# The Effects of Age and Shiftwork on Perceived Sleep Problems

## *Results From the VISAT Combined Longitudinal and Cross-sectional Study*

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**Objective:** With workforces in industrialized countries getting older, the study examined how shiftworking affects sleep in later life. **Method:** Longitudinal data were collected in 1996, 2001, and 2006 from a large sample of employees who were 32, 42, 52, and 62 years old in 1996. **Results:** Effects of shiftwork were most apparent in middle-aged participants, becoming less apparent in later years when people tended to leave shiftwork. Nevertheless, a group of younger former shiftworkers reported more sleep problems than those who had never worked shifts. Giving up shiftwork offset a trend for sleep problems to accumulate over time, with the net result of no change in sleep problems after cessation of shiftwork. **Conclusions:** Poor sleep quality is a temporary consequence of shiftwork for some, whereas for others it is a cause of shiftwork intolerance.

Sleep disturbances are one of the most frequent complaints of rotating shiftworkers and those working on other shift systems that interfere with the normal timing of sleep. Numerous cross-sectional studies have indicated that shiftworkers normally report more sleep problems than dayworkers.[1] Similarly, studies that have distinguished between past and current shiftwork experience have observed more sleep disturbances in former shiftworkers than in people who have never worked shifts.[2–4] There have been, nevertheless, very few longitudinal studies in this area that have examined either the build up of sleep problems over time or their potential amelioration after exit from shiftwork.

In their pioneering study in this area, Verhaegen et al[5–7] observed a small group of new young shiftworkers over a number of years but failed to include measures of sleep disturbance. Nevertheless, they found that fatigue increased as early as 6 months after starting shiftwork and continued to do so up to 7 years, after which it leveled off. They also found sleep duration to decrease in a subsample in which it was measured. This reduced sleep duration was confirmed in another longitudinal study in this area by Radošević-Vidaček et al,[8] in which a small, but significant decrease in overall sleep duration after 5.5 years of exposure to shiftwork was found (from 7.9 hours after 1.5 years of exposure to 7.6 hours after 5.5 years). Nevertheless, this decrease was largely due to reduced sleep duration on the afternoon shift, and the study failed to find any effect of shiftwork exposure on perceived sleep quality. Unfortunately, neither of these earlier longitudinal studies included a control group of nonshiftworkers, and hence the modest effects they did find were totally confounded with potential ageing effects.

More recently, Åkerstedt et al[9] reported a longitudinal study of a large sample of a working population, and examined the effects of entering or quitting shiftwork between two measurement points separated by 5 years. Those entering shiftwork during this period showed an increased likelihood of difficulties falling asleep, but no other adverse consequences. In contrast, those quitting shiftwork showed a reduced likelihood not only of difficulties falling asleep, but also of feeling not well rested, awakening prematurely, and nodding off at work. This pattern of findings suggests that, at least for some measures, the build up of sleep problems with experience of shiftwork may be rather slower than their dissipation after quitting shiftwork. Nevertheless, although this study controlled for potential ageing affects, it failed to examine the potential combined effects of shiftwork and age on perceived sleep disturbances.

The finding that former shiftworkers report more sleep problems than those who have never worked shifts[2–4] could be interpreted as reflecting long-lasting detrimental effects of shiftwork, which would be at odds with the findings of Åkerstedt et al.[9] There is thus considerable uncertainty as to how long such effects last, and whether they depend on age and shiftwork experience. An alternative interpretation of persistent detrimental effects might be that people who quit shiftwork are more likely to be people who perceive their sleep quality as poor or are less able to tolerate the sleep impairments associated with shiftwork. There appears to be, nevertheless, a lack of information available to decide between these interpretations.

The present study attempts to address these issues by observing large groups of workers over long periods of time using data from the VISAT study. VISAT is a French prospective study examining how working conditions and age interact to influence a wide range of health resources, including sleep quality and cognitive efficiency.[10] We are thus able to examine sleep complaints at a given point in time and to compare them with data previously recorded concerning both the workers' initial sleep quality and their experience of shiftwork between baseline and follow-up. As far as we are aware, no previous study has examined sleep complaints using longitudinal data from different age cohorts and has been able to distinguish between former shiftworkers, current shiftworkers, and workers who have never worked on shift. The primary aim of the present study was to examine how shiftworking affects sleep in later life and to determine whether poor sleep quality persists after giving up shiftwork.

