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EQSAR:

A national survey of sleep duration among French Anaesthesiologists and Intensivists

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INTRODUCTION

The US National Sleep Foundation recommends more than 7 hours of sleep per night for adults. Anaesthesiologists and intensivists (AI) are at high risk of short sleep time. The aim of this present survey was to assess the sleep duration of French AI and to identify independent factors related to a sleep time less than the recommended 7 hours.

METHODS

This prospective observational study was conducted between April and June 2018 and included 6,210 French AI with night-work obligations. The primary outcome variable was sleep duration strictly inferior to 7 hours per night. The covariables included in the multivariable model were selected after the univariate analysis, with those with a $p < 0.05$ included in the final model.

RESULTS

Of the 6,210 AI, 3,699 responded to the survey, and 2,483 were included in the analysis. Of the 2,483 responders, 1,533 (61.7%) reported sleep duration strictly less than 7 hours per night. After the multivariate analysis, the following risk factors were independently associated with sleep duration strictly under 7 hours: age (OR: 1.28 ; IC [1.19 – 1.37]), more than 5 on-call shifts per month, (OR: 1.41 ; IC [1.30 – 1.50]), active smoking (OR : 1.37 ; IC [1.07 – 1.75]), and screen consultation at bedtime (OR : 1.85 ; IC [1.31 – 2.62]).

CONCLUSION

This study gives a recent overview of sleep time and quality of French AI. It could be a useful tool for monitoring sleep disorders among the practitioners and their impact on quality of life.

Keywords: sleep time; anaesthesiologists; survey; sleep quality; sleep disorders

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1.INTRODUCTION

The 2017 French National Health Barometer survey (Baromètre de Santé publique France) [1] recently reported that the average sleep duration has declined over the last few years, which is for the first time less than the recommended minimum of 7 hours per night by the US National Sleep Foundation [2]. This sleep debt is a significant public health problem. Short duration of sleep is associated with a higher risk of obesity, diabetes, hypertension, cardiovascular [3,4] and neurodegenerative diseases [5].

Moreover, people exposed to alternating day and night shift as anaesthesiologists and intensivists could suffer from sleep deprivation and disorders due to desynchronisation of normal biological and circadian rhythms. A decrease in quantity and quality in sleeping time impairs cognitive functions and have deleterious effects on psychological health. This can be expressed by symptoms such as anxiety, irritability, mood disorders, attention deficit, and can result in a higher risk of traffic accidents [6].

In 2015, Richter et al. demonstrated that sleep duration in French practitioners was already shorter than in the general population [7]. We know that anaesthesiologists and intensivists are probably a subpopulation of physicians particularly at high risk of sleep disorders, due to their stress [8] and their frequent alternating day and night shifts every month. These facts underline the need to ensure epidemiological surveillance of sleep behaviours and to regularly determine the social impact of sleep problems.

The aim of this present survey was to assess sleep duration reported by French AI and to identify independent factors related to less than the 7 hours of sleeping time recommended by the National Sleep Foundation[2].

2.METHODS

After registration by the National Commission for Data Protection (CNIL: Commission Nationale Informatique et libertés) (number of approval: 2170580 v 0), this survey was carried out from April to June 2018. On the basis of the information available, Ethics Committee of the University Hospital of Bordeaux (GP-CE 2019-31) gave a favourable opinion for research and publication. Participants were French anaesthesiologists and intensivists, including residents, with night-work obligations. All practitioners with no night-work shift were excluded.

2.1 Survey development

Contact email addresses of the participants were identified through the membership databases from different partner organisations: the French Society of Anaesthesia and Intensive Care (SFAR: Société française d'anesthésie et de réanimation), the French College of Anaesthesia and Intensive Care (CNEAR: Collège national des enseignants d'anesthésie et de réanimation), the French Association of Young Anaesthesiologists and intensivists (AJAR: Association nationale des jeunes anesthésistes-réanimateurs et médecins du périopératoire), the French Union of Anaesthesia and Intensive Care (SNARF: Syndicat national des anesthésistes-réanimateurs de France), the Association of French-speaking Paediatric Anaesthesiologists and Intensivists (e-ADARPEF: association des Anesthésistes-réanimateurs pédiatriques d'expression française), and the French Union of Anaesthesia and Intensive Care Hospital Practitioners (SNPHARe: Syndicat national des praticiens

hospitaliers en anesthésie-réanimation). Residents were approached by local and national coordinators of the French anaesthesia and intensive care residency.

