

Fatigue in Medical Residents - Lessons to be learned

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KEY WORDS

Medical residency; sleep disorders; motor vehicle accidents

SUMMARY

Background: *Fatigue among medical residents is a well-known and widely discussed phenomenon that has generated much debate.* **Objective:** *We wanted to evaluate self-reported fatigue and sleep deprivation, as well as some of the major consequences that have been identified in the period after the medical residents' strike in 2000.* **Design:** *A cross sectional study.* **Participants:** *Seventy-six medical residents at Soroka university medical centre, who were asked to answer a questionnaire about their personal lives and fatigue level.* **Data and results:** *The average work-week was 68.1±12.4 hours. Residents reported 6.0±1.3 hours of sleep per night on a regular day and an average of 1.1±0.5 hours during a 24-hour on-call shift. The ESS score was 11.5±5.4 points. The number of hours worked per week correlated significantly with the ESS score. Of the residents who drove after a night shift, 29.3% reported falling asleep at least once while driving, and 13.9% of drivers reported that they were involved in a motor vehicle accident.* **Conclusions:** *In view of these results, we express a deep concern for the future of Israeli medical residents and their patients. We call upon the authorities to develop appropriate working conditions that will ensure the safety of patients and residents*

RIASSUNTO

«**Affaticamento fra medici interni israeliani: una lezione da apprendere**». **Introduzione:** *In Israele l'affaticamento fra i medici interni è un fenomeno ben noto che ha generato un ampio dibattito.* **Obiettivo:** *Lo scopo di questo studio è stato quello di valutare l'affaticamento e la privazione del sonno autoriferiti, nonché alcune delle principali conseguenze di tali fattori.* **Metodi:** *È stato effettuato uno studio trasversale in cui 76 medici del Centro Medico Universitario di Soroka, Israele, sono stati invitati a rispondere ad un questionario sulle abitudini di vita e sul livello di affaticamento.* **Risultati:** *I medici lavoravano una media di 68.1±12.4 ore settimanali; i medici hanno riferito di dormire 6.0±1.3 ore per notte in un giorno normale e una media di 1.1±0.5 ore durante un turno di guardia della durata di 24 ore. Il punteggio ESS era di 11.5±5.4 punti. Il numero di ore lavorate settimanalmente era correlato in modo significativo con il punteggio ESS. Fra i medici che guidavano l'automobile dopo un turno notturno, il 29.3% ha riferito di addormentarsi almeno una volta durante la guida ed il 13,9% ha riferito di essere stato coinvolto in un incidente stradale.* **Conclusioni:** *I risultati di questo studio ci inducono ad esprimere grande preoccupazione per il futuro dei medici interni israeliani e dei loro pazienti. Facciamo un appello alle autorità affinché elaborino un progetto per stabilire condizioni di lavoro adeguate che salvaguardino la sicurezza sia dei pazienti che dei medici.*

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INTRODUCTION

Prior to the application of the work and resting hours laws for medical residents (MRs) in the US and Europe, working in excess of 90 hours/week was not uncommon (a "normal" week of 45 hours plus 2-3 nights "on call"). Lately, some countries have recognized this situation as a major public health hazard for patients treated by MRs. This awareness has led to a significant reduction in working hours, limiting the hours worked per week to around 60 (4). Even with this dramatic reduction, the allowed number of continuous working hours is significantly longer for MRs than for pilots or commercial truck drivers in the US (1).

Of the more serious consequences relating to fatigued MRs, sleep deprivation has been the subject of many studies. Researchers have repeatedly found a negative effect on the medical profession as a whole with a significant effect on MRs, a category typified by extensive work hours (3, 9, 18). The historical reasoning for this situation is to be found in an opinion that emphasizes the need of the medical trainee to experience, first hand, the continuation of care, the natural evolution of disease and treatment interventions (19). Nevertheless, there is no argument that adequate sleep is essential for general health, physical performance and cognitive functioning. Researchers have reported a correlation between fatigue and poor performance (3, 9, 11). An extensive literature search found no data as to the optimal number of weekly work hours for MRs. It seems logical to conclude that the MR should get at least enough sleep to be efficient and effective. It is estimated that an adult should sleep 6-8 hours per night or 56 h per week (17). Individuals who are continuously sleep deprived (less than 5 hours/day) are likely to experience severe daytime sleepiness and impaired cognitive functioning, as well as being more prone to error and show a lower level of performance in manual skills (3, 9, 11). Self-reporting of sleep deprivation is common among MRs. This large body of young and eager people seems willing to accept the long working hours as the "norm" during residency. This acceptance is variously motivated, including fear of losing their job and not wanting to be per-

ceived as complainers, as well as extra pay for additional on-calls. Employers not only do not deny this situation but also seem to benefit from it, while offering little or no compensation for the extra work, sometimes merely promises of professional advancement in the future.