## METHOD

### Participants

The data were taken from the cross-sectional and longitudinal phases of the VISAT study (for further details on the methodology and aims of this study, see Marquié et al[11]). The initial sample comprised 3237 present and former wage earners born in 1964, 1954, 1944, or 1934. They were exactly 32, 42, 52, and 62 years old at the time of the first data collection (1996, T1). A total of 83% of the participants born in 1934 was retirees. Participants were randomly drawn from the patient list of 94 occupational physicians in three southern regions of France, who volunteered for VISAT. The participation rate was 76%. More than two-thirds of participants ($n$ = 2288; 70.68%) were seen again at the first follow-up (T2)

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5 years later (2001). The second follow-up (T3) took place in 2006 and examined 1308 participants (40.40%), including 51 participants who were not seen at T2.

At each measurement occasion, the participants were asked four questions to determine whether they were on some form of shift system, (more than 50 days per year), with three possible responses, namely: "yes, currently" (now), "not now, but yes in the past" (past), or "never" (never). The questions were (i) whether they were rotating shiftworkers, whether their work schedule (ii) did not allow them to go to bed before midnight, (iii) resulted in their having to get up before 5 AM, or (iv) prevented them sleeping during the night. In the present article those who answered "yes currently" or "in the past" to any of these questions were considered to be working, or to have previously been working, on some form of shift system and are referred to as "shiftworkers" or "former shiftworkers" from hereon.

## Materials

The materials for the present study included self-reported information about past and current work conditions and sleep quality. It was part of a broader set of data recorded at baseline, first, and second follow-up through clinical measures and questionnaires.

Sleep quality was assessed by asking the participants to rate on a 4-point scale (never, seldom, sometimes, often) the frequency in the last month, of five symptoms associated with sleep problems, as follows: (1) difficulty falling asleep, (2) difficulty maintaining sleep, (3) difficulty getting back to sleep, (4) premature awakening, and (5) hypnotic medication use. These items were the same as those used in the previous sleep-related VISAT cross-sectional study,[11] and the same or quite similar to numerous earlier studies on perceived sleep problems (eg, Kecklund & Akerstedt[12]). The Cronbach $\alpha$ computed from these items revealed high internal consistency ($\alpha = .74$, .75, and .75 at baseline, first, and second follow-up, respectively).

## Procedure and Data Analysis

Data were collected during the yearly medical examination, which formed part of the health screening program that took place within the employing organizations. The mean interval between the T1 and T2 data collections was 61.57 months ($SE \pm 0.08$), and between the T2 and T3 data collections was 59.84 ($SE \pm 0.12$). Questionnaires were self-administered but validated in a face-to-face interview. Retired workers, who were no longer monitored by the occupational physicians, were invited specially for the purpose of the study. Data were analyzed using analysis of variances (ANOVAs) and post hoc analyses were employed using the Bonferroni correction where appropriate. Unless otherwise specified, age values used in the result and discussion sections refer to age at baseline.

# RESULTS

## Current and Former Shiftworkers Versus Nonshiftworkers

Among the participants who were seen on all three occasions there were 625 participants (339 women) who had never done shiftwork ("nonshiftworkers") and 621 participants (256 women) who were currently working on, or had previously worked on, some form of shift system at T3 ("shiftworkers"). The distribution of current and former shiftworkers at each measurement occasion is illustrated in Fig. 1. An overall ANOVA was conducted that examined the between-subject factors of "Shiftwork Experience" (2 levels; shiftworkers vs nonshiftworkers) and "Cohort" (ie, 4 levels; 32, 42, 52, or 62 years old at T1), and the within-subject factors of "Measurement Occasion" (3 levels; T1, T2, and T3) and "Symptom" (5 levels; difficulty falling asleep, difficulty maintaining sleep, difficulty getting back to sleep, premature awakening, and hypnotic medication use). This indicated that there were significant interactions between Shiftwork Experience and Cohort ($F [3,1238] = 3.285$, $P < 0.05$; see Fig. 2) and Shiftwork Experience and Symptom ($F [4,4952] = 5.10$, $P < 0.001$), but no higher order interactions involving Shiftwork Experience. Both interactions were explored by analyses of simple effects. Analysis of the first interaction indicated that there was only an effect of Shiftwork Experience in the cohort that was 42 years old at T1 ($F [1,1241] = 6.42$, $P < 0.05$), with the shiftworkers more likely to report sleep problems than nonshiftworkers, as indicated by their overall sleep problem score (ie, the average of the five symptom scores; shiftworkers, $M = 2.38$, SE $\pm$ 0.04; nonshiftworkers, $M = 2.24$, SE $\pm$ 0.04). Analysis of the second interaction indicated that shiftworkers and nonshiftworkers only differed in their response to the measure of premature awakening ($F [1,1238] = 8.11$, $P < 0.01$) with shiftworkers more likely to report the problem than nonshiftworkers (shiftworkers, $M = 2.48$, SE $\pm$ 0.04; nonshiftworkers, $M = 2.34$, SE $\pm$ 0.03).

