



Individual Differences in Shift Work Tolerance

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# INDIVIDUAL DIFFERENCES IN SHIFT WORK TOLERANCE

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## Summary

### *Chapter 1*

An introduction is given on the central theme: 'Individual differences in shift work tolerance', as expressed in a personal blog of a shift worker.

Shift work is a key feature of our contemporary 24/7 society, employing several successive work teams to sustain around-the-clock operations. However, numerous studies imply that frequently shifting the periods of sleep and wakefulness poses a serious threat to the shift worker's physical, mental and psychosocial health. One of the major issues related to the adverse consequences of shift work concerns the impact of inter-individual differences. Some workers tolerate shift work well, whereas others develop symptoms of chronic illness.

The aim of this thesis is to investigate shift work tolerance, focused on inter-individual variability in response to shift work and the search for potential baseline predictors, using both cross-sectional and longitudinal data.

### *Chapter 2*

This chapter describes the first cross-sectional study of Dutch police officers (N = 740), and was set out to examine how subjective shift work tolerance relates to general health variables, and to examine inter-individual differences in the nature of this relation. A newly constructed questionnaire covered seven health-related domains: sleep quality, sleep duration, need for recovery, fatigue, physical health, mental health and work-life balance. Shift work tolerance appeared to be primarily related to sleep quality, need for recovery, fatigue and work-life balance. This study highlights the central role of sleep for tolerance to shift work and underlines the need for occupational medicine to take explicit account of sleep.

### *Chapter 3*

In the second cross-sectional study, the aim was to investigate individual factors in relation to subjective health and sleep variables, used as indicators for (in)tolerance of shift work. Another group of shift workers were examined: croupiers of the Dutch casino (N = 315). The results show the person-specific factors flexibility of sleeping habits and vigorousness to be the main factors related to subjective health, emotional stability and sleep.

### *Chapter 4*

A longitudinal field study of novice police officers (N = 26) was carried out to examine prospectively whether diurnal sleep parameters after commencing shift work could be predicted by individual sleep characteristics at baseline. With the use of wrist actigraphy and sleep diaries, nocturnal sleep was measured at baseline (before commencing shift work) and inter-individual differences in daytime sleep after night shifts were examined during two follow-up sessions, after approximately four and twelve months of shift work exposure.

Daytime total sleep time showed a 66-minute decline during the first year of shift work exposure. Systematic inter-individual differences were observed for daytime total sleep time and subjective sleep quality. Although no predictors were found for daytime total sleep time, the subjective quality of nighttime sleep before the onset of shift work predicted 40% of the variance in the subjective quality of daytime sleep after commencing shift work.

### ***Chapter 5***

The objective of this chapter is to evaluate the development of individual stress responses to commencing shift work. A longitudinal field study of young novice police officers (N = 25) was performed, including a baseline session and three follow-up sessions about 4, 14 and 20 months of shift work exposure. Inter-individual differences were measured by repeated assessments of the cortisol awakening response, as a prime index of shift work tolerance. Results showed that in the interval between about four and 14 months after transitioning from regular day work to rotating shift work, mean values began to rise from baseline to significantly higher levels at about 14 months after commencing shift work. Visual inspection of the individual trends revealed that a subgroup of 10 subjects followed a monotonically rising trend, whereas another 14 subjects reverted to a smaller, baseline level cortisol response at about 20 months after the start of shift work. If the initial increase in the cortisol response marks the development of a chronic stress response, the subsequent reversal to baseline levels in the subgroup might be indicative of a process of recovery, possibly the development of shift work tolerance.

### ***Chapter 6***

In continuation of chapter 4, this chapter examines inter-individual differences in sleep responses within the first two years of shift work exposure, using data of all three follow-up sessions (N = 42). Moreover, to search for potential baseline predictors thereof. Wrist actigraphy and sleep diaries were used to study nocturnal sleep at baseline and inter-individual differences in daytime sleep after night shifts during the three follow-up sessions. Overall systematic inter-individual differences were found for daytime total sleep time and subjective sleep quality. Flexibility of sleeping habits and subjective quality of nighttime sleep prior to shift work were found to be predictors of subjective quality of daytime sleep. These results suggest that it may be possible to detect and even predict sleep deficiencies in response to shift work early on, which could be a basis for the development of individualized interventions to improve shift work tolerance.

### ***Chapter 7***

This final chapter discusses issues that have been raised in previous chapters, such as the main findings in the light of earlier research, strengths and limitations, closing with practical implications. In conclusion, this thesis presents one of the few longitudinal studies with inclusion of baseline measurements, allowing for causality. To our knowledge this research is the first to present data of the effects of shift work exposure both subjectively as well as objectively in novice shift workers, and may contribute to identifying 'vulnerable' shift workers. For future research it is worthwhile pursuing the long-term development of the (in)tolerance of shift workers.