MRs deal with matters where mistakes could mean life-long disabilities or even death, and thus it is essential that they perform to the best of their abilities (10). In an important report from 1991, MRs attributed 45% of their own mistakes to fatigue (22). In a study dealing with medical errors, it was found that MRs made 5.6 times more diagnostic errors and 20-30% more mistakes in treatment than MRs who were not on call (10). Tired surgical MRs were found to have a lower performance rate, and made significantly more mistakes resulting in more complications (6). A recent study has linked several personal risks to sleep deprivation, such as stress, depression, somatization and pregnancy complications (14). One of the most important risks for tired MRs is involvement in Motor Vehicle Accidents (MVA). It was found that every shift added after the first five increased the risk of falling asleep while driving or stopped in traffic (20, 23).

In Israel, the issue of residents' working hours was addressed after the lengthy physicians' strike in 2000. The strike was about physicians' demand for improvement in their working conditions, but it became mainly a strike for trying to limit the amount of hours a resident is supposed to work per week. The Israeli law concerning work and resting hours for medical residents specifically indicated that an MR is allowed, and to some extent expected, to continue working after a 24-hour shift for up to 2 hours. These additional 2 hours are allowed by law for reporting to the day staff events that occurred during the on-call. But more often than not this additional time is regarded and utilized by the employers as part of the daily routine. The law refrained from determining the number of hours/week a resident is allowed to work, neither how many days off are required and needed for a resident. Thus in theory, a resident can work more than a 100 hours/week. In fact, many MRs are often requested to continue beyond the 26 hours due

to an acute and chronic shortage of MRs. This practice is contrary to the recommendations of the Israeli Ministry of Health and lacks medical liability insurance, which has acknowledged the inherent danger in this situation and has decided by law to forbid the situation and tried to enforce a mandatory sleeping period for the resident, but which could not be enforced.

The current study was carried out as a follow-up to a study reported in 1994 (12) by one of the authors (AMM), in order to evaluate self-reported fatigue in the period since the law for MRs resting hours came into force.

MATERIALS AND METHODS

Study population

Seventy-six MRs performing overnight on-calls at Soroka University Medical Center (SUMC) were recruited for the study. The residents were recruited on a voluntary basis. This sample was 30% of all of the hospital's resident population at that time. This sample included 35 MRs from the Division of Pediatrics, 22 MRs in OB/GYN, 8 surgical MRs, 6 family medicine MRs, and 4 not officially in a residency programme, and one missing. The work loads of these physicians were varied, but the residents from pediatrics, OBGYN and surgery were working about 70 hours/week (2 on call shifts and at least 3 normal work days of 8 hours a day).

Methods

The study questionnaires were distributed at the beginning of the workday, for 5 consecutive days.

Participants were asked to answer a questionnaire relating to demographics, work and sleep hours, as well as a self-assessment of their own degree of tiredness, fatigue and performance relating to post-call days of the previous month. They were also asked if they had ever been involved in a MVA as residents, if they had gained weight or smoked more from the start of their residency. In addition they were asked 8 questions adapted from the Epworth Sleepiness Scale (ESS) questionnaire (7),

rating on a scale of 0-3 their probability of falling asleep during routine activities (see Appendix 1). The ESS has been used extensively, enabling standardization of the findings and comparison with other professions (7, 8, 21).

Data gathering and statistical analysis

Data were gathered, coded and stored in an SPSS® programme (version 14, Chicago, IL). We first analyzed data utilizing descriptive statistics (mean & SD, graphs) and then by analytical statistics using parametric (paired *t*-test), and a-parametric statistics (Mann Whitney and χ^2). A multi-variate model examined the effect of specific demographic variables on MR vigilance and responses.

RESULTS

Seventy-six MRs participated in this study (40 males, 36 females). Fifty-two MRs (68.4%) were married, 65 MRs (85.5%) had an average of 1.67 (± 1.04) children; 48.7% were born in Israel, 39.5% had immigrated from the former USSR. No significant differences were noted between males and females or between medical professions in all variables surveyed. The average age of the participants was 35.5 (± 4.8) years and they had been in residency for 4.2 (± 2.7) years.

