

Negative impact of a 1-month period of night shifts on mental and physical health among Swiss internal medicine residents

Amandine Berner¹, Clement P. Buclin^{1,2}, Delphine Courvoisier^{2,3,4}, Jean-Luc Reny^{1,2}, Nicolas Garin^{1,2,5}, Jacques Serratrice^{1,2}, Thomas Agoritsas^{1,2,6,7}, Pauline Darbellay Farhoumand^{1,2}

1 Division of General Internal Medicine, Geneva University Hospitals, Geneva, Switzerland; 2 University of Geneva, Faculty of Medicine, Geneva, Switzerland; 3 Division of Rheumatology, Geneva University Hospitals, Geneva, Switzerland; 4 Quality of Care Division, Geneva University Hospitals, Geneva, Switzerland; 5 Division of Internal Medicine, Riviera Chablais Hospital, Rennaz, Switzerland; 6 Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario, Canada; 7 MAGIC Evidence Ecosystem Foundation, Oslo, Norway

Summary

STUDY AIMS: To assess the impact of short periods of night shifts on: sleep quality and sleep medication intake, burnout scores, care-related regrets experience and coping mechanisms of internal medicine residents.

METHODS: Before-after analysis of data from the Nightshift project, a repeated measures evaluation of the clinical activity and burden of night shifts, conducted between October 2019 and March 2020 in the Division of General Internal Medicine of Geneva University Hospitals (Clinicaltrials.gov: NCT04123015). Forty-one residents of 55 (74.5%) screened for eligibility were included before their first night shift. They completed an anonymous e-survey before and after a 1-month period of night shifts, assessing sleep quality, sleep medication intake, burnout scores using the Copenhagen Burnout Inventory (CBI), the number and intensity of care-related regrets using the Regret Intensity Scale (RIS-10) and resident's coping abilities with the Care-related Regret Coping Scale for Health-care Professionals (RCS-HCP).

RESULTS: After the 1-month period of night shifts, sleep medication intake had increased from 7.3% to 24.4%, $p = 0.02$. At baseline, 31 (75.6%) of the 41 participating residents (65.9% women) scored low in all three dimensions of burnout. For each burnout dimension, at least 30% of residents had an increase in score ≥ 5 points. Moderate or high levels of burnout remained stable for professional burnout (24.4%), but increased for personal (17.1% to 26.9%) and patient-related burnout (4.8% to 14.6%) though none of these changes were statistically significant. All of the 25% of residents who experienced regrets on actions taken during their shift were women. They reported overall limited coping abilities, e.g. 80% displayed frequent use of negative maladaptive strategies to deal with regret.

CONCLUSIONS: Even short periods of night shifts can have a significant impact on residents' mental and physical health. A high proportion of residents had increased burnout scores, a factor known to be correlated with job dissatisfaction and absence due to sickness. Sleep medication intake increased 3-fold, suggesting sleep issues. Respondents reported frequent care-related regrets and poor coping abilities, with use of maladaptive strategies, known to be associated with poor sleep and job resignation. As stricter regulations on daily working hours are proposed, the frequency of on-call duties will inevitably increase. Understanding the implications of short periods of night shifts is not only essential for shaping residency programme policies and for shift scheduling, but also for informing training programmes on non-pharmacological sleep management, burnout prevention and the development of positive regret-coping strategies.

Introduction

Shift work, including after-hours and weekends, is inherent to current inpatient care models, especially in acute settings [1]. During shifts, physicians in postgraduate training are typically in charge of larger numbers of patients and their potential urgent needs while facing limited access to com-

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Correspondence
Dr Amandine Berner
[amandine.berner\[at\]hug.ch](mailto:amandine.berner[at]hug.ch)

prehensive clinical resources and the full supervision that are available during normal working hours. These additional stressors may negatively impact residents' health or quality of life, as well as the quality of care provided to inpatients [2, 3].

Physicians' wellbeing is a worldwide concern. In the US, more than 40% of physicians reported at least one symptom of burnout [4]. In a nationwide cross-sectional survey in France, 40% of tenured university hospital faculty staff reported severe burnout and 15% suicidal ideation [5]. In Switzerland, reports of burnout prevalence are on the increase [6], particularly among young physicians [7-9]. Zumbunn et al. [9] reported that, among 450 surveyed Swiss internal medicine residents, 60% felt burnt out (emotionally exhausted), 21% regretted their career choice, and 19% had reduced well-being, which was associated with a higher intention to leave clinical practice. The looming shortage of primary care physicians requires efforts to better understand and mitigate these negative impacts.