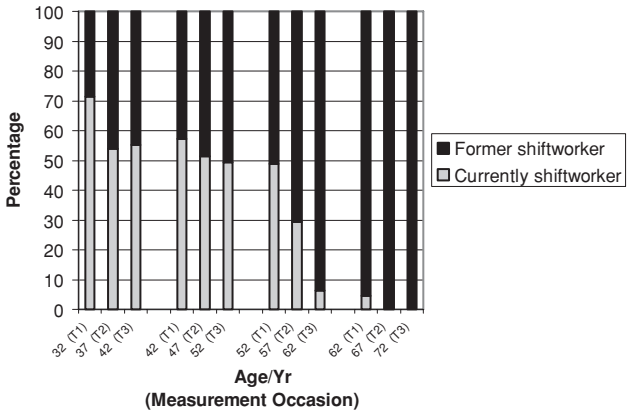


**FIGURE 1.** The distribution of former and current shiftworkers in each cohort on each Measurement Occasion.

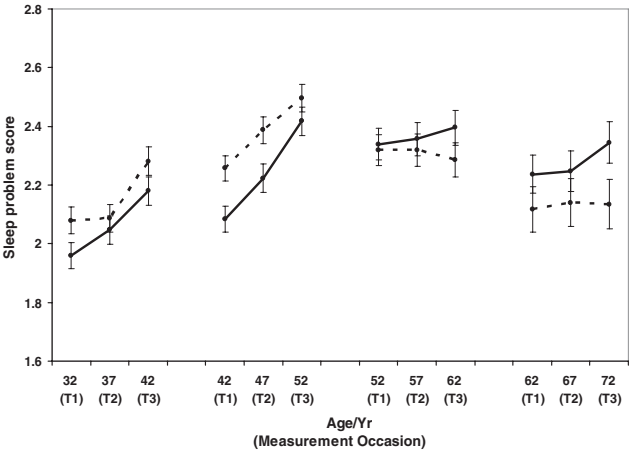


**FIGURE 2.** Sleep problem scores (averaged over the five symptom scores) as a function of Shiftwork Experience, Cohort, and Measurement Occasion. Dashed lines represent current and former shiftworkers and solid lines represent nonshiftworkers. Error bars are SEMs.

## Current Shiftworkers Versus Former Shiftworkers Versus Nonshiftworkers

The second set of analyses built on the findings of the first analysis by seeking to differentiate between current and former

 

shiftworkers. This required conducting separate analyses for each measurement occasion. Because of the very small number of participants working shifts after the age of 60 years, the analyses were restricted to comparing the younger three cohorts (those aged 32, 42, and 52 years at T1) on the first and second measurement occasion.

An overall ANOVA was conducted for data collected at T1 with between-subjects factors "Cohort" (3 levels: 32, 42, and 52 years of age at T1) and "Shiftwork Experience" (3 levels, past, now, or never). The within-subject factor was "Symptom" (5 levels, as earlier). There was a main effect of Shiftwork Experience ($F [2,2752] = 8.29$, $P < 0.001$), with post hoc pairwise comparisons indicating that the "never" group ($M = 2.14$, SE $\pm$ 0.02) had significantly lower overall sleep problem scores than other two groups ("past": $M = 2.25$, SE $\pm$ 0.03; "now": $M = 2.22$, SE $\pm$ 0.02). The interaction between Shiftwork Experience and Cohort was marginally nonsignificant ($F [4,2752] = 2.02$, $P < 0.09$; see Fig. 3). Simple main effects analysis indicated that there were significant effects of Shiftwork Experience in the younger two cohorts (32 years old at T1, $F [2,2754] = 19.24$, $P < 0.001$; 42 years old at T1, $F [2,2754] = 8.39$, $P < 0.001$) but not in the older cohort (52 years old at T1).

There was also an interaction between Shiftwork Experience and Symptom ($F [8,1108] = 5.02$, $P < 0.001$). Simple main effects analysis indicated that there were significant effects of Shiftwork Experience for 4 of the 5 sleep problem symptoms (with the exception of difficulty getting back to sleep), with nonshiftworkers being less likely to report symptoms in each case. In keeping with the earlier finding, the largest effect was in the measure of premature awakening ($F [2,2752] = 16.75$, $P < 0.001$. Current shiftworkers $M = 2.59$, SE $\pm$ 0.04; former shiftworkers $M = 2.50$, SE $\pm$ 0.05; and nonshiftworkers $M = 2.33$, SE $\pm$ 0.03).

Similar trends were observed in the analysis of data collected at T2. There was a main effect of Shiftwork Experience ($F [2,1941] = 4.13$, $P < 0.05$), with post hoc pairwise comparisons indicating that the never group ($M = 2.22$, SE $\pm$ 0.02) had significantly lower scores than other two groups (past: $M = 2.30$, SE $\pm$ 0.03; now: $M = 2.34$, SE $\pm$ 0.03). There was an interaction between Shiftwork Experience and Cohort ($F [4,1941] = 2.48$, $P < 0.05$), with simple effects analysis indicating significant effects of Shiftwork Experience in the younger two cohorts (32 years old at T1, $F [2,1943] = 7.98$, $P < 0.001$; 42 years old at T1, $F [2,1943] = 3.29$, $P < 0.05$) but not in the older cohort (52 years old at T1). Also, as at T1, there was an interaction between Shiftwork Experience and Symptom ($F [8,1764] = 5.42$, $P < 0.001$). In this case, however, simple main effects analysis indicated that there was only a significant effect of Shiftwork Experience in the measure of premature awakening ($F [2,1941] = 8.36$, $P < 0.001$. Current shiftworkers $M = 2.641$, SE $\pm$ 0.05; former shiftworkers $M = 2.56$, SE $\pm$ 0.05; and nonshiftworkers $M = 2.41$, SE $\pm$ 0.03).

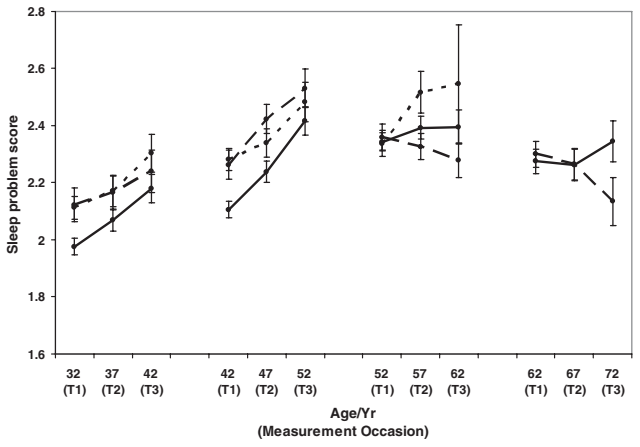


**FIGURE 3.** Sleep problem scores (averaged over the five symptom scores) as a function of Shiftwork Experience, Cohort, and Measurement Occasion. Short-dashed lines represent current shiftworkers, long-dashed lines represent former shiftworkers, and solid lines represent nonshiftworkers. Error bars are SEMs. (Note that although participants in the oldest cohort were excluded from the analyses, their mean scores are illustrated for comparison purposes.)

## The Impact of Giving Up Shiftwork on Sleep Problems

The third set of analyses compared three groups of participants who had been seen on the first two occasions (T1 and T2), defined in terms of their shiftwork experience, as follows: those who had never been engaged in any form of shiftwork at T2 ("never"); those who were working shifts at T1 and were still working the same form of shiftwork at T2 ("continued"); and those who had been working shifts at T1 but had stopped shiftwork between T1 and T2 ("stopped"). Because of the very small number of participants working shifts after the age of 60 years, the analyses were restricted to comparing the younger three cohorts (those aged 32, 42, and 52 years at T1).

An overall ANOVA was conducted that examined the between-subjects factors "Shiftwork Experience" (3 levels; never, continued, and stopped) and "Cohort" (3 levels; as earlier) and the two within-subjects factors "Sleep Problem" (5 levels; as earlier) and "Measurement Occasion" (2 levels; T1 and T2). There was no main effect of Shiftwork Experience but there was a 2-way interaction between Status and Measurement Occasion ($F [2,1319] = 3.57$, $P < 0.05$; see Fig. 4). There were no higher order interactions involving Shiftwork Experience and Measurement Occasion. Simple main effects analysis was used to examine the effect of Measurement Occasion on overall sleep problem score (averaged over the five symptom scores) for each of the three Shiftwork Experience groups. There were significant effects of Measurement Occasion in the analysis of the never group ($F [1,1325] = 36.12$, $P < 0.001$) and in the analysis of the continued group ($F [1,1325] = 6.44$, $P < 0.05$), but not in the analysis of the stopped group. From inspection of Fig. 4 it can be seen that although sleep problems increase between T1 and T2 for the never and continued groups, they remain unchanged for the stopped group.

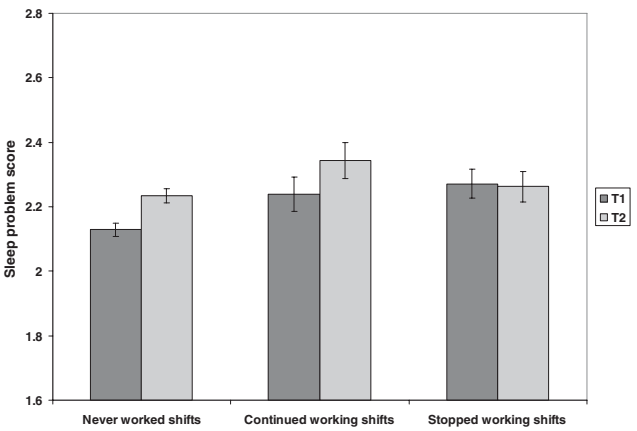


**FIGURE 4.** Sleep problem scores (averaged over the five symptom scores) as a function of Shiftwork Experience and Measurement Occasion. Error bars are SEMs.

## DISCUSSION

Our initial comparison of current and former shiftworkers ("shiftworkers") with those who had never worked shifts ("nonshiftworkers") confirmed previous findings that the shiftworkers tend to experience greater problems sleeping. It also provided evidence, for the first time, that premature awakening is a particular problem for shiftworkers. The effect of shiftwork experience appeared to be greatest among those in their 40s, with only the second cohort (42 years old at T1) showing a significant difference. The disappearance of the effect in older workers coincided with the reduction in the proportion of shiftworkers currently working shifts (see Fig. 1). This suggests that effect of shiftworking reduced as participants left shiftwork (ie, when they transferred to dayworking or retired), and that the effects of shiftwork did not subsequently persist.

The second and third analyses found that former shiftworkers in the younger two cohorts (32 and 42 years old at T1) reported significantly poorer sleep than those who had never worked shifts. This was despite the fact that neither group worked shifts at the time the measurements were taken. Moreover, the former shiftworkers in these two cohorts were reporting the same level of sleep problems as their currently shiftworking counterparts (the latter group could be expected to have poor sleep due to the nature of their work schedule). This suggests that participants who left shiftwork early in their working lives continued to have worse sleep than those who had never worked shifts. This may have been the effect of shiftwork persisting after they had left shiftwork. Nevertheless, the idea that sleep disruption persists after stopping shiftwork is not supported when considering the trends observed in the older cohort (52 years old at T1). The difference between former shiftworkers and those who had never worked shifts disappeared in this cohort, indicating that the effects of shiftwork on sleep did not persist in this group of exshiftworkers.