MRs reported an average of 68.1 \pm 12.4 work hours per week (range 40–100 hours, figure 1). On an average night, an MR slept 6.0 \pm 1.2 rest hours; while on duty the number of hours fell to 1.1 \pm 0.5 rest hours, with a cumulative weekly total of only 33 \pm 2.4 hours of sleep.

MRs reported working on average an additional 4 hours after the end of their on-call shift (range 1.1–7.8 hours); 90% of the MRs exceeded the maximum of 2 hours allowed. 67% of the MRs surveyed said that they were required to stay on to treat patients and to complete routine ward assignments. Twenty-three MRs (30.3%) reported that they worked part-time in another occupation after work hours.

Although only 13 MRs (17.1%) were smokers, 5 increased the quantity of cigarettes smoked during

residency. 51 MRs (67%) did not routinely engage in any physical activity, mostly overlapping with MRs reporting little or no leisure activities.

MRs evaluated that they were cognitively and medically functioning below average (2 on a scale of 0-5). When asked about the confidence level (on a scale of 0-5) of their performance and judgment at the end of a shift, the median was 2, with 75% of MRs scoring 3 or less in their confidence level (figure 3).

The average ESS score of the subjects was 11.5 ± 5.4 (figure 2). More than two-thirds of the

MRs had an ESS score greater than 9, a value considered by experts in the field of sleep medicine as indicating a high level of daytime sleepiness, which may be a symptom of numerous sleep disorders.

Fifty-four MRs (71%) reported driving a motor vehicle after an on-call shift. The rest used other means of transport. Nevertheless, 22 MRs (40.7% of drivers) reported falling asleep at least once in the past month while driving and 10 MRs (18.5%) were involved in an MVA after a shift in their residency. MRs who were involved in an MVA after an on-call shift differed significantly in the number of years in residency (5.9 vs 3.9 on average for those who were not involved in an MVA, $t=2.27$, $p=0.026$), with a borderline significance between falling asleep while driving and the number of years in residency ($t=1.93$, $p=0.057$). The only predictor enabling a significant regression model for the ESS score (which by itself is a marker of sleep disorders), was the number of weekly working hours ($R=0.296$, $F=6.51$, $p=0.013$; Figure 4). Gaining weight and residency years (reported by 32 MRs) was found to correlate significantly, but due to the small number of subjects we could not show a dependence of the ESS on weekly work hours and obesity together. The risk of being involved in a car accident after an on-call period was estimated using a logistic regression model. Weight gain, ten-

