

Shift Workers Health Consequences

Salma Ummul¹ and Kameswara Rao K²

¹Post Doctoral Fellow, Department of Environmental Sciences, Andhra University, Visakhapatnam, India

²Department of Environmental Sciences, Andhra University, Visakhapatnam-530003, Andhra Pradesh, India

E-mail: ¹usalma7@yahoo.com

Shift work has become a routine feature in industries, transportation, hospitals and many other essential sectors (Gupta et al, 1997) and the numbers of shift workers are increasing every year. However, schedules of rotating shift work timing (activity) away from the customary clock will eventually do upset the human circadian clock and causes internal desynchronization, thereby leading to health problems and several clinical complications. Therefore, it is desirable to become vigilant so that the quality of life and the state of health do not deteriorate among shift workers.

According to the International Labour Office, shift work is defined as a method of work organization under which groups or crews of workers succeed each other at the same work station to perform the same operations each crew working a certain schedule or shift so that the undertaking can operate longer than the stipulated weekly hours for any worker.

According to the Bureau of Labour Statistics, the most common shift work professions include:

- a) Production, transportation and material moving (mechanics and repairers, construction worked machine operators, truck drivers, assemblers, inspectors and equipment cleaners);
- b) Technical/sales/administrative support);
- c) Managerial/professional (executives, computer scientists, government staff and other executives of public service sectors);
- d) Other services (health care support, food, cleaning personal, and private household);
- e) Protective services (emergency medical services workers, police and fire fighters);
- f) Defence Sector.

In India, very meager work has been done in shift workers from chronobiological point of view. Work of this nature is of considerable significance to India, especially because the number of shift workers is likely to go up and if shift work posed a threat to health of the workers it would become a problem of national importance.

In view of the above, the present work entitled “Shift workers health consequences” has been contemplated with the following objectives:

1. To understand the occupational health problems among shift staff of different age groups with varying service experience;
2. To identify the different health disorders or diseases associated with the shift staff and the incidences of these health problems;
3. To assess the different types of stress associated with the shift work and understand the impacts on health;
4. To evaluate the present shift pattern with special reference to their impacts on health and to suggest the optimal pattern.

The study was carried out during June 2006 to February 2009. The staff of E.Co. Division of the Indian Railways, who are working on shift duties constituted the main target group of the study. Their shift pattern mostly included rotational shift work. The employees included mostly were Running staff members who mostly work all the shifts according to their turn. The Employees with Shift duties mostly belonged to the following five types: (1) Loco Pilots; (2) Train Guards; (3) Train Ticket Examiners; (4) Office Staff; (5) Technicians. The selection of the employees for the study was random and was based on their proportional distribution. At the second level, the age-sex groups within the each employee type was considered.

METHODOLOGY

The study followed “*Syndrome Approach*” to realize the objectives of the study, by adopting a combination of the methods of obtaining data on the study respondents. The focus of the study being the health problems associated with the shift work, sampling was carried out by selecting the employees.

The selection of the employees for the study was random. Based on the proportional distribution of the 5 types of employees, and based on their distribution in the

Visakhapatnam division, the proportion of the samples for each type was determined.

The **Standard Shift Work Index** developed by the Shift work Research Team MRC/ERSC Social and Applied Psychology Unit was used in the present study with few modifications to suit the local conditions. This Shift Work Index is a questionnaire which aims to identify the shift schedules, sleep habits, eating patterns if any psychological effects for an initial survey of the health which might be expected to increase or decrease the effects on health.

RESULTS

The employees were approached for their consent to take part in the study exercise and only those who volunteered to participate were finally interviewed and questionnaire schedules were given. A total of 384 employees were approached, and 300 have obliged to participate in the study. Information from the respondents was obtained *Personalized Interview, Workplace Environment, structured questionnaire*. 42% of the respondents have filled the questionnaires on their own, while the remaining have sought for assistance at various degrees. Their shift pattern mostly included rotational shift work. The employees included mostly were Running staff members who mostly work all the shifts according to their turn. The Employees with Shift duties mostly belonged to the following five types:

1. **Loco Pilots:** Train drivers, their assistants, and other staff associated with the Driver of the running train.
2. **Train Guards**
3. **Train Ticket Examiners**
4. **Office Staff:** working in various support offices of the railways, belonging to all cadres;
5. **Technicians:** working as technical staff attending to the technical maintenance of the trains, stations, tracks etc. belonging to all cadres.