From these databases, the number of recipients of the survey was estimated to be 6,210 among the 11,497 practicing anaesthetists, intensive care physicians, and 2,235 residents in 2018.

An anonymous electronic questionnaire was sent and each IP address was limited to only one response to prevent multiple reports from the same individual. The survey was created and hosted by the website sondageonline.com and two email reminders were sent during the study period.

2.2 Questionnaire

The survey was developed by three anaesthesiologists with an expertise in the fields of survey research and two members of the sleep clinic at Bordeaux University Hospital and the National Scientific Research Council (CNRS: Centre national de la recherche scientifique) research unit SANPSY "Sleep, Addiction and Neuropsychiatry".

The survey included 50 questions, divided into four sections. The survey is available in French in the supplementary appendix. The first set of items concerned the characteristics of the practitioner: age, sex, and professional status. The second assessed professional activity: type of exercise, type of institution, number of night shifts per month, and the distance and mode of transportation to go from home to work. The third section explored life habitus including smoking status, alcohol, and drug consumption; use of substances to sleep; use of stimulants; weekly physical exercise;

and habits before going to sleep. The aim of the fourth section was to assess daytime sleepiness and sleep quality. Excessive daytime sleepiness (EDS) was evaluated by the Epworth scale [9,10]. This scale consists of questions assessing the risk of falling asleep in eight real-life situations. It is graded from 0 to 24, with mild-to-moderate and severe daytime drowsiness defined as a score equal or greater than 11 and 16, respectively. The quality of sleep was assessed by the Pittsburgh Sleep Quality Index (PSQI) [11], which is currently the most common measure of sleep quality [12]. A modified version validated in France was used for the study [13]. PSQI includes 19 questions about the subjective quality of sleep over the last month. A score greater than 5 indicates sleep disturbances. The global satisfaction toward sleep was auto-evaluated with a 0-100 visual analog scale (with 0 as the worst sleep and 100 as the best possible sleep).

2.3 Outcomes

The primary objective was to determine the prevalence of practitioners with sleep duration strictly inferior to 7 hours per night. The primary outcome variable was sleep duration. Sleep duration was self-reported by each responder as mean sleep duration per night in the previous month. The threshold of 7 hours was chosen according to the minimum duration of sleep to promote optimal health as stated by the National Sleep Foundation [2]. The secondary outcomes were to identify independent factors associated with sleep duration strictly less than 7 hours.

2.4 Statistical analysis

Data collected by the online questionnaire were exported to Microsoft® Excel software.

Quantitative data were reported by median and interquartile range (IQR). Qualitative data were reported by their count and percent. Data were described for the total sample and according to the primary outcome.

Comparison of qualitative data was performed using a Chi-2 test. A p -value of < 0.05 was considered significant.

The factors independently associated with sleep duration strictly less than 7 hours were evaluated by univariate and then multivariate logistic regression. The covariables included in the multivariate model were selected after the univariate analysis, with those with a $p < 0.05$ included in the final model.

The linearity assumption of Logit for quantitative variables was verified by the introduction of a fractional polynomial.

Statistical analysis was performed by the R software (version 3.5.1., Development Core Team 2005).

3.RESULTS

A total of 3,699 anaesthetists, intensive care physicians, and residents responded to the survey. Among them, 860 were excluded from the analysis due to incomplete data for the primary outcome parameter and 356 due to no night-shift work. Finally, 2,483 were included in the analysis, for a total response rate of 40%. Demographic characteristics of the responders are reported in Table 1. This table also shows professional activity and life habitus.

Of the 2,483 responders, 1,533 (61.7%) reported sleep duration strictly less than 7 hours per night. 1,425 (57.4%) reported mean sleep duration of 6 hours or less per night. Figure 1 describes the age-adjusted sleep duration of the responders compared to the French general population [1].

A total of 1424 (57.3%) had a PSQI greater than 5. Responders reporting mild-to-moderate daytime sleepiness were 906 (36.5%), and those reporting severe excessive daytime sleepiness (EDS) were 145 (5.8%) (table 2). Prevalence of sleep disorders (59.1% vs. 54.5%; $p = 0.03$) and EDS (52.2% vs. 26.4%; $p < 0.01$) were statistically greater for the anaesthesiologists sleeping less than 7 hours compared to those sleeping over 7 hours.