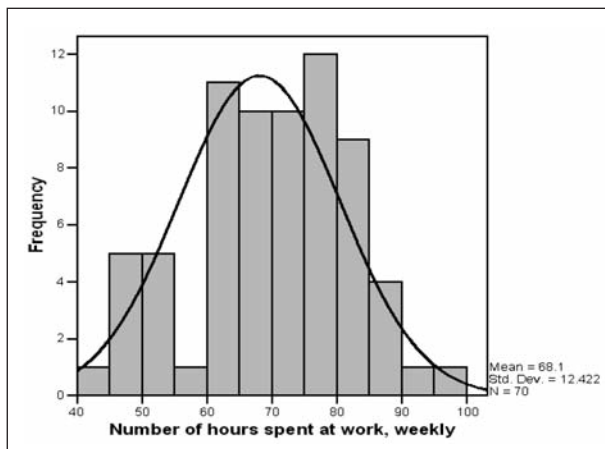


Figure 1 - Residents' weekly working hours



Figure 2 - Residents' ESS scores

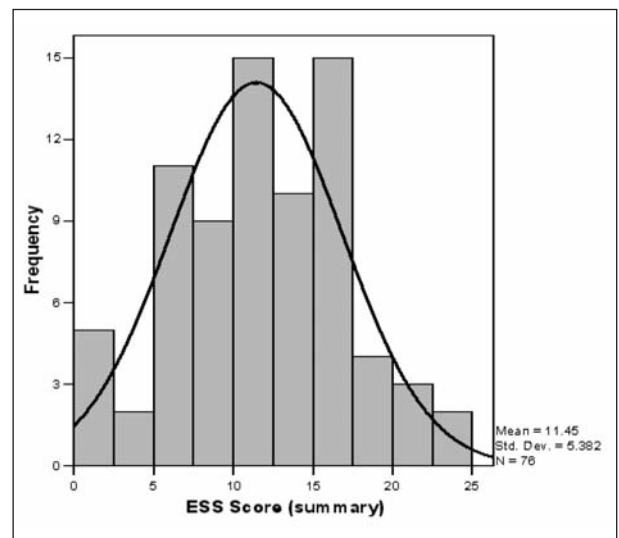


Figure 3 - Confidence level of residents at the end of an on-call shift

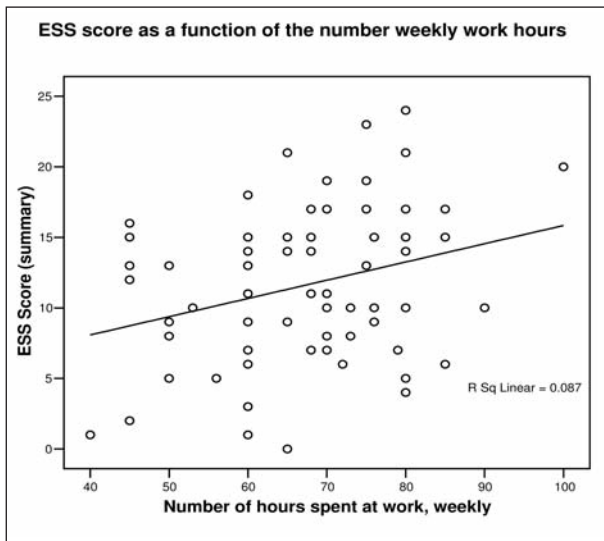


Figura 4 - Correlation between weekly work hours and ESS score

endency to fall asleep while driving, and hypertension (as was self-reported) showed a prediction accuracy of 90.1% (Model Chi-Square [df=3]=19.8 Nagelkreke's-R²=0.437).

The predictors and their significance are shown in table 1.

DISCUSSION

The aim of this study was to evaluate the effects of the current regulatory laws concerning Israeli MRs. We found that their average work-week consists of 68.1±12.4 hours, while in the European Union current legislation sets a limit of 48 hours work per week for MRs . The average sleep an MR reported during an on-call 24-h shift was only 1.1±0.5 hours (vs 6.0±1.2 hours). This striking finding emphasizes a well-known fact that for most medical residencies the on-call period is exceedingly strenuous.

More than 90% of MRs reported working in their regular workplace until about noon of the post-call day (two hours more than allowed by law). In addition to engagement in activities that they are not intended to perform, application of the law in this area is still far from optimal. As if the burden of such a hard and tiring profession were not enough, about one-third of the MRs reported that they supplement their salary by taking on extra work (not associated with their residency programme).

The mean ESS score was 11.4±5.4 with more than two-thirds of MRs scoring above 9. This figure on its own would require the evaluation of a sleep specialist (Johns 1991; Johns 1994). The ESS score correlated significantly with the weekly work hours. Post-call MRs feel that their own performances and decision making was poor, with most feeling uncomfortable with their own decisions. The MRs seemed to be suffering from this abnormal situation: most had ceased physical activity, 42% had gained weight (correlating with the years in residency), 38.5% of smokers had increased smoking and almost all had drastically reduced leisure activities. The most striking results point to the MRs' real life-threatening behaviour as drivers: 40.7% reported that they had fallen asleep while driving. 18.5% of the drivers were involved in a MVA (correlating with years in residency). A regression model found that the probability for involvement in an MVA was 7.4 times greater for MRs who reported falling asleep (95% CI 1.3--41.9), 10 times greater for MRs who gained weight (95% CI 1.4-70.4), and 15.6 times greater for MRs who had hypertension (95% CI 1.8-136.4).

The multivariate analysis identifying the relationships between MVC, reported drowsy driving, resident weight gain, and hypertension are striking and should be a warning sign for us all. The extremely high odds ratios associated with each of

Table 1 - Predictors for involvement in car accidents after an on-call shift

Significance	OR	95% CI - Lower limit	95% CI - Upper limit	Predictor
0.024	7.39	1.303	41.918	Falling asleep while driving
0.02	10.04	1.431	70.396	Gaining weight during residency
0.013	15.63	1.791	136.371	Hypertension

these predictor variables are alarming. For example, residents who reported falling asleep while driving were 7.4 times more likely to be involved in a car accident. This means that by overworking residents, we not only jeopardize their mental stability and family relations, but create a serious threat to their lives (considering the fact that one third declared they were falling asleep while driving, this is indeed a serious health problem). The even higher odds ratio for weight gain (10 times more likely) and for hypertension (15.5 times higher) could lead us to think that these are indicators of obstructive sleep apnea syndrome, that in residents has an even more deleterious effect, and thus one should consider having residents screened for this disorder.