The sample subjects of the study consisted of 300 permanent employees of shift workers who were respondents to a questionnaire, all working in the railways in different shift patterns. Similarly, the distribution different age-sex groups in the each employee type were arbitrarily determined from the records of the E.Co. Rly. The total sample of 300 was distributed accordingly.

The population was stratified in to the four Age groups: AG-1: between 20 and 30 years of age; AG-2: between 31 and 40 years of age; AG-3: between 41 and 50 years of age; and AG-4: 51 years or above.

Information from the respondents was obtained in **four stages**:

The **I Stage** begins with the *Personalized Interview* with the employee. In this stage, the employee was appraised for the purpose of the study and through a structured interview, the

employees perception on the shift work and its effects on the health, family, performance, social well being and leaves on medical grounds during the past two years and other information on the health and stresses were obtained;

After the interview, in the **II Stage**, *observations on the Workplace Environment* was carried out. Observation of work process and work environment conducted in different shifts over a period of 8 months. The researcher was assigned to observe, the change of workers from one shift to another, work organization, and programme of the shift system. An observation of the working environment was also conducted to assess ergonomical conditions of the workstations, rest rooms, cafeteria / lunch room, toilets and bathrooms, safety and security. The main domains of the observation were cleanliness, ventilation, and lighting.

In the **III Stage**, information is obtained through a *structured questionnaire* that is filled by the respondent and provides detailed information on different aspects as delineated here under.

The **First Part** of the questionnaire provides information on the employee, his/her socio-economic profile, family details, education and other details like food habits, other habits, etc.

To classify smokers, respondents were asked the number of cigarettes they smoked before and after starting shiftwork. Respondents were identified as having increased smoking if they had been increasing the number of packs after starting shiftwork.

To measure alcohol consumption, respondents were asked the number of drinks they had before and after starting shiftwork. A drink was defined as one bottle of beer.

The **Second Part** identifies to which type of shift pattern the employee belongs and the nature of duties, work load etc. The identification of sleep habits according to which is being worked early, late or night or if on a rest day, extent to which sleep is disturbed depending on which shift he has been or is about to work. To estimate working hours, respondents were asked about jobs they had over the previous years. They were asked their usual weekly working hours and the start and end timings for each shift.

Respondents who reported working anything but a regular daytime shift were coded as shift workers (including evening shift, night shift, rotating shift, and split shift, irregular / on-call schedule or other). Individuals were classified as working standard hours if, on average they worked 35 to 40 hours per week, and as working long hours if, on average, they worked 41 or more hours.

Physical activity was assessed by questions on the frequency of vigorous exercise or leisure time physical activity that lasted more than 15 minutes covering a wide range of activities (and scored as the number of days per week in which any such activity was performed). Respondents rated the

frequency of consumption of meat, animal fat, sweets / starch, vegetables, fruit, salt, dairy products, eggs and fish.

The **Third Part** of the questionnaire evaluated the physical health status of the employee. The physical health questionnaire was specifically constructed for the initial survey as the standardized health questionnaire subjects are asked to rate how frequently they experience symptoms such as digestive difficulties, respiratory problems, heart palpitations etc. A question relating to weight loss and weight gain has been included.

The Canadian guidelines for healthy weights use Body Mass Index (BMI) to determine an acceptable range of healthy weights and to identify conditions of excess weight and underweight. BMI is calculated by dividing weight in kilograms by height in meters squared.

Four weight categories are identified based on BMI

Underweight : (BMI less than 20)

Acceptable weight : (20-24.9)

Some excess weight : (25-27)

Overweight : (>27)

These guidelines are recommended for everyone aged 20 to 64 years, excluding pregnant women. The BMI scale is intended to be used as a “continuum” where the risk of developing health problems increases with shifts away from the “generally acceptable range.” Rapid changes within and between BMI categories should be considered as important indicators of potential problems.

