CHAPTER
5

Summary, Conclusion and Recommendations
5.1. Summary

The work included in this thesis entitled, "Sleep Behavior and Psychosocial Problems in Shift Workers" has been divided into five chapters.

- **Chapter-01** contains a mini review of literature on studies on Shift work research as one of the applied areas studied under the domain of 'Chronobiology'. It also includes hypotheses and objectives of the studies.
- **Chapter-02** aims at evaluating the Morningness-Eveningness preferences and circadian type personality dimensions in Shift Workers working in different organizations.
- **Chapter-03** includes the study of Job Satisfaction Social Satisfaction/Disruption and Anxiety (cognitive somatic) in Shift Workers.
- **Chapter-04** includes studies aimed at examining the impact of shift pattern on Sleep behavior in permanent night workers, regular rotational and irregular rotational shift workers. It also includes data on nap analysis of those shift workers.
- **Chapter-05** (this chapter) contains the summary of the doctoral dissertation.

**Chapter-01 – Introduction and a Mini Review:**

Homo sapiens have been evolved as a diurnal species, which habitually sleep at night and stay awake or work during the day; therefore, engaging in shift work is believed to result in a mismatch between our internal bodily rhythms and the external time cues that entrain the circadian rhythms. This may therefore result in the sleep of the shift worker being shifted to a time of day that is not appropriate for sleep (Åkerstedt and Gillberg, 1981). In particular, shift workers are required to stay awake when their rhythms are preparing them for sleep, and to sleep when preparing for wakefulness. Therefore, sleep problems among shift workers has been raised as an important issue by the Chronobiologists. Different rhythms are known to adjust at different rates; though there is considerable debate concerning the degree to which full adjustment is likely to take place. It is well known that shift work causes adverse physiological, psychological and behavioural problems that may eventually interfere with the sleep, performance, social satisfaction and job satisfaction (Dijk et al., 1992; Presser, 2000; Shield, 2002; Demerouti et al., 2004). Fatigue, anxiety, clinical
complications have also been reported as one of the major problems among shift workers (Dawson and Fletcher, 2001, Pati and Chandrawanshi, 2001, Pasqua and Moreno, 2003). Further, it has been reported that taking nap during the night shift has various impacts on workers (Matsumoto et al., 1982; Sakai and Kogi, 1986; Matsumoto and Morita, 1987; Matsumoto and Harada, 1994; Saito and Sasaki, 1996). This nap minimizes the disruption to the circadian rhythm when taken near the nadir of the circadian rhythm, or help in recovery from the fatigue caused by the night shift. Recently wrist actigraphy is used to study the effect of shift work on sleep parameters (Park et al., 2000; Seo et al., 2000, 2005; Pilcher and Coplen, 2000; Moreno et al., 2003). Sleep profile in shift workers has been adequately studied, but in very few cases the wrist actigraphy technique has been used. Although there are several studies on sleep behaviour of shift workers, they are mostly based on questionnaires. Subjective assessment of sleep behaviour has been studied in Indian shift workers (Gupta and Pati, 1993a, b, c; Gupta and Pati, 1994a, b; Gupta et al., 1997; Chandrawanshi and Pati, 2000; Pati, 2001; Pati et al., 2001; Parganiha and Pati, 2005). Surprisingly, there has not been a single report on objective assessment of sleep problems of Indian shift workers. The objective assessment of sleep behaviour has not yet been carried out on Indian population of shift workers. Therefore, the present study has been designed to investigate sleep profile in shift workers by using wrist actigraphy. The main objectives of the present Ph. D. dissertation were:

1. To study the impact of different types of shift system on flexibility of sleeping habits and languardness and morningness eveningness preference in shift workers;
2. To study the impact of work place difference on job satisfaction, anxiety (both cognitive and somatic), social & domestic satisfaction and disruption of shift workers; and
3. To study various sleep and nap parameters, such as sleep efficiency (SE), time in bed (TIB), assumed sleep (AS), actual sleep time (AST), actual wake time (AWT), fragmentation index (FI), frequency of naps (NF), total time spent napping (TN), average nap length (AN), and the total time spent napping per 1-hour awake (TN/A) of shift workers as function of types of shift rotation adopted by different organizations.
Chapter-02 – Morningness-Eveningness and Circadian Type Personality in Shift Workers:

The impact of different types of shift system on morningness eveningness preference, flexibility of sleeping habits, languidness in shift workers was studied. Three hundred forty-eight (348) male subjects consisting of 93 rotating shift workers (RS) and 59 general shift workers (GS) from Raipur Alloys, 111 permanent night workers (PNS) in four different Newspaper offices and 85 irregular rotational shift workers (IRS) from CSEB participated in this study voluntarily. Raipur Alloys and CSEB adopted a three-shift system characterized by rotation from night (22:00-06:00) to afternoon (14:00-22:00) and to morning shift (06:00-14:00). Although, the irregular shift workers do not follow the rotation pattern strictly, regular rotational shift workers follow it strictly. Where as workers of Newspaper offices worked permanently on night shift. However the onset and duration of night shift in the later varied between offices and within the office depending upon the type of job. All subjects also responded to the morningness-eveningness questionnaire (Horne and Östberg’s MEQ) for the determination of their chronotype. In addition, all subjects responded to the modified Hindi version of Standard Shift work Index (SSI) that consisted of a set of inventories designed for comparing the effects of different types of shift systems. Data were stored in the form of records and analyzed with the help of chi-square, descriptive statistics, regression and correlation methods. The average MEQ score put all shift workers in the category of morning type (MT), irrespective of the actual frequency distribution of chronotype. However, PNS scored more towards the lower limit of MT scale. They were more flexible for sleep habits and languid than the GS and the RS. In contrast, IRS were low flexible and moderate languid for sleep habits.