Our results should not come as a surprise considering the vast amount of literature covering MRs' sleeping hours. Samkoff and Jacques (15) investigated residents' fatigue in the early 1990s and concluded that simple tasks requiring careful attention that are monotonous by nature, were performed in error most often in sleep deprivation conditions. Rosen et al. (13) reported that most sleep-deprived MRs were daydreaming while performing routine assignments such as writing orders or prescriptions, and interpreting lab results. Daugherty et al. (2) reported that 70% of second-year MRs experienced first-hand poor judgment calls by colleagues who were sleep deprived. They found that MRs sleeping less than 5 hours reported more accidents and injuries, more conflicts with peers, more drug and alcohol abuse, weight changes and medical errors. Almost half reported medical record forgery by peers. When trying to evaluate the situation in Israel, this important study from 1998 must be amplified several times: the average sleep time of MRs during on-calls in our study was 1.1 hours only.

An interesting study by Zohar et al. (25) examined 78 MRs, finding that sleep deprivation affected the psyche by depressing positive experiences and augmenting negative ones.

It seems that our study is in agreement with most published studies (1, 4-6, 25): sleep-deprived MRs make more mistakes in judgment and are less willing to invest in understanding the patients, not only the diseases, who are under their care. Tired MRs

are likely to be less professional and are more likely to unintentionally harm themselves. More MRs were involved in road accidents; many suffered from overweight or hypertension and an overwhelming majority reported almost no vocational and leisure time. We are witnessing a vicious cycle – overworked MR also experience disturbed sleep patterns (waking up frequently), as reported by Soderstrom et al. (16) Attrition continues to weaken the MR who is not allowed adequate recovery time prior to the next on-call shift. We believe that non-compliance with the current law causes significant damage to the frail self-esteem of young MRs. There is mounting evidence regarding how limitation of work hours may improve this situation. Gopal et al. (5) reported that the amended law in the USA significantly decreased MRs reporting attrition from 42% to 29%, without any corresponding decrease in academic performance or quality of care. Zare et al. (24) showed that the levels of self-reported emotional distress dropped significantly after the amendment of the law. One should note from this report that while a reduction from 38% to 24% in stressed MRs must be considered a significant improvement, it still stands dangerously above the average for the profession and age of repliers. An important addition to this complex puzzle was added by Lockley et al. (11) who found that by reducing the weekly work load and increasing the sleep hours, mainly on the post-call days, MRs had significantly fewer attention-derived mistakes.

We argue that the consequences of negligent application of the law might be that if we fail to reduce the mistakes caused by sleep-deprived MRs through reduction of work hours, we will, most likely, find ourselves forced to do so by malpractice law suits, insurers and public demand, with a cost much greater than anticipated. We challenge the main argument of the employers against reduction in work hours: fear that the quality and continuity of care might suffer by MRs granted fewer working hours. This claim is not supported in reports such as those by Gopal (5) and Zare (24). Due to our findings and prior studies we call for the development of appropriate working conditions. We have shown that 6-8 of sleep are considered minimal for night sleep, and newer studies show that

young adults of the same age as medical residents sleep for an average of 8.5 h per night when permitted 16h of unrestricted sleep for over a week. The target sleep requirement is therefore even higher than the previous studies suggest, making the problem of inadequate sleep even worse than initially considered.

We are aware that the number of MRs participating in this study was limited, as well as the fact that all came from the same medical centre, and that the sole use of self-reporting questionnaires without active testing measures such as actigraphs is less than optimal. However, we feel that the number of MRs was sufficient to answer the main study questions. We do believe our subjects are adequately represent the medical profession and the work strain found in other medical centres in Israel. Due to the fact this is a cross-sectional study, one cannot talk truly about cause and effect, and thus we do not know if the residency and its strains were the cause of MVAs for example (we did not ask if the accident occurred right after on call duty).

Conclusions: The results are strongly indicative of a great need for extensive studies and for the use of objective as well as subjective measures of fatigue. All of this does not lessen our call to at least strictly apply the current work laws before unwanted consequences occur.

We are highly concerned for the future of Israeli MRs. Unlike most MRs in the developed world, the average age of the Israeli MR is higher, many more are (or were) married and most have children. In addition, the low salary of the Israeli MR increases the need to engage in additional remunerative activities. This will evidently lead to more professional and personal mistakes, some with life threatening consequences (involving patients and MR alike).

This is a serious warning sign that must not be ignored. The current laws might not be limiting enough for the general wellbeing of MRs and patients alike, and it should be considered changing them by further reducing work hours, with strict enforcement of these laws by a government agency.

Conclusions: We described the results of a cross-sectional study in which residents at Soroka uni-

versity medical centre in Israel were surveyed about their fatigue, work hours, and drowsy driving experiences. Average work hours (68 per week) and sleep (6 h per night, 1.1 h per night during extended in-hospital shifts) were similar to those reported in U.S. hospitals, as was the high rate of falling asleep incidents while driving (29% of drivers) and motor vehicle accidents (14%). Worldwide, very few data have been gathered on the work hours of healthcare personnel or the risks involved. By reporting the Israeli experience, which appears similar to that in the U.S., the study provides a good demonstration that work hour policy change, to improve resident and patient safety, is probably needed not just in the U.S. and Europe, but in Israel (and perhaps elsewhere) as well. The results of our study, and similar data from around the world, led us to the conclusion that the Israeli regulations are not adequate and pose a risk to patients and residents alike. We believe that just as nurses are not allowed to work more than two 8h shifts consecutively, neither should their physicians. Due to our findings that the current law is not being strictly enforced, we believe that a firm government enforcement agency, that will survey residents' work conditions is essential or else all of the would-be benefits of such a law will shortly disappear.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED

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APPENDIX 1

Questionnaire: Fatigue in Medical Residents

1. Are you post-call: yes/no

Demographics

2. Gender m/f, Age ____

3. Birth Place _____

4. Year of immigration to Israel _____

5. Single/Married/Divorced/Other

6. Residence: town/village/kibbutz/settlement/other

7. Children yes/no

8. Number ____ Ages ____

9. If yes to question 7, who takes primary care: Both parents/Spouse/Grandparent/other

Residency

- 10. Which medical residency _____
- 11. Years of residency _____

Working hours

- 12. Estimated number of hours at hospital per week _____
- 13. Estimated number of hours at hospital post-call _____
- 14. Main occupation in post-call hours: Paperwork/blood taking/patient rounds/other
- 15. Additional jobs yes/no
- 16. If yes to 15, what nature: Clinical/Emergency services/research/other

Fatigue and sleeping hours

- 17. Average sleeping hours per night 1/4/5/6/7/8+
- 18. Average sleeping hours per on-call night 1/2/3/4/5/6+
- 19. How do you estimate your level of functioning as a physician on a post-call day vs. a regular day; on a scale of 0 to 5, with 5 being highest
- 20. To what degree are you confident of your performance and judgment on a post-call day; on a scale of 0 to 5, with 5 being highest

ESS

- 21. What is the probability of your falling asleep while performing the following tasks?

Chance	None (0)	Slight (1)	Medium (2)	Large (3)
While reading	0	1	2	3
While watching television	0	1	2	3
While sitting in a public place e.g., meeting, lecture, performance	0	1	2	3
As a <u>passenger</u> in a vehicle for more than 60 minutes	0	1	2	3
Resting around midday when circumstances allow	0	1	2	3
While chatting in a sitting position	0	1	2	3
Afternoon relaxing (alcohol consumption not included)	0	1	2	3
Driving a motor vehicle during a short stop (red light, traffic)	0	1	2	3

Risk Factors

- 22. Do you drive on the morning post-call: yes/no
- 23. Do you fall asleep while driving post-call: yes/no
- 24. During your residency, have you been involved as a driver in a MVA: yes/no
- 25. Do you smoke: yes/no
- 26. Have there been any changes in smoking habits during residency: same/more/less
- 27. Sports activities: yes/no
- 28. If yes to 27, which kinds _____
- 29. Leisure activities: yes/no
- 30. If yes to 29, which kinds _____

Health

- 31. Weight gain: yes/no
- 32. Hypertension: yes/no
- 33. Pregnancy complications: yes/no
- 34 Routine medications: yes/no