Significant risk factors associated with less than 7 hours of sleeping time obtained after the univariate analysis are presented in Table 3.

After the multivariate analysis, the following risk factors were independently associated with a sleep duration strictly under 7 hours: age (OR: 1.28 ; IC [1.19 – 1.37]), more than 5 on-call shifts per month, (OR: 1.41 ; IC [1.30 – 1.50]), tobacco consumption

(OR: 1.37 ; IC [1.07 – 1.75]), and screen consultation at bedtime (OR: 1.85 ; IC [1.31 – 2.62]) (table 4).

4.DISCUSSION

This observational study highlights the high prevalence of short sleep duration among French anaesthesiologists and intensivists. Among responding physicians, 61.7% reported an average of less than the recommended minimum of 7 hours of sleeping time [2]. Moreover, our results show that 57.4% had 6 hours or less of sleeping time.

Sleeping less than 6 hours increases the risk of all-cause mortality [14,15]. It is also associated with a high risk of diabetes mellitus, hypertension, cardiovascular disease, coronary heart disease, and obesity. In our study, the prevalence of anaesthesiologists and intensivists sleeping less than 6 hours appears nearly twice as high as in the general population, in which a 35.9% rate was reported by the French data recorded by the National Institute of Sleep and Vigilance (INSV: Institut national du sommeil et de la vigilance) [1].

In the present study, the PSQI explored the prevalence of sleep disorders. This was previously done by Richter et al. in 2012 [7]. The prevalence appears to be increasing, with a 27% augmentation in the 6-year interval between the two studies (45% vs. 57%). In their study, they showed that the most important factor associated with sleep disorders was sleep duration of 7 hours or less (OR: 8.86 (6.50 to 12.20)). Over this same period, the increase of EDS prevalence was 18% (44% vs. 52%). In their study in 2013, Mion et al. showed in French practitioners a quantitative correlation between sleep disturbance, tiredness, EDS, and the intensity of burnout syndrome [16].

Four independent factors were identified in our study as factors associated with short sleep duration of less than 7 hours: age, number of on-call shifts, active tobacco

consumption, and screen consultation at bedtime. Average sleep duration per 24 hours decreases gradually with age, from 6h23 for younger anaesthesiologists to 5h59 for those over 65 years. For all age ranges, the mean sleep duration was inferior among anaesthesiologists and intensivists than in the general population (Figure 1).

More than 5 on-call shifts were associated with a significant reduction in sleeping time. This can be explained by desynchronisation of the normal biological rhythms which, in addition to sleep deprivation, also result in irritability, decrease of vigilance, and can alter social relations [17,18]. In daily practice, Tesniere et al. has demonstrated a direct correlation between sleep deprivation after an on-call shift and impaired non-technical skills for anaesthesia residents in a simulated anaesthesia intraoperative crisis scenario [19]. For surgeons, sleeping only 6 hours or less the night before is associated with a 170% increased risk of serious surgical error on patients [20]. Finally, non-restorative sleep induces near-misses in drivers [21].

Tobacco consumption is a major public health problem, given its health and social impact. In our study, the prevalence of smoking among anaesthesiologists was 14%, vs. 25.4% among the general population in 2018 [22]. The correlation between tobacco consumption and sleep disorder is well documented [23,24]. Nicotine is known to be a stimulant, and its presence in smoking products and substituents is associated with a diminution in quality and quantity of sleep.

Short sleep duration can also be explained by working or using the Internet on smartphones, tablets, or computers just before going to bed, which acts as a stimulant

and disrupts the time normally devoted to sleep. Indeed, the blue light that is emitted from screens can delay the release of sleep-inducing melatonin, increase alertness, and have an impact on circadian rhythm. Moreover, this behaviour could be considered as an internet addiction, associated with the risk of comorbid mood and anxiety disorders [25], which seriously affects the continuity and duration of sleep in the general population, including anaesthesiologists [26].