The **Fourth Part** of the questionnaire deals with the specific questions in which the respondent try to rank different stress indicators related to sleeplessness, fatigue, anxiety, anger, depression and mental states and their frequency as they perceive.

The **Fifth Part** deals with the General and Specific health problems, doctors consulted, treatment or medication taken, ailments during the past two years, and other information related to the health and family health. Two general screening questions are included in the 4th and 5th parts, concerning stress felt, diseases suffered, and medicine consumption since starting shift work and before, where in the respondent can compare the two stages.

The questionnaires were completed at the running rooms when drivers were off duty and/or at DYD stations or in their house when they were in Head Quarters. Respondents came from the division of the E.co. Railway for which the Headquarters’ is Bhubaneswar. Every effort is made to collect the in-depth health information directly from the randomly selected individuals.

In the **IV Stage**, after the questionnaire is recorded, analyzed and documented, formal meeting with respondent and his/her family members/ friends are held very informally so as to

understand if any, qualitative or intangible effects/stresses/information, if any is not stated in the questionnaire and also to understand the family and friends perception on the stress feeling by the respondent. The IV stage is only to validate the information collected on the respondent.

DESCRIPTION OF THE SAMPLE DISTRIBUTION:

The sample selected for the present study is described here under. The distribution of the different age-sex groups in the sample reflected their proportional distribution among the railway employees of Visakhapatnam division. About 3-5% of the population was selected as samples that constitute 300 individuals.

DISTRIBUTION OF AGE GROUPS:

The population was stratified in to four Age groups, with an interval of 10 years, as shown in **Table 1**:

Table 1: Distribution of Age Groups

No.	Age Group Name	Age in Years	Number Sampled
1.	AG-1	Up to 30	120
2.	AG-2	31 to 40	99
3.	AG-3	41 to 50	56
4.	AG-4	51 and above	25

About 40% (120) of the individuals were in AG-1, while AG-2, AG-3, and AG-4 account for 33% (99), 18.67% (56) and 8.33% (25), respectively (**Fig.1**). The average age of the AG-1 was at 25.5 years; similarly, the average ages for the AG-2, AG-3, and AG-4 were at 36.8 years, 44.4 years and 54.9 years, respectively.



Fig. 1: Age-Sex Groups distribution of the SW Sample

GENDER DISTRIBUTION:

On the whole, about 228 (76%) of the individuals were Men; and 72 (24%) were women. Among different age groups, the

gender composition varied and the women’s ratio has declined in the higher age groups. (Table 2).

Table 2: Gender Distribution of the respondents

S. No.	Gender	AG-1		AG-2		AG-3		AG-4		TOTAL	
		N	%	N	%	N	%	N	%	N	%
1	Men	67	29.39	87	38.16	53	23.25	21	9.21	228	76
2	Women	53	73.61	12	16.67	3	4.17	4	5.56	72	24
3	Total	120	40.00	99	33.00	56	18.67	25	8.33	300	

Of the total individuals in AG-1, Men constituted 55.83% and women account for 44.17%; In AG-2, Men constituted 87.88% and women account for 12.12%; In AG-3, Men constituted 94.64% and women account for 5.36%; In AG-4, Men constituted 84% and women account for 16%. The distribution of the men and women in different age groups is illustrated in Fig. 1 showing their actual numbers.

DISTRIBUTION OF EMPLOYEES TYPES:

Of the 300 individuals examined in the study, Drivers (Loco Pilots) accounted for 41.33%; Train Guards have accounted for 7% and the TTEs have accounted for 6.67%. Thus, Travel mode shift employees altogether constitute 55% of the total individuals examined. Stationary employees i.e. Technicians and Office accounted for 22.67% and 22.33%, respectively (Fig. 2).