Night shifts and extended on-call duty are known to affect burnout rates [10-12], sleep quality [13-17] and the use of sleep medication [18], with potential short- and long-term implications for mental and physical health [19-24]. According to Swiss regulations, employees who work at least 25 night shifts annually are eligible for specific counselling and follow-up. Other countries have distinct definitions of night work and medical surveillance obligations, which vary in terms of exposure thresholds and assessment criteria. The impact of night work has primarily been studied in emergency or intensive care settings, where chronic exposure for several months, or even years, is common [10, 13, 25-27]. Data on the impact of shorter periods of off-hours work interspersed with regular working hours, as planned in many acute care residencies, remain limited however.

Providing healthcare carries an inherent emotional burden, which can result in the experience of care-related regret – an emotion felt when people think that an outcome could have been better had they acted differently [28]. Although its involvement with perceived medical errors is common, regret also stems from decisions and actions unrelated to errors [28, 29]. Experiencing a high number of regrets is associated with poor job satisfaction, and increases the use of negative coping strategies, inducing rumination and self-blaming, and is further associated with low self-esteem, depression and resignation [28]. Regret intensity drives turnover intention, especially among young healthcare workers [30], and can result in insomnia [31]. How night shifts specifically affect the occurrence of care-related regrets, their intensity and physicians' coping strategies is unknown.

Recent years have seen a trend towards shorter night shifts due to concerns about residents' health and patient safety [21-23, 32]. In parallel, work regulations have reduced total working hours. The combination of these measures has had an untoward consequence: while being shorter in duration, night shifts recur more frequently.

In this study, we aimed to assess the impact of short periods of night shifts on both the mental and physical health of Swiss internal medicine residents by assessing their sleep quality and sleep medication intake, burnout scores, care-related regret experience and coping mechanisms.

Methods

Study design, setting and participants

This is a before-after analysis, part of a broader project called the Nightshift project, a repeated measures study of out-of-hours patient care. The primary outcomes aim to describe how residents allocate their time during night shifts and the secondary outcomes, which are the focus of this publication, aim to quantify the burden of this clinical activity (study protocol registered in Clinicaltrials.gov: NCT04123015). We conducted the study between October 2019 and March 2020 (pre-pandemic COVID-19 era) in the Division of General Internal Medicine of Geneva University Hospitals, a 2000-bed teaching tertiary care hospital group in Switzerland, with more than 63,000 hospitalisations per year. With 157 beds including a 9-bed intermediate care unit, the Division of General Internal Medicine treats approximately 7300 patients per year. Out of hours, 3 residents are responsible for a maximum of 340 patients, including those admitted to other departments (dermatology, haematology and oncology).

Each year approximately 30 new medical residents join our 3-year curriculum residency programme, as part of their 5-year specialisation in General Internal Medicine. The programme includes six on-call rotations (i.e. off-hours hospital shifts) on the wards. These on-call shifts consist

of four to five consecutive weeks of weekday evenings (5:30 pm to 10:30 pm), weekday nights (10:00 pm to 8:00 am) and weekends with a schedule split into day shifts (8:30 am to 7:30 pm) and night shifts (7:00 pm to 9:00 am), adding up to the legal maximum of 50 working hours per week [33]. The standard schedule before a 1-month period of night shifts consists of daytime work on weekdays (7:45 am to 6:45 pm including a 1-hour break).

All residents starting an on-call rotation during the study period were eligible for inclusion. All participants provided written informed consent after oral and written study information was provided by the research team, up to five days before the beginning of their on-call rotation. The Geneva Research Ethics Board exempted the study from formal ethical review.

Objectives and data collection

Before their first on-call shift, residents completed an automatically sent anonymous online survey. A second survey was administered immediately after the 1-month on-call rotation, with weekly reminders to non-respondents.

Participants provided their demographics (age, sex) and level of training which included: years of practice, previous experience in our service, previous intensive care or emergency department training, completion of the 1-hour optional preparatory course with a chief resident providing organisational details and completion of the 4-hour high-fidelity simulation training on inter-professional emergency situation response based on frequent clinical scenarios.