Interpretation of these results must be tempered by recognition of the various limitations of the study. The sleep time was self-reported and thus was not objectively measured. Polysomnography or actigraphy would have been more accurate, but their use would have been expensive and difficult to implement for this many participants. Moreover, the self-questionnaire method can predominantly encourage the least favourable responses, as stated by Mion et al. [16]. It reflects only a sample, and results cannot be generalised to all the population because of this possible selection bias. In the present survey, the absolute number of responders is high, but the global response rate is relatively low. Our sample represents only 21.6% of French anaesthesiologists and intensivists. Moreover, the questionnaire could have been more exhaustive and some items are lacking. Comparison of sleep disturbance between workdays and work-free days or strategies to get a better sleep as napping could have also been explored. Finally, our study only evaluated sleep quality in anaesthesiologists with on-call night work. It would have been interesting to compare these results with those of anaesthesiologists with exclusive diurnal activity. Many studies report that night

workers sleep on average one hour less than day workers per night [27]. This equates to one night less per week and 40 fewer nights per year.

Despite these limits, our study should make us wonder about the measures that could help reduce sleep deprivation and improve sleep quality among anaesthesiologists and intensivists. In a review published in 2018, Mc Kenna et al. presented the best evidence from trials and expert opinion that promote individuals to find their own strategies to get a better sleep [28]. Among them, one of the solutions could be napping. Naps as brief as 10 minutes and extending up to four hours during an extended shift are simple and free way to improve vigilance and reaction time [29,30]. Even if this is an effective measure that should be spread more in the workplace, the best napping regimen remains unclear and an adequate moment should probably be allowed after awakening from a nap to minimise the negative effects of sleep inertia on cognitive performance and decision-making. Another strategy could be to eliminate 24-hour call shifts in favour of shorter schedules. Sussman et al. showed with medical residents that reducing the duty period to 16 hours reduced fatigue [31]. However, more studies are needed to determine which shift duration do not compromise sleep quality and patient care. Taking care of the environment where anaesthesiologists sleep in their workplace could also be effective in reducing work-related fatigue after a night shift: the call room must be silent, well isolated, and dark enough to allow workers to maximise recovery [32].

Using stimulants such as caffeine or theine may be useful countermeasures during extreme situations. They temporarily improve performance and alertness in

sleep-deprived individuals; however, all practitioners should know they should be avoided for at least six hours before trying to sleep. Raising awareness among French AI is important and a national campaign promoting sleep quality could help them to prevent the individual risk factors of short sleep duration and to develop means within the operational setting of their hospital. Some simple countermeasures as exposure to bright and/or blue-enriched light or moderate physical activity during a prolonged period of work time (also called “micro breaks”) may be viable to improve sleep quality and reduce the effects of sleep deprivation.

5.CONCLUSION

The current study provides a global description of sleep habits of French AI. This could be a useful tool for health authorities to monitor sleep disorders among the practitioners and their impact on their work and quality of life. Even more importantly, it could help implement simple measures to improve the sleep of anaesthesiologists and intensivists, which could have a direct impact on the quality and security of patient care. Each institution should have a prevention policy designed to promote good sleep habits among their employees.

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Table 1: Demographic characteristics, professional activity and life habitus among French Anaesthesiologists and Intensivists responders