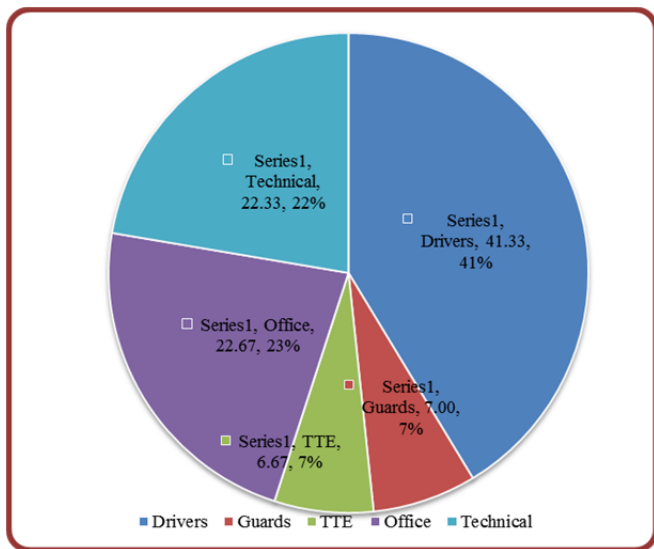


Fig. 2: Employees types distribution in the sample

By gender, among the Loco Pilots (LP), Guards (GD), TTEs, Office staff (OS) and Technicians (TN) women account for 3.23%, 4.76%, 65%, 64.7% and 14.9%, respectively. The distribution of the employee types in to different age-sex groups was presented in Table 3.

Women’s presence in different employee types in the sample reveals that their numbers is very low in LP and GD types. Of

the total 72 women in the sample, 5.56% were LPs, 1.39% were GDs, 18.06% were TTEs, 61.11% were OS, and 13.89% were TNs (Fig. 3).

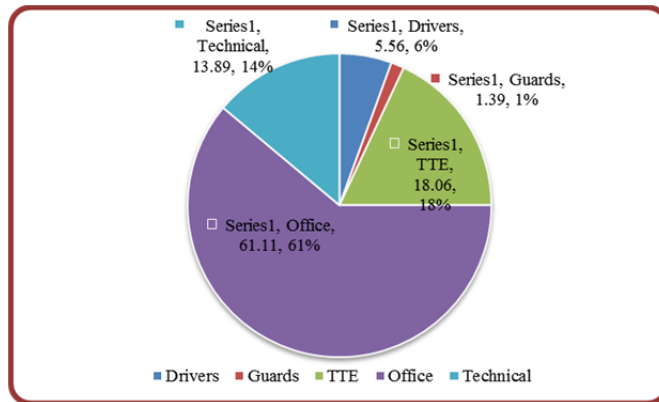


Fig. 3: Womens representation in the Employee Types

By Age groups, LPs have more or less equal representation in the AG-1 and AG-2 groups with 38.71% and 37.90%, respectively. However, the older age groups were represented by lower numbers and account for 17.74% by AG-3 and 5.65% by AG-4. (Fig.4). Among the GDs, maximum numbers (52.38%) were in AG-1, while there was no representation from AG-2, AG-3 and AG-4 had equal representation with 23.81% each (Fig.4). Among the TTEs, also maximum representation was by AG-1 with 60%, followed by AG-2 with 25% representation, while AG-3 and AG-4 were with 5% and 10% representation, respectively (Fig. 4).

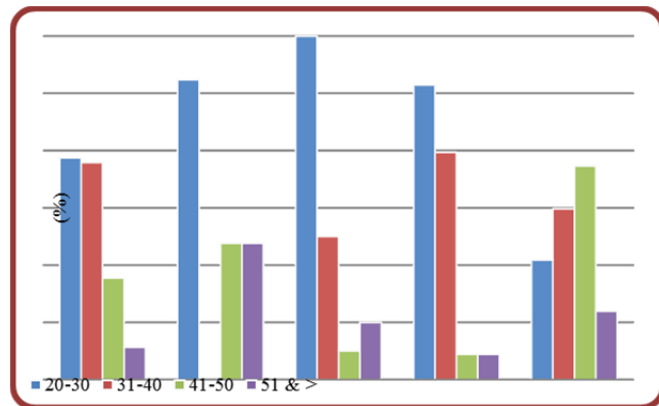


Fig. 4: Frequency of different Age groups within Employee Types

Table 3: Distribution of Employees Types

S. No.	Employee Types	AG-1		AG-2		AG-3		AG-4		TOTAL	
		N	%	N	%	N	%	N	%	N	%
LOCO PILOTS											
1	Men	4	91.6	4	100	2	100	7	100	12	96.
		4	7	7	2	2	0	77			

2	Women	4	8.33	0	0	0	0	0	0	4	3.23
3	Total	48	38.71	47	37.90	22	17.74	7	5.65		124
TRAIN GUARDS											
1	Men	10	90.91	0	0	5	100	5	100	20	95.24
2	Women	1	9.09	0	0	0	0	0	0	1	4.76
3	Total	11	52.38	0	0	5	23.81	5	23.81		21
TRAIN TICKET EXAMINERS											
1	Men	1	8.33	4	80.00	0	0	2	100	7	35.00
2	Women	11	91.67	1	20.00	1	100	0	0	13	65.00
3	Total	12	60.00	5	25.00	1	5.00	2	10.00		20
OFFICE STAFF											
1	Men	5	14.29	18	66.67	1	33.33	0	0	24	35.29
2	Women	30	85.71	9	33.33	2	66.67	3	100	44	64.71
3	Total	35	51.43	27	39.71	3	4.41	3	4.41		68
TECHNICAL STAFF											
1	Men	7	50.00	18	90.00	2	100	7	87.50	57	85.07
2	Women	7	50.00	20	10.00	0	0	1	12.50	10	14.93
3	Total	14	20.90	20	29.85	2	37.31	8	11.94		67

A similar trend of maximum representation in the AG-1 followed by the AG-2 was recorded in case of the OS type also. The AG-1 and AG-2 had representation by 51.47% and 39.71%, respectively, while the AG-3 and AG-4 were represented by 4.41% each. Among the TN type, relatively more even type of distribution was observed and AG-1 had a representation of 20.90%, while in case of AG-2, AG-3 and AG-4 were represented by 29.85%, 37.31% and 11.94%, respectively.

CONCLUSION

In India, the adversaries being faced by the shift workers have not received much attention from the researchers and required a systematic documentation of the studies on the impacts of the altered biological rhythms on the health, social and domestic well being of the workers, along with the public safety. In view of this dearth, the present study is contemplated and focuses on the Railway shift workers, perhaps the largest group under a single employer in India.

To survive and remain healthy, the human body has to keep a balance between different processes within the organism (Ader et al 1990; Anisman et al, 1996; and Mason, 1959). This regulation involves many systems that interact on various

levels (Ader et al, 1995; Besedovsky and del Rey, 1999) and have evolved intricate processes to keep the different systems within certain boundaries. These, so called, "homeostatic systems" are vital and allows the individual to retain a physiological and behavioral stability despite environmental fluctuations (Mc Ewen, 1998). Furthermore, the homeostatic systems are regulated by several endogenous biological rhythms.

Although shiftwork has frequently been shown to have detrimental effects on the health of employees, it is becoming increasingly prevalent in contemporary life (Harma 1998; Smith et al, 1999.). Various studies (Schor 1991; Tarumi et al, 1992; Harrington 1994; Morimoto 1994; Maruyama et al, 1995; Maruyama and Morimoto, 1996; Spurgeon et al, 1997; Sparks et al, 1997) have reported that long hours of work are one of the possible risk factors, which may cause health defects in employees working in varying shift schedules of time.

Physiological disruptions are some of the major problems for the shift workers. Shift work has been shown to develop impaired metabolism and impaired tolerance or response to medications (Philips et al, 1991). Rutenfranz and co-workers have concluded that "Perhaps the most important physiological problem regarding shift work particularly, shift work which includes night work, is the problem of the resynchronization of physiological functions after a phase shift of working and sleeping times (Rutenfranz et al, 1977). The poorly adapted night workers suffers from a potentially progressive state of chronic fatigue, which may be manifest in episodes of irritability, loss of drive, depression, loss of appetite, constipation and other disturbances (Pheasant, 1991).

As the study reveals alarming situation of the lower age groups being affected mostly, and the railways being one of the vital sectors that need to ensure safety of not only their employees, but also the public, their customers, at large, a review of the shift pattern in terms of work load and distribution compatible to the biological clock.

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