An alternative explanation of the poorer sleep reported by younger exshiftworkers is that, compared with the older cohort, they were poorer sleepers when they entered shiftwork or that they were especially vulnerable to the disruptive effects of shiftwork on sleep. It may be that as a consequence of these difficulties early in their shiftworking career, they could not tolerate shiftwork and so gave it up quite quickly. The reason for the difference between the younger and older cohorts may be that people who stay in shiftwork until relatively late in their working lives are more tolerant of shiftwork, that is, they do not suffer such negative effects on their sleep. For them, the transfer from shiftwork to daywork later in working life is more likely to be part of the normal process of career progression. They are less likely to be compelled by severe sleep problems to leave shiftwork early, in the way that the younger exshiftworkers perhaps were.

The above explanation, if correct, is an example of the "healthy shiftworker effect"[13] operating within the older cohort. The healthy shiftworker effect is the tendency for research to underestimate the impact of shiftwork because it is based on self-selected groups of shiftwork-tolerant participants, that is, people who have remained in shiftwork because they exhibit specific sleep behaviors that facilitate coping with odd work hours. In the current study, it seems that while the older exshiftworkers did not continue to experience poor sleep after giving up shiftwork, this may be due, at least in part, to the fact that they were a self-selected group—a "survivor population."

The final analysis also addressed the issue of persistence of the effect of shiftwork by examining the effects of transferring from shiftwork to daywork between two successive measurement occasions. Participants who left shiftwork between T1 and T2 showed no change in sleep problems, whereas those whose work schedule status remained unchanged (ie, as shiftworkers or as nonshiftworkers) showed a significant increase. At first glance this might suggest that sleep problems in the former group persisted after stopping shiftwork. However, the trends in the other two groups indicate a general tendency for sleep problems to increase over the 5 years between T1 and T2; a trend that was absent in the group who left shiftwork. Hence, perhaps the most plausible explanation is that the effects of shiftwork did not persist in those who stopped. Rather, it seems that the beneficial effects of giving up shiftwork offset the general tendency for sleep problems to accumulate over time, as observed in the other two groups.

Shiftwork is associated with range of health complaints, some of which may be linked to sleep problems. In particular, impaired sleep among shiftworkers may be linked to the greater prevalence of mental health problems such as anxiety and depression.[14] Nevertheless, we found no evidence that the current pattern of results could be explained in terms of higher incidence of depression or other psychological disorders (analysis not reported here). Incidence of sleep-disordered breathing was not measured in the current study. Nevertheless, the limited evidence that is available regarding the link between shiftwork and sleep-disordered breathing suggests that it mainly affects older shiftworkers,[15] which would not account for the greater sleep disturbance observed among the younger cohorts in the current study. Finally, while sleep disturbances and habits can vary significantly between men and women,[16] gender differences were not examined in the current study as this variable was confounded by occupation (and hence shift patterns, etc) within the sample, as noted elsewhere.[17]

In summary, the current data showed that the effects of shiftwork were most prevalent in middle-aged participants (42–52 years old), that is, before the age at which many people began to leave shiftwork for daywork or retirement. This is not to say that older shiftworkers were not affected by their work schedule, but rather that relatively few in the current sample stayed in shiftwork until late middle age or retirement. In later life, after leaving shiftwork, sleep problems were no worse for the former shiftworkers than they were for those who had never worked shifts. The apparent lack of effects of shiftwork in the later lives of the current sample can be explained, at least partly, by the healthy shiftworker effect (ie, the trends are observed in a survivor population). It is also partly explained by the effects of giving up shiftwork, which served to offset the (possibly age-related) accumulation of sleep problems. The findings suggest that, so long as shiftworkers are able to leave shiftwork (ie, by transferring to daywork or by retiring) if they find the effects on their sleep and wellbeing intolerable, and so long as they are not required to remain in shiftwork beyond middle age (approximately 52 years old), there is a relatively low likelihood of the effects of shiftwork on sleep persisting after they have left shiftwork. Although poor sleep quality seemed to have been a temporary consequence of shiftwork for those individuals who remained in shiftwork until middle age, for those who left shiftwork earlier in their working lives, poor sleep quality appears to have been a cause of their shiftwork intolerance.

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