Our study had three objectives. The first objective was to investigate whether short periods of night shifts affect sleep quality including the use of sleep medication. For this, we used three questions assessing satisfaction with sleep, influence of sleep on daily performance and sleep medication intake. Two questions were taken from the Insomnia Severity Index (ISI) [34] and asked the residents to evaluate their satisfaction with their sleep on a modified visual analogue scale ranging from 0: *"Very unsatisfied"* to 100: *"Very satisfied"*. Residents who answered ≤ 80 were then asked to evaluate how their sleep difficulties impacted their daily functioning on a scale from 0: *"No impact"* to 100: *"Extreme impact"*. To assess residents' sleep medication intake, we asked *"During the past month, how often have you taken medicine to help you sleep – prescribed or over the counter?"* The possible answers were *"Never"*, *"Less than once a week"*, *"Once to three times a week"* and *"More than three times a week"*.

The second objective was to assess the impact of night shifts on burnout level in the personal, work-related and patient-related dimensions. We used the Copenhagen Burnout Inventory (CBI) [35], a self-reported questionnaire that assesses three dimensions: overall physical and psychological fatigue and exhaustion experienced by the person (personal burnout; P-CBI), and the physical and psychological fatigue perceived by the person as related to their work (work-related burnout; WR-CBI) or to their work with patients (patient-related burnout; PR-CBI). The CBI is scored on a scale ranging from 0 to 100 for each of the three dimensions and is categorised as follows: low burnout (0–49), moderate burnout (50–74) and high burnout (75–100) [36]. The proportion of residents exhibiting a meaningful variation in CBI score across any of the three dimensions was calculated using a threshold of a 5-point difference before and after night shifts [35].

The third objective was to describe care-related regrets, their intensity and coping mechanisms used in relation to clinical practice. The number of regrets was quantified by a single question: *"During your one-month night shift, how many patient care situations were there in which you experienced regret?"* [30]. Regret intensity was assessed with *"What would be your average level of regret about these situations?"* with a sliding scale from 0 to 10 [30]. Two regret scores were added: the Regret Intensity Scale (RIS-10) [37] to evaluate the current intensity of the most important regret experienced during the month of night shifts and the Care-related Regret Coping Scale for Health-care Professionals (RCS-HCP) [38], a validated tool to assess coping abilities healthcare professionals may use to deal with care-related regret. The scale contains 15 items divided into 3 subscales: 2 positive adaptive strategies (problem-focused and emotion-focused adaptive) and 1 negative strategy (emotion-focused maladaptive). Problem-focused strategies aim at rectifying the situation or avoiding its recurrence (e.g. *"I try to find concrete solutions to the situation"*). Emotion-focused adaptive strategies consist in coping with the emotions without trying to modify the situation (e.g. reappraisal or acceptance, as in *"I try to put the situation in perspective"*). Emotion-focused maladaptive strategies attempt to cope with the emotions without success (e.g. compulsive

thinking, self-blaming about lack of competence or value as in “*I turn these situations over in my mind all the time*”). Answers are given on a 4-point Likert scale ranging from 1 (never or almost never) to 4 (always or almost always) [30].

Statistical analysis

We described the baseline characteristics of participants using means and standard deviations (or medians and interquartile ranges [IQR] when normality was not met) or counts and proportions. We compared sleep satisfaction and sleep quality’s impact on daily functioning before and after night shifts using the Wilcoxon signed-ranked test. Sleep medication intake was dichotomised into “none” versus “any” and each dimension of the CBI was dichotomised into low (0–49) and moderate to high (50–100). The values of these variables before and after night shifts were compared using McNemar’s test. Residents reporting experience of regrets (versus not) were compared using Fisher’s exact test for categorical variables (sex, previous experience in emergency care and in intensive care, 1-hour night shift training course completion, 4-hour simulation training course completion, willingness to leave clinical practice, coping style) and Mann-Whitney tests for continuous variables (age, postgraduate years, number of situations regretted, mean intensity of regrets, RIS-10). Based on the cut-offs of previous studies, we defined three types of residents according to the coping strategies they had implemented [31, 39]. Residents were classified as “adaptive copers” if they exhibited minimal use of negative coping strategies (<1.8 on the 4-point Likert scale for emotion-focused maladaptive strategies), while frequently also using positive coping strategies ((emotion-focused adaptive + problem-focused) ÷ 2 ≥2.2). “Maladaptive copers” were residents scoring at least 1.8 on the negative coping strategies and a mean score below 2.2 for positive coping strategies ((adaptive + problem-focused) ÷ 2 <2.2). The remaining residents who did not match either of the previous groups were classified as “mixed copers”. The association of each dimension of burnout with intention to quit was examined using linear regression. We report R² to reflect the proportion of explained variance by each factor, as it is more interpretable than regression coefficients. Assumptions of conditional normality, heteroscedasticity and linearity were verified before running the models. All analyses were performed using R 4.3.3, R Core Team (2023). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org> [40].

