Night shift workers

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The International Labour Organization defines working in shifts as:

“a method of organization of working time in which workers succeed one another at the workplace so that the establishment can operate longer than the hours of work of individual workers.”

In the scientific literature, the term “shiftwork” generally includes any arrangement of daily working hours other than the standard daylight hours (7/8 am – 5/6 pm).

Synonyms: irregular, odd, flexible, variable, unusual, non-standard working hours.
Definition of night work

- Night work is “all work which is performed during a period of not less than seven consecutive hours, including the interval from midnight to 5am”.

- Night worker is “an employed person whose work requires performance of a substantial number of hours of night work which exceeds a specified limit, fixed by the competent authority” (C171 Night Work Convention, ILO, 1990)
“Normal hours of work for night workers should not exceed eight in any 24-hour period in which they perform night work…. The normal hours of work of night workers should generally be less on average than and, in any case, not exceed on average those of workers performing the same work to the same requirements by day in the branch of activity or the undertaking concerned….

Where shift work involves night work:

a) in no case should two consecutive fulltime shifts be performed, except in cases of force majeure or of actual or imminent accident;

b) a rest period of at least 11 hours between two shifts should be guaranteed as far as is possible.”

R178 Night Work Recommendation, ILO, 1990
Prevalence of evening and night work by group of country in Europe in 2005
(4th EU Survey on working conditions)
Prevalence of evening and night work by work sector in Europe in 2005
(4th EU Survey on working conditions)
Factors that can affect tolerance to shiftwork and night work

- **Family and living conditions**: Marital status, Number and age of children, Partner’s (shift)work, Housing conditions, Family attitudes, Incomes

- **Individual characteristics**: Age, Gender, Circadian structure, Personality and behaviours, Sleep strategies, State of health

- **Social conditions**: Shiftwork tradition, Community organization, Social involvement, Social support, Commuting, Public services

- **Working conditions**: Compensative measures, Monetary compensation, Work organization, Job satisfaction, Work load, Counselling

- **Working hours**: Shift schedules, Timetables, Overtime, Amount of night work, Flexible times arrangement

Disturbance of the circadian system due to **light at night** with alteration of the sleep–activity pattern leading to potential melatonin suppression and circadian gene alterations.

**Sleep deprivation** that results from the need to sleep when it is not readily possible and misaligned with the surrounding active daytime social environment.
Cortisol and melatonin level cycles

Influence of daylight on the human body

Pathogenesis

- Genes that are responsible for maintaining circadian rhythms have been identified and may function as transcriptional factors and regulate expression of genes in cancer-related pathways, such as cell cycle, DNA repair, and apoptosis.

- Exposure to artificial light during the night has been demonstrated to disrupt circadian gene expression in mice and humans, which in turn, may alter circadian-regulated biological pathways (e.g., knockout of the circadian Period gene, Per2, promotes tumour development).
Pathogenesis

- Melatonin is a direct and indirect immunostimulant; its suppression leads to a state of immunodeficiency that is aggravated by the pronounced effects of sleep deprivation upon the immune system.
- The decrease in endogenous melatonin may lead to diminished free radical scavenging that may induce local tissue damage.
- Prolactin, a strong immunostimulant, is decreased during sleep deprivation.
- Changes in the immune system have been shown to occur in partial (early or late night) sleep deprivation and comprise changes in the cytokine pattern that favours the Th2 group of cytokines and decreases Th1 cytokines (e.g. interferon γ) which act in cellular immune defence and in immune surveillance to counteract tumour growth.
Pathogenesis

The evidence in support of shiftwork-induced carcinogenesis thus links events at the cellular level that affect cell proliferation and endocrine changes with hormonal constellations that promote endocrine-dependent cancers with defects in the immune surveillance that enhance tumour development and growth.
The main indications for the design of better shift systems according to ergonomic criteria are:

» Quickly rotating shift systems are better than slowly rotating ones.

» Clockwise rotation (morning/afternoon/night) is preferable to counterclockwise (afternoon/morning/night).

» Early starts for the morning shift should be avoided.

» Prolonged work shifts (9–12 hour) should only be considered when the workload is suitable, there are adequate breaks, and the shift system is designed to minimize accumulation of fatigue and exposure to toxic substances.

» Shift systems should be regular and able to guarantee as many free weekends as possible.

Knauth, 1996; Knauth and Hornberger, 2003; Wedderburn, 1994
Permanent night work can be acceptable only for particular working situations which require a complete adjustment to night work to guarantee the highest levels of safety. Be aware that such complete adjustment requires people to maintain the inverted sleep/wake cycle also on rest days and to avoid exposure to bright light after night shifts (i.e. wearing dark sun glasses while commuting home).

Adequate time off between shifts should be allowed to compensate for fatigue and sleep as quickly as possible (i.e. two shifts in the same day must be avoided), and rest days should come preferably after the night duty period to allow prompt recovery from sleep deficit and an easier return to the normal sleep/wake cycle.

Some flexibility in working times is desirable to give the workers the possibility of combining better work duties with family and social life.

Knauth, 1996; Knauth and Hornberger, 2003; Wedderburn, 1994
Conclusion

- There is *limited evidence* in humans for the carcinogenicity of shiftwork that involves night work.
- There is *sufficient evidence* in experimental animals for the carcinogenicity of light during the daily dark period (biological night).
- Shiftwork that involves circadian disruption is *probably carcinogenic to humans* (*Group 2A*).