Chapter-03 – Job Satisfaction, Social Satisfaction / Disruption and Anxiety (Cognitive & Somatic) in Shift Workers:

In the present study, an attempt was made to study the impact of work place difference on job satisfaction, social/domestic situation (satisfaction or disruption) of rotating shift workers (RS), general shift workers (GS), permanent night workers (PNS) and irregular rotational shift workers (IRS). All subjects completed a copy of the standard shift work index, which is a set of inventories designed for comparing the effects of different types of shift system. It includes measurement of job satisfaction,
social/domestic satisfaction/disruption and anxiety. In addition they also responded on morningness-eveningness questionnaire. Data were stored in the form of records and analyzed with the help of chi-square, descriptive statistics, regression and correlation methods. Results clearly indicate a statistically significant difference between rotating and permanent night shift workers for at least two measures, namely satisfaction and social/domestic satisfaction/disruption. It was revealed that the rotating shift workers (Raipur Alloys) were more satisfied with their job as compared to the permanent night workers (Newspaper offices) and irregular rotational shift workers. The situation was exactly reverse in respect of social/domestic situation satisfaction/disruption. In addition, the cognitive anxiety level was also higher in PNS as compared to the GS and the RS. However, near about 50% of the IRS shift workers were low jobs satisfied and less socially satisfied and other 50% were moderately job satisfied and moderately socially satisfied. The percentage of highly socially disrupted subjects, cognitive anxiety score was also higher in IRS shift workers as compared to PNS, RS and GS. In addition, age showed significant correlation with job satisfaction score, irrespective of schedules.

Chapter-04 – Sleep behavior in Different Shift Schedule / Patterns / System / Organization:

In this study sleep-wake parameters, such as sleep efficiency (SE), sleep latency (SL), time in bed (TIB), assumed sleep (AS), actual sleep time (AST), actual wake time (AWT), sleep bouts (SB), wake bouts (WB), fragmentation index (FI) were studied in 74 shift workers consisting of 20 from Chhattisgarh State Electricity Board (CSEB), 14 from Raipur Alloys (Sponge Iron manufacturer) and 20 from Newspaper offices and 20 day workers with the help of Actiwatch (AW64, Mini Mitter Co. Inc., USA). In addition, attempts were made to study the nap behavior among the shift workers. Data were analyzed with the help of Actiware sleep software, ANOVA, Duncan’s multiple-range test and t-test. Results clearly demonstrated that in RSW and IRS shift workers during the night shift several sleep parameters, such as time in bed, assumed sleep and actual sleep time decreased significantly \((p<0.05)\) as compared to those on morning and afternoon shifts. The frequency of nap and total nap duration in RSW shift workers was higher during night shift as compared to that of the morning shift and night shift. Further their sleep latency, duration and fragmentation index was significantly \((p<0.05)\) higher than those of the day workers. Sleep parameters
were compared between shift workers of Raipur alloys and CSEB while they were on morning, afternoon and night shifts. Results depicted that in comparison to IRS shift workers the RSW shift workers exhibited lower time in bed, had low assumed sleep, actual sleep and actual wake durations time, experienced less sleep bouts and wake bouts during the night shift. When comparison of sleep behavior was made among the permanent night workers and day workers, the PNW workers exhibited significantly lower time in bed, assumed sleep, actual wake time, sleep bouts, wake bouts, nap frequency, total nap duration, average nap duration and total nap per one hour awake durations as compared to day workers.

5.2. Conclusion

In conclusion, irregular rotational shift workers were found to have poor shift-work coping abilities. They were less flexible, moderate languid for sleep habits, moderately socially satisfied and higher cognitive anxiety score. They obtain minimum amount of sleep during the night shift. Further, the rotating shift schedule seems to be responsible for the impairment of feelings of social/domestic discount among the investigated RSW shift workers of Raipur Alloys. These might force shift workers to face negative health consequences in future. Results of this study conclusively demonstrate that the permanent night workers differed from rotating shift workers for at least two measures, namely job satisfaction and social/domestic situation. The distribution of chronotype, observed in the present study, is independent of shift system and that the PNW are more flexible in their sleeping habits, languid and exhibit more cognitive anxiety as compared with the GSW and the RSW. Further, sleep behavior and nap behavior are influenced by work type, shift and organizations. In general, the average actual sleep time was drastically less in shift workers, irrespective of work schedules. Although a majority of shift workers did not suffer from any clinical problems, the chronic sleep debt observed specially during night shift workers seems to be extremely alarming. It seems therefore that Night shift could be detrimental for the shift workers of CSEB, RA and Press.
5.3. Recommendations

Shift work often leads to chronic partial sleep loss in subjects on rotational shift and permanent night duties. This has been recognized as a major health issue in industrialized countries. However, in India, sleep research in this direction is in infancy. Therefore shift work sleep research should be more promoted in Indian shift workers. On the basis of these results attempts should be made to implement specific counter measures to minimize ill effects on sleep physiology and psychology of rotational shift work, irregular rotational shift work and permanent night work.