	≥ 7 hours		< 7 hours		Total population	
	Sample		Sample		Sample	
Age, years (IQR)	950	40.1 (12.0)	1533	43.1 (12.8)	2483	41.9 (12.6)
Sex	950		1533		2483	
- Male, n (%)		535 (56.3)		874 (57.0)		1409 (56.7)
Status	950		1533		2238	
- Resident, n (%)		245 (25.8)		336 (21.9)		581 (23.4)
- Assistant, n (%)		71 (7.5)		93 (6.1)		164 (6.6)
- Public Clinician, n (%)		406 (42.7)		705 (46.0)		1111 (44.7)
- Private Clinician, n (%)		207 (21.8)		371 (24.2)		578 (23.3)
- Ass. or Full professor, n (%)		21 (2.2)		28 (1.8)		49 (2.0)
Years of service, years (IQR)	705	11.0 (4-22)	1170	16.0 (6-27)	1875	14.0 (5– 25)
Type of institution	941		1515		2456	
- University Hospital, n (%)		494 (52.5)		790 (52.1)		1284 (18.7)
- Regional Hospital, n (%)		208 (22.1)		326 (21.5)		534 (21.7)
- Private clinic, n (%)		163 (17.3)		296 (19.5)		459 (18.7)
- Others, n (%)		76 (8.1)		103 (6.8)		179 (7.3)
Distance to work, km (IQR)	939	7.0 (4-14.5)	1515	8.0 (4-15)	2454	7.0
On-call shifts per month, n (%)	950	4.5 (1.7)	1533	4.9 (1.8)	2483	4.7 (1.7)
> 5 on-call shifts per month, n (%)	950	523 (55.1)	1533	666 (43.4)	2483	1189 (47.9)
With children at home, n (%)	950	403 (42.4)	1533	647 (42.2)	2483	1050 (42.3)
Tobacco consumption, n (%)	950	112 (11.8)	1533	236 (15.4)	2483	348 (14.0)
Alcohol consumption, n (%)	950	861 (90.6)	1533	1346 (87.8)	2483	2207 (88.9)
- < 1 a week, n (%)		310 (36.0)		517 (38.4)		827 (37.5)
- 1 to 2 a week, n (%)		395 (45.9)		579 (43.0)		974 (44.1)
- 3 or more a week, n (%)		156 (18.1)		250 (18.6)		406 (28.4)
Cannabis consumption, n (%)	950	33 (3.5)	1533	66 (4.3)	2483	99 (4.0)
Other drugs use, n (%)	950	55 (5.8)	1532	82 (5.3)	2482	136 (5.5)
Substances use to sleep better, n (%)	950	123 (12.9)	1533	366 (23.9)	2483	489 (19.7)
Substances use to stay awake, n (%)	950	640 (67.4)	1533	1182 (77.1)	2483	1822 (73.4)
Physical activity duration per week, min (IQR)	861	120(60-180)	1319	120(60-180)	2180	120.0
Physical activity according to the WHO recommendations, n (%)	950	309 (32.5)	1533	438 (28.6)	2483	747 (30.1)
Screen consultation at bedtime, n (%)	950	878 (92.4)	1533	1462 (95.4)	2483	2340 (94.2)

Quantitative data were reported by median and interquartile range (IQR) and qualitative data were presented as number (percentage). Number of responders is indicated for each variable. ^aWHO developed the "Global Recommendations on Physical Activity for Health". Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week.

Table 2: Sleep quality and disturbance among French Anaesthesiologists and Intensivists responders

	≥ 7 hours		< 7 hours		Total population	
	Sample		Sample		Sample	
Self-reported sleep quality scale, VAS (0-100)	950	80 (60-90)	1533	60 (30-80)	2483	70.0
EDS^a, n (%)		250 (26.4)		801 (52.2)*		1051 (42.3)
Mild to moderate (Epworth 11-15)	950	220 (23.2)	1533	686 (44.7)*	2483	906 (36.5)
Severe (Epworth ≥ 16)		30 (3.2)		115 (7.5)*		145 (5.8)
Sleep disorders^b, n (%)	950	518 (54.5)	1533	906 (59.1)*	2483	1424 (57.3)

Quantitative data were reported by median and interquartile range (IQR) and qualitative data were presented as number (percentage). Number of responders is indicated for each variable. ^aExcessive daytime sleepiness is defined as a Epworth Sleepiness Scale ≥ 11 and a score ≥ 16 represents severe excessive daytime sleepiness. ^bSleep disorders is defined as a Pittsburgh Sleep Quality Index > 5. * A p-value of < 0.05 was considered significant.

Table 3: Factors independently associated with a sleep duration strictly less than 7 hours after univariate logistic regression

	OR	CI	p value
Age (every 10 years)	1.21	[1.14 – 1.29]	< 0.001*
Sex (male vs. female)	1.03	[0.87 – 1.21]	0.733
Status			0.068
- Assistant	Ref	-	-
- Resident	1.05	[0.74 – 1.49]	
- Ass. or Full professor	1.02	[0.53 – 1.94]	
- Public Clinician	1.37	[0.96 – 1.95]	
- Private Clinician	1.33	[0.95 – 1.85]	
> 5 on-call shifts per month	1.37	[1.26– 1.47]	< 0.001*
Tobacco consumption	1.36	[1.07 – 1.73]	0.011*
Physical activity according to the WHO^a recommendations	0.83	[0.70 – 0.99]	0.037*
Type of institution			
- Others	Ref	-	0.403
- University Hospital	1.18	[0.86 – 1.62]	-
- Regional Hospital	1.16	[0.82 – 1.63]	-
- Private clinic	1.34	[0.94 – 1.91]	-
Screen consultation at bedtime	1.69	[1.20 – 2.37]	0.003*
Cannabis consumption	1.25	[0.82 – 1.91]	0.299
With children at home	1.00	[0.97 – 1.03]	0.916
Other drugs use	0.91	[0.64 – 1.29]	0.594
Alcohol consumption			0.082
- Never	Ref	-	
- < 1 a week	0.79	[0.59 – 1.06]	
- 1 to 2 a week	0.70	[0.53 – 0.93]	
- 3 or more a week	0.76	[0.55 – 1.05]	
Substances use to stay awake	1.63	[1.36 – 1.95]	< 0.001*
Substances use to sleep better	2.11	[1.69 – 2.64]	< 0.001*

