and manual handling of heavy materials (MAEDA et al., 1983). It has also been reported that complaint rates of fatigue and work stress related disorders including low back pain are very high in FA (CAMERON, 1969; PRESTON et al., 1973; SMOLENSKY et al., 1982; WATANABE et al., 1984).

In recent years, the number of long nonstop flights between Tokyo and the U.S. East Coast or western Europe have markedly increased together with heavier passenger loads. With the sophistication of administrative control of working hours, cumulative monthly flight hours are also steadily mounting and closer to the limits set by an agreement between labor and management. Although the number of passengers has been increasing, there has not been a corresponding increase in the number of FA. Thus, there is a need for an optimal balance of working hours and rest time to maintain good health conditions or prevent fatigue symptoms from worsening.

The aim of the present study is to clarify the present problems of working conditions chiefly by focusing on working hours and to study those relations to fatigue symptoms of FA.

**Working hours on international flights**

The timetables for outbound international flights in December, 1990, of Japan Air Lines (JAL) were analyzed in terms of the weekly number of departure times from Narita International Airport, arrival times at destinations and flight hours. There were 251 flights a week departing Narita airport and the distribution of departure times is shown in Fig. 1. Since FA generally had to show up 105 min before departure times, flights requiring them to show up before 8 a.m. would be only 2% of total number of flights for one week. The number of departures after 10 p.m. was only 4% of all outbound flights.

The number of outbound flight hours distributed in the wide range from less than 3 through more than 12 hr (Fig. 2A). Long flights of 9 or more hours accounted for 32% of all flights. From the standpoint of Japanese Standard Time (JST), the number of late-evening flight arrivals between 22:00 and 7:00 made up 61% of all flights (Fig. 3).

The number of flights in each JST departing Narita International Airport was surveyed for one week (Fig. 4). Midnight or early morning (22:00–7:00)
Fig. 1. The number of JAL outbound flight departures from Narita International Airport over one week.

Fig. 2. Distribution of flight hours of JAL international outbound (A) and return (B) flights.
flights accounted for 36% of the distribution in Fig. 4. Thus, it was considered that FA often had to work in a time zone in which human biological condition would not be suitable for active behavior or to cope with stress.

Daily return flights were also analyzed regarding departure times from foreign cities for layover and arrival times at Narita (Fig. 5). As there is often a time difference between these cities and Japan, the desynchronization and subsequent resynchronization process of biological circadian rhythms are bound to occur among FA during layover, even though the period of the layover is not long enough to complete resynchronization in many cities having a large time difference from Japan.

Workers' biological time at take-off was then estimated following the hypothesis that adaptation of the workers' circadian system to the new time zone will be accomplished by phase advance in response to eastbound transmeridian flights and by phase delay in response to westbound flights. If time zone shifts of
Fig. 5. The number of JAL return flight departures from foreign cities over one week, expressed in local standard times of the cities (A) and in Japanese Standard Time (JST) (B).

Fig. 6. The number of estimated biological hours of FA upon JAL return flight departures, calculated according to Sasaki and Tsuzuki (1985).
more than 3 hr occurred, the biological clock time was calculated following Sasaki and Tsuzuki (1985), and its distribution was studied in long nonstop daily flights. It was found that the biological clock time was midnight or early morning of JST at take-off of the return flight (Fig. 6), when show-up time would be very early in the morning in some cases. Thus, as to time zone of FAs' work, problems similar to those for outbound flights were considered to occur on return flights.

In return flights departing the American continent, the flight hours are longer than in outbound ones from Japan, being 9 or more hours in 37% of all flights (Fig. 2B). The time difference between JST and FAs' biological clock was also estimated on the supposition that resynchronization with the local times of cities for layover will continue during the return flight until landing at Narita airport. The difference was estimated to be 4 or 5 hours at Narita arrival if flights were returning from New York or western Europe. This suggested that a new resynchronization process with JST would inevitably occur during holidays in Japan. By trial estimation calculated on the basis of the above-mentioned supposition, however, three holidays after such flights were suspected to be insufficient, because 2.5 days for FA after New York flights and 4.0 days after western Europe lines would be needed to resynchronize the human biological clock with JST with a difference of less than 2 hrs.

In conclusion, FA working hours are frequently very long, and distributed over broad time zone embracing midnight and early morning, when any FA would be chronobiologically more susceptible to work stress than in daytime.

Fatigue on international flights

Changes in the fatigue symptoms of FA during long international flights were surveyed. Two hundred and eleven JAL female FA were asked to volunteer to take part in this survey when assigned to daily nonstop flights between Tokyo and New York (with a flight time of about 12–14 hr), Chicago (11–13 hr), London/Pari (12–13 hr), and Sydney (9 hr) in 1987. The subjects were asked to rate fatigue on a scale of 5: 1 (not tired), 2 (slightly tired), 3 (tired), 4 (very tired) and 5 (completely exhausted), at 9 time points from pre-flight through post-flight of the outbound and return flights on four consecutive days on duty. The ratings of 4 (very tired) or 5 (completely exhausted) were regarded as a positive complaint of severe fatigue. Complaint rates of FA abruptly increased after the second meal service (the seventh time point), which corresponds to 7–10 hr after taking off (Fig. 7). Differences in complaint rates among flights were suspected to be caused by factors such as the length of the flight and midnight hours, and in the case of return flights, the magnitude of the time difference from JST and the possibility for getting a good rest during the layover.

Working hours and fatigue on domestic flights

As a general rule, FA work repeatedly on a consecutive schedule of nine days
Fig. 7. Changes in complaint rates of severe fatigue in long nonstop JAL international outbound (A) and return overseas flights (B), checked at nine points with intervals of about 1.5 or 2 hours: just before show-up (1), after take-off and no-smoking sign turned off (2), after the first meal service (3), after FA meal and before rest (4), at the change of rest shift (5), before the second meal service (6), after the second meal service (7), just before landing (8) and at the end of work (9).

in the following order: three days on duty, two holidays, three days on duty, and one holiday on domestic flights, with the exception of FA in an air service company (ANK) where duty lasted four days. The earliest departure was 6:45 a.m. and the latest was 8:50 p.m. Female FA (n=3,111) on 4 Japanese airlines (JAL, ANA, JAS and ANK) domestic flights were surveyed in 1987 and 1988. They were asked to log daily showing up and debriefing times and fatigue symptoms during a series of three or four days on duty; 1,317 (42.3%) valid responses were then analyzed. The questionnaire to evaluate fatigue drawn up by the Sangyo Hirou
Kenkyukai in Japan Association of Industrial Health (1970) was used.
The distributions of show-up and debriefing hours are shown in Fig. 8. Early show-up hours at 8 a.m. or earlier accounted for more than 40% of the figure, and that of late debriefing at 8 p.m. or later made up one-third of the same. This was suspected to have adverse effects on FA health conditions. Since showing up early tended to be frequent on the first day of the consecutive work days and late debriefing was frequent on the last day, rest hours on holidays tended to be decreased, which would be unfavorable for FA health conditions and quality of working life. Another factor suspected to increase work stress was the fact that time zone of their work was not uniform and changed irregularly day by day.

The complaint rate of fatigue symptoms increased correspondingly with the working hours elapsed, especially on days with long flights or portal-to-portal hours. Landing frequency was also considered to contribute to the increase of the complaint rate (KANEKO et al., 1990). By multiple regression analysis, flight
Table 1. Results of multiple regression analyses of fatigue symptoms among domestic flight attendants in four Japanese airlines. Dependent variable was the daily increase in the number of total fatigue complaints ($R^2=0.4155, n=1,317$).

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Partial regression coefficients</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>0.0218</td>
</tr>
<tr>
<td>Order of workdays</td>
<td>0.5269*</td>
</tr>
<tr>
<td>Debriefing hours</td>
<td>0.4425***</td>
</tr>
<tr>
<td>Rest interval between workdays</td>
<td>-0.1477***</td>
</tr>
<tr>
<td>Flight hours</td>
<td>1.2793***</td>
</tr>
<tr>
<td>Landings per day</td>
<td>0.8477***</td>
</tr>
<tr>
<td>Constant</td>
<td>-8.2455***</td>
</tr>
</tbody>
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Statistical significance: *$p<0.05$, **$p<0.01$, ***$p<0.001$.

Table 1 shows that working hours or portal-to-portal hours, landing frequency, the order of the day among a series of days on duty, debriefing hours and the time intervals between debriefing on the previous day and showing up were considered to be significant factors in the daily increase in the number of total fatigue complaints ($R^2=0.4155$) (Table 1).

Summary

There have been some reports concerning high complaint rates of fatigue or fatigue-related symptoms including lower back pain in flight attendants (FA). Thus, the relations of working conditions with work stress and fatigue symptoms were studied chiefly by focusing on working hours. From analysis of the time-table and fatigue symptoms of workers on international flights, it was suspected that there were some work-related factors jointly causing serious FA fatigue symptoms; night time and early morning work, long flight hours and a large time difference, thus disturbing their biological rhythms. On domestic flights, showing up early in the morning and debriefing late in the night were often observed together with a highly irregular FA time schedule. By statistical analyses, some factors including long working hours, frequent landing and late debriefing hours were considered to contribute significantly to the high fatigue complaint rates. Thus, it should be emphasized that many countermeasures are necessary to improve FA working conditions including working hours, rest on the airplane (Ono et al., 1990) and sleep during layover, in order to reduce their work stress and fatigue symptoms.

REFERENCES