Results

We screened 55 residents for eligibility; 41 were included, 4 refused to participate and 10 were not enrolled owing to research staff availability. Respondents’ characteristics are shown in table 1. A majority were women (65.9%), a proportion representative of our residency programme. Overall, participants were relatively experienced, with a median of three years of postgraduate training (IQR: 2.0–4.0). Among participants, 92.7% had previous experience in an emergency department and 41.5% had previously worked in the ICU. Most of them were in their first three months working in our department (IQR: 2.0–11.0). Participants were scheduled for four to five weeks of on-call rotation, depending on the month, at an average of 42.5 hours per week. The number of beds attended to individually by residents ranged from 72 to 172, depending on the assigned area, bed availability and occupancy, and the inclusion of intermediate-care patients within the coverage area.

Table 1: Residents’ sociodemographic characteristics at baseline (n = 41).

	Overall
Women, n (%)	27 (65.9%)
Age, mean ± SD	29.0 ± 1.9
Postgraduate years, median [IQR]	3 [2.0–4.0]
Previous experience in emergency care, n (%)	38 (92.7%)
Previous experience in intensive care, n (%)	17 (41.5%)
Completed the night shift training course, n (%) *	36 (87.8%)
Completed the simulation training course, n (%) **	10 (24.4%)

* An optional 1-hour group session led by a chief resident that provides organisational details.
** A 4-hour high-fidelity simulation training course on interprofessional emergency situation response based on frequent clinical scenarios.

Sleep

More residents took sleep medication after their 1-month on-call shifts (from 7.3% to 24.4%, $p = 0.02$), though satisfaction with sleep and self-evaluated impact of sleep on daily functioning did not change significantly (table 2).

Table 2: Satisfaction with sleep, impact of sleep on daily performance and sleep medication intake before and after a 1-month period of night shifts (n = 41).

		Before	After	p-value
Satisfaction with sleep, median [IQR]		63 [39.0–74.0]	50 [35.0–61.0]	0.14
Impact of sleep on daily functioning, median [IQR] *		50 [23.8–63.0]	55.5 [34.0–68.5]	0.39
Sleeping pills, n (%)	None	38 (92.7%)	31 (75.6%)	0.02**
	<1x/week	3 (7.3%)	5 (12.2%)	
	1–3x/week	0 (0.0%)	5 (12.2%)	
	>3x/week	0 (0.0%)	0 (0.0%)	

* n = 37, as the question was asked only to residents with a satisfaction with sleep score ≤ 80 .
** p-value for sleeping pills is calculated for “No sleeping pills” versus “Any sleeping pills”.

Burnout

According to the Copenhagen Burnout Inventory, 31 residents (75.6%) had low scores (<50) across all three dimensions of burnout at baseline. Twenty-nine residents (70.7%) continued to score low in the three dimensions after the rotation. At baseline, 34 (82.9%) had low personal burnout (P-CBI), 31 (75.6%) had low work-related burnout (WR-CBI) and 39 (95.1%) had low patient-related burnout (PR-CBI). After the rotation, median burnout scores were stable, although 18 (43.9%) met the criterion of a meaningful increase of ≥ 5 points for P-CBI, 15 (36.6%) for WR-CBI and 13 (31.7%) for PR-CBI. There was an increase in the proportion of residents reporting moderate (50–74 points) or high (75–100 points) burnout scores in the P-CBI (from 17.1% to 26.9%) and PR-CBI (from 4.8% to 14.6%) dimensions. In the WR-CBI, the proportion of residents reporting a high score also increased from 4.9% to 9.8%, though the increase was not significant. After the rotation, 36.6% reported that they might be or were willing to leave clinical practice (table 3). All three dimensions of burnout were associated with a willingness to resign from one’s job ($p < 0.001$ for each dimension), with a proportion of explained variance ranging from 35% to 46% (R^2 of 0.35 for patient-related burnout, 0.39 for work-related burnout and 0.46 for personal burnout). Figure 1 shows the evolution of the distribution of burnout categories for each dimension before and after night shifts, displaying that the majority of changes in burnout category are to a higher level.

Table 3: Evolution of the Copenhagen Burnout Inventory (CBI) score before and after a 1-month period of night shifts (n = 41).

			Before	After	p-value*
Personal burnout (P-CBI)	Median [IQR]		33.3 [16.7–45.8]	33.3 [25.0–50.0]	0.11
	Category distribution, n (%) **	Low	34 (82.9%)	30 (73.2%)	0.22
		Moderate	4 (9.8%)	7 (17.1%)	
		High	3 (7.3%)	4 (9.8%)	
	Change in score, n (%) ***	Increased	–	18 (43.9%)	
		Constant	–	13 (31.7%)	
Work-related burnout (WR-CBI)	Median [IQR]		35.7 [21.4–42.9]	32.1 [21.4–46.4]	0.44
	Category distribution, n (%) **	Low	31 (75.6%)	31 (75.6%)	>0.99
		Moderate	8 (19.5%)	6 (14.6%)	
		High	2 (4.9%)	4 (9.8%)	
	Change in score, n (%) ***	Increased	–	15 (36.6%)	
		Constant	–	16 (39.0%)	
Patient-related burnout (PR-CBI)	Median [IQR]		25.0 [12.5–29.2]	25.0 [8.3–41.7]	0.29
	Category distribution, n (%) **	Low	39 (95.1%)	35 (85.4%)	0.13
		Moderate	1 (2.4%)	5 (12.2%)	
		High	1 (2.4%)	1 (2.4%)	
	Change in score, n (%) ***	Increased	–	13 (31.7%)	
		Constant	–	20 (48.8%)	
		Reduced	–	8 (19.5%)	

* p-values are calculated using McNemar’s test on dichotomised score (low vs moderate-high) and the paired Wilcoxon test for continuous variables.

** CBI categories: low: 0–49 points; moderate: 50–74 points; high: 75–100 points.

*** The scores were considered as increased or reduced when they changed by ≥5.

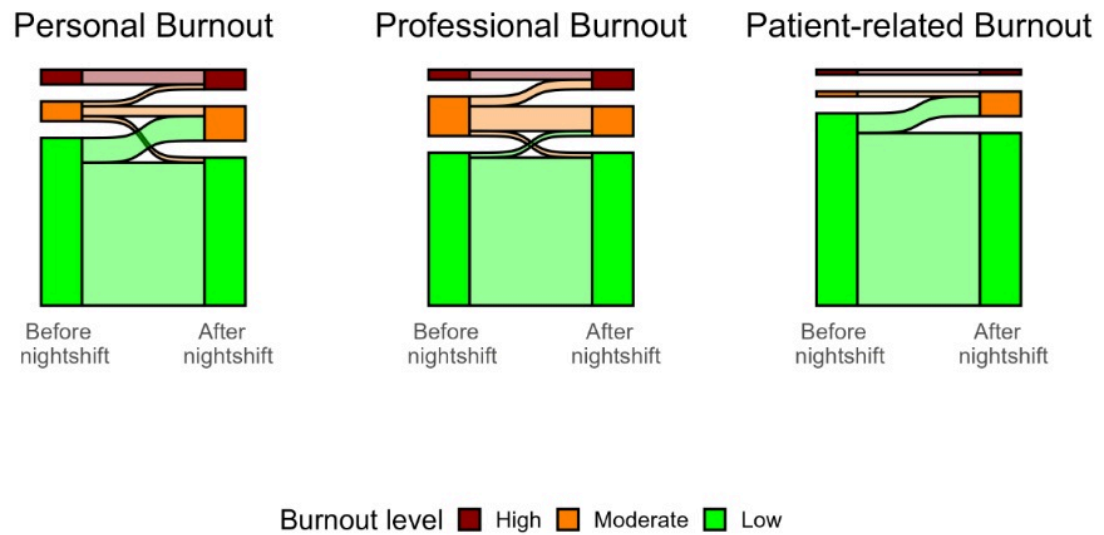


Figure 1: Copenhagen Burnout Inventory (CBI): change in burnout dimension levels before and after a 1-month period of night shifts.

Regret

Of the 41 participating residents, 10 (24.4%) reported experiencing care-related regrets for their actions, all of whom were women (table 4). There were no differences between residents reporting regrets in terms of previous experience in emergency or intensive care, or completion of the simulation and night shift preparatory courses. The mean reported number of regrets per month was

2.1±1.9. Of these 10 residents, 6 (60%) regretted 1 situation, 2 (20%) regretted 2 situations and 2 (20%) regretted 5 or more situations. The mean regret intensity was moderate (6.2±1.1, range: 0–10) and the current intensity of the most important regret experienced during their month night shifts was 2.13±0.72, from a range of 1 to 5. The majority of residents reporting regrets were mixed copers (80%), using both positive and negative coping strategies, while only 2 of 12 adaptive copers expressed regrets.

Table 4: Reporting of care-related regrets after a 1-month period of night shifts and coping mechanisms.

		Overall (n = 41)	No regret (n = 31)	Regrets (n = 10)	p-value*
Women, n (%)		27 (65.9%)	17 (54.8%)	10 (100.0%)	0.01
Age, mean ± SD		29.0 ± 1.9	29.06 ± 2.03	28.80 ± 1.62	0.71
Postgraduate years, median [IQR]		3 [2.0–4.0]	3 [2.00–4.00]	3 [1.25–3.75]	0.54
Previous experience in emergency care, n (%)		38 (92.7%)	29 (93.5%)	9 (90.0%)	>0.99
Previous experience in intensive care, n (%)		17 (41.5%)	14 (45.2%)	3 (30.0%)	0.48
Completed the night shift training course, n (%)		36 (87.8%)	26 (83.9%)	10 (100.0%)	0.31
Completed the simulation training course, n (%)		10 (24.4%)	10 (32.3%)	0 (0.0%)	0.08
Willingness to leave clinical practice, n (%)		15 (36.6%) **	10 (32.3%)	5 (50.0%)	0.45
Number of situations regretted, mean ± SD		–	–	2.1 ± 1.9	–
Mean intensity of regrets, mean ± SD ***		–	–	6.2 ± 1.1	–
Regret Intensity Scale (RIS-10, mean ± SD) ****		–	–	2.13 ± 0.72	–
Coping style, n (%)	Adaptive	12 (29.3%)	10 (32.3%)	2 (20.0%)	0.77
	Mixed	28 (68.3%)	20 (64.5%)	8 (80.0%)	
	Maladaptive	1 (2.4%)	1 (3.2%)	0 (0.0%)	

* p-values are calculated using Fisher's test for categorical variables and the Mann-Whitney test for continuous variables.
** Willingness to leave clinical practice, n (%): Yes, 3 (7.3%); Maybe, 12 (29.3%); No, 26 (63.4%).
*** Assessed with a single item: "What would be your average level of regret about these situations?" (range 0–10).
**** Current intensity of the most important regret experienced during the 1-month night shift (range 1–5).

Discussion

This analytical before–after study provides descriptive data on the emotional and physical burden of internal medicine residents involved in night shift work in an acute hospital setting. We showed that short periods of night shifts have a significant impact on sleep medication intake and important trends on sleep quality, burnout scales and care-related regrets.

Sleep quality and sleep medication intake

There was a 3-fold increase in the use of sleep medication, with 1 in 4 residents taking sleep medication after a 4-week period of night shifts. These findings are in line with previous studies [41–43]. This is concerning, given that doctors have easy access to these drugs coupled with a high rate of self-treatment with controlled medication, thus potentially increasing their risk of drug abuse or dependence [44, 45]. Sleeping pills can affect psychomotor performance in the workplace [46], which could in turn lower quality of care. For example, a large survey in France reported that anaesthetists' dependency on hypnotics or sedatives could be predicted by sleep deprivation (OR: 3.26, 95% CI: 2.12–5.02) [47]. Another survey in Finland showed that sleep disturbance among on-call anaesthetists was associated with suicidal thoughts [48].

Extended-duration work shifts (most often defined as a shift of ≥24 hours) have a negative impact on patient safety [49, 50], whereas shorter-duration work shifts increased the total amount of sleep and improved performance on psychomotor vigilance testing [14]. Swiss work regulations [33] do not allow a working week of more than 50 hours or a night shift duration of more than 12 hours. Despite an average working week of 42.5 hours and a maximum of 7 nights per month, the increasing use of sleeping pills by our residents during the study period underlines the fact that worktime limitations might not be sufficient to mitigate the impact of night shift-related sleep disorders. This warrants efforts to provide training in sleep management for on-call periods [51].

Burnout scores

Seventy-five percent of residents had low scores in all three dimensions of burnout prior to their 1-month period of night shifts. The median scores and their distribution are consistent with data from Kristensen et al. [35] in their validating cohort of physicians: they reported higher scores on work-related but lower on patient-related burnout. Another study reported much higher CBI scores among Swiss emergency physicians. In that study however, participants had more than ten years of clinical experience and were long-time night shift workers [27]. Zumbrunn et al. reported that 60% of 450 Swiss internal medicine residents [9] felt burnt out from their work; however they did not use CBI, limiting comparison. Thus, one could infer a relatively good mental condition of our residents at baseline.

Median burnout scores remained stable across the three dimensions after night shifts. Several studies have shown an association between night work and the risk of burnout [10, 11, 13, 52, 53]; however, this was mostly demonstrated in the context of long-term night work such as in the emergency or intensive care sectors [10, 25-27] and less so in the context of shorter periods of night shifts, as in our study. Nevertheless, we showed an increase in the scores of 5 points or more in each burnout dimension for more than 30% of the residents. Considering that increases of at least 5 points are deemed significant and associated with low job satisfaction, sick leave, sleep problems, use of medicine and intention to quit the job [35], a change of category is concerning, particularly in the patient-related dimension, as observed in our sample. This dimension is indeed best correlated with the willingness to leave clinical practice, concurring with Kristensen et al. [35].

One plausible hypothesis to explain the increase in burnout scores among many of our residents is the impact of night shifts on their sleep quality, especially their sleeping pill intake and their exposure to care-related regret.

Care-related regret experience and coping mechanisms

Regret is the second most frequent emotional state [54], though difficult to avoid in clinical practice [29], and has to be considered a normal part of learning [30]. Accumulation of care-related regrets is associated with job dissatisfaction, whereas regret intensity is associated with turnover intention [30, 55]. Twenty-five percent of our residents reported regrets for the actions taken during their 1-month night shift. This is higher than previously reported in a cross-sectional survey at our hospital [38]. However, the number of regrets and their intensity are in range with previous data from junior healthcare professionals [30]. Hence, these on-call periods must be identified by residents and supervisors as high-risk periods of exposure to care-related regrets.

It is of note that only women reported regrets in our sample. Previous studies on regret failed to identify a sex difference, but were also too small to address this question [39]. These studies also showed that women use problem-focused coping strategies more often than men, a trend driven by more frequent talking to colleagues and superiors. This corroborates studies on emotion regulation [38, 56]. In this context, one could hypothesise that men also experienced regrets but failed to report them. This avoidant attitude towards negative emotions could be a barrier to the normal learning process. Learning to adequately process regrets is an important part of the non-technical skills during residency [57].

Our residents' coping abilities were limited. They displayed mixed mechanisms using several suboptimal strategies to deal with regrets, including self-blaming. These maladaptive coping strategies may limit learning from potential mistakes and lead to sleep disorders, depression, burnout [28], low job satisfaction and intention to leave clinical practice [30, 38]. On the other hand, adaptive emotion-focused strategies are positively associated with higher self-rated health, quality of life and lower depression rates [55]. Besides highlighting the need to foster a safe error culture, our findings suggest that training programmes promoting regret-coping strategies with problem-focused and adaptive coping, while minimising maladaptive strategies could prove useful to mitigate the burden of these short but repeated high-risk periods [29].

Implications and perspectives

As we strive to regulate working hours to protect residents and patients, an untoward outcome is that individuals are required to work more frequent shifts to cover the need for inpatient care. In the USA, the 2003 regulations limited the working week to 80 hours and in 2011 the duration of night shifts to less than 16 hours. Residents reported benefits on patient safety outcomes [23, 58] and their risk of motor vehicle accidents, percutaneous injuries and attention failure decreased

[59], without affecting clinical education [60]. This contrasts with a trial in Canada where randomising ICU residents to overnight schedules of 24, 16 or 12 hours failed to show advantages on patients' or residents' outcomes [61]. Their mean working week was 52–59 hours. This is closer to the European Working Time Directive (2003/88/EC) [62], applicable EU-wide for junior doctors, and to Swiss laws that limit the working week to 50 hours for residents. Nevertheless, we documented a detrimental impact on our sample scheduled for 42.5 working hours per week consisting of short but frequent shifts. If confirmed, our findings must be considered when informing residency programme policies and shift scheduling practices.

Within the Swiss system, general internal medicine residency programmes last at least five years. Our residents had already acquired two to three years' experience with 40% of them already being exposed to professional experience in an intensive care unit. One could assume that the more experienced the trainees are, the less affected by night shifts they are. We observed the contrary, with a negative impact measured on our experienced residents. In a cohort study in the USA including over 4800 experienced residents (postgraduate year 2 and above), self-reported safety outcomes increased in the same magnitude as previously reported by less-experienced doctors working more than 48 hours per week or shifts of extended duration (≥ 24 hours) [23, 50, 58, 59, 63]. It appears then that the total number of on-call hours or the duration of the shifts are not the only factors at play. The frequency and recurrence of on-call periods could also be an issue, even for more experienced doctors.

Further reduction of daily working hours – as advocated by the Swiss Medical Association of Residents and Fellows (*Verband Schweizerischer Assistenz- und Oberärztinnen und -ärzte / Association Suisse des Médecins-assistant(e)s et chef(fe)s de clinique*) [64], which seeks a working week of 42 hours plus 4 hours training – would inevitably increase the proportion of off-hours work. Our findings highlight the need to implement a multifaceted strategy to reach a balanced compromise between individual and institutional needs. Further limitation of working hours remains a frequent request but might not be sufficient or even relevant. This issue is not only important at an individual level for the wellbeing of doctors working night shifts, but it also constitutes a major issue at the healthcare system level itself and although familiar to work planners, may be less known to regulators. Our findings also identify avenues for future research to confirm these results on a larger scale and across multiple centers, possibly with a longer-term follow-up. Thought should also be given to establishing support programmes, especially for non-pharmacological sleep management [51], to systematically including off-hours work in burnout prevention measures and to implementing training programmes on positive care-related regret coping strategies.

Limitations and strengths

Since this before-after analysis reports the secondary outcomes of the larger Nightshift project with a repeated measures design involving numerous observations, the sample size for the before-after assessments remains limited and may have had an impact on the statistical power to show differences in sleep quality, burnout and regret rates. Given the large number of variables and outcomes assessed, the associations are exploratory in nature. Several outcomes were measured only after night shifts (i.e. assessment of regrets and willingness to leave clinical practice) and we could not compare them with measurements at baseline. We were nevertheless able to demonstrate a significant increase in sleeping pill intake, and the effects on burnout scores measured immediately before and after the period reduce the odds of a potential confounding and reinforce a potential causality. Despite our sample being small, the scores were repeated within a short period of time, contributing to the plausibility of a causal relationship.

Self-reporting may have introduced measurement and recall bias.

The single-centre design and lack of long-term wellbeing assessment limit generalisability and comprehensive understanding of impacts. Nevertheless, this study contributes to the scarce evidence on short periods of night shift work in acute care, focusing on postgraduate trainees who typically dedicate substantial time to night work during residency. Importantly, the study was conducted before the COVID-19 pandemic, avoiding potential confounding factors, as many healthcare systems are still overburdened by the aftermath of the pandemic and its long-term implications [65].

Conclusion

Our study suggests that even a single month of night shifts can have an impact on the mental and physical health of internal medicine residents, with a significant 3-fold increase and almost a quarter of residents taking sleep medication at the end of their on-call period. There was also a high incidence of care-related regrets and gaps in coping strategies. Finally, our findings may suggest a detrimental effect on burnout scores, as one-third of participants exhibited a clinically significant increase across all three burnout categories simultaneously, despite the median scores for the entire group remaining stable. This would require confirmation in further studies.

Understanding the implications of shorter periods of night shifts on Swiss general internal medicine residents is essential for informing residency programme policies, shift scheduling and support systems aimed at promoting resident wellbeing and professional development.

Data sharing statement

The full dataset is not currently available in public repositories, to prevent identification of the study participants. Please contact the corresponding author for access to specific data.

Notes

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Author contributions: PDF, NG, DC, TA designed the study. PDF, NG, JS contributed to data collection. CB and DC performed data analysis. AB, PDF, TA, CB drafted the initial manuscript, and all authors revised it. PDF and TA provided oversight.

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Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest related to the content of this manuscript was disclosed.

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