CI, confidence interval; OR, odds ratio; REF, reference value.

^aWHO developed the "Global Recommendations on Physical Activity for Health". Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week.

* A p-value of < 0.05 was considered significant

Table 4: Factors independently associated with a sleep duration strictly less than 7 hours after multivariate logistic regression

Variables	OR	CI	p value
Age (every 10 years)	1.28	[1.19 – 1.37]	< 0.001*
> 5 on-call shifts per month	1.41	[1.30 – 1.50]	< 0.001*
Tobacco consumption	1.37	[1.07 – 1.75]	0.013*
Physical activity according to the WHO recommendations^a,	0.85	[0.71 – 1.02]	0.079
Screen consultation at bedtime	1.85	[1.31 – 2.62]	< 0.001*

CI, confidence interval; OR, odds ratio.

^aWHO developed the "Global Recommendations on Physical Activity for Health". Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week.

* A p-value of < 0.05 was considered significant.

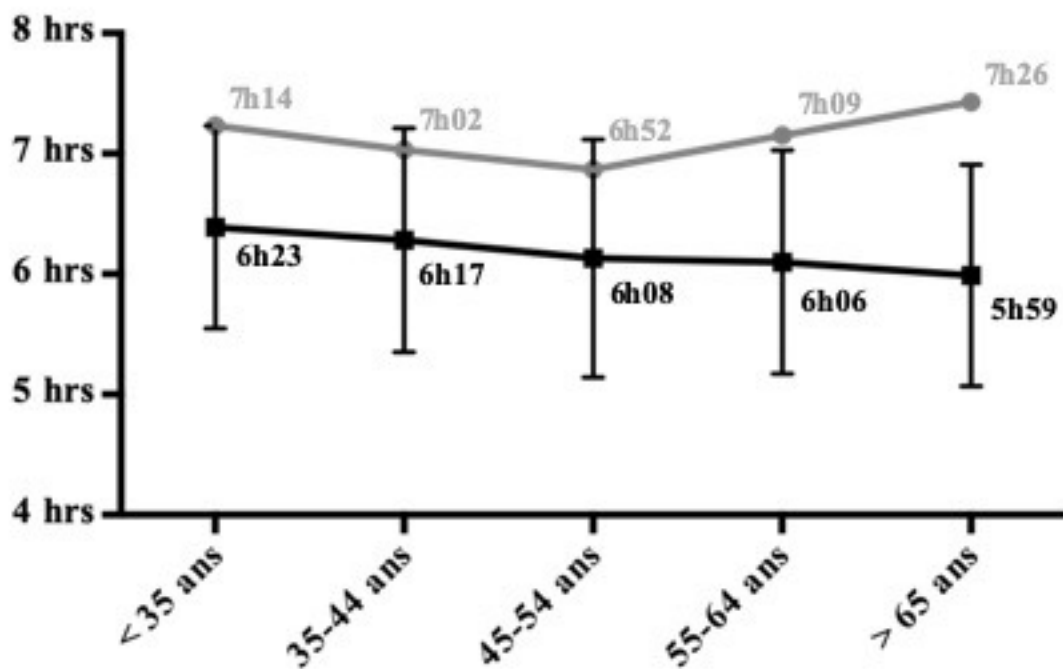


Figure 1. Comparison of total sleep duration among French population vs anaesthesiologists and intensivists per age range

Data were reported by mean \pm SD. SD are not available for French population [1]. Mean sleep duration is indicated for each age range. Black line with squares represents French Anaesthesiologists and Intensivists: Grey line with rounds represents French population: