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ORIGINAL RESEARCH

A prospective analysis of shift work and fatigue scores in anaesthesiology registrars at four Johannesburg hospitals

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Background: Fatigue among anaesthesiologists is a critical safety concern. The prevalence of fatigue is high among South African doctors, with an unknown prevalence among South African anaesthesiologists. This study aimed to determine the fatigue scores of anaesthesiology registrars at four academic hospitals in Johannesburg.

Methods: This was a prospective, cross-sectional study using selective sampling. Data were collected from shifts worked by 47 anaesthesiology registrars in the Department of Anaesthesiology at the University of the Witwatersrand across the four academic hospitals. Objective and subjective fatigue scores for each completed shift worked by each anaesthesiology registrar were obtained using the Fatigue Audit InterDyne (FAID®) Quantum tool by InterDynamics (Brisbane, Australia) and the Karolinska Sleepiness Scale (KSS), respectively. Descriptive statistics, t-tests, ANOVA, chi-square tests, and correlation and agreement analyses (Pearson, Spearman, and Kappa tests) were used to analyse the data.

Results: A total of 1 321 shifts were analysed across 47 anaesthesiology registrars. There were 183 shifts (13.9%, 95% confidence interval [CI] 12.0 to 15.8) that scored a dangerous level of objective fatigue during a shift. Also, 446 shifts (33.8%, 95% CI 31.2 to 36.4) scored a dangerous level of subjective fatigue after a shift, indicating an elevated risk of fatigue-related errors ($p < 0.001$). A moderate positive correlation of 0.35 was observed between the two fatigue scores ($p < 0.001$).

Conclusion: Anaesthesiology registrars at the University of the Witwatersrand experience fatigue that can be considered dangerous based on objective and subjective scores. The implications of fatigue on clinical decision-making and burnout present important areas for future research.

Keywords: shift work, hours, fatigue, anaesthesiology, scores

Introduction

Anaesthesiologists are responsible for maintaining constant vigilance while monitoring patients in the theatre.[1] Their prompt recognition and response to rapidly changing situations rely on their critical thinking and fine motor skills.[2] Fatigue is a safety concern among anaesthesiologists, contributing to their cognitive, behavioural, and physiological impairment.[3] Fatigued individuals may slow their pace to maintain accuracy; however, there is no equivalent compensation to counteract their decreased alertness.[4] Therefore, monitoring an anaesthesiologist's fatigue level is important.

Safety-critical industries, like aviation, monitor employees' fatigue using fatigue risk management systems (FRMS). FRMS utilise tools to identify, manage, and prevent fatigue among employees.[5] A validated subjective fatigue tool, the Karolinska Sleepiness Scale (KSS), is commonly used to measure sleepiness as a proxy for fatigue.[6] The Fatigue Audit InterDyne (FAID®) Quantum program is an objective fatigue risk assessment tool used to discriminate between safe and dangerous fatigue levels.[7,8] Globally, the use of FRMS within the healthcare industry is uncommon.[9,10] FRMS could be implemented in the healthcare industry to monitor fatigue among anaesthesiologists, improving their vigilance over patients.

Within the healthcare industry, the Queensland Department of Health in Australia used the FAID® Quantum scoring system within its FRMS. However, the author does not report on the outcomes of using FAID® Quantum among healthcare workers. The Queensland Department of Health's guidelines stipulate that 95% of working hours should have a FAID® Quantum score < 70, with no working hours exceeding a FAID® Quantum score of 80.[9]

In South Africa (SA), the South African Society of Anaesthesiologists (SASA) guidelines on fatigue prevention are adapted from other non-medical industries. These guidelines recommend using improved shift rosters, napping, caffeine, and shorter on-call duties to address fatigue.[11] Furthermore, continuous on-call duty of less than 12.5 hours is recommended, shifts longer than 17 hours are discouraged, and shifts exceeding 24 hours are opposed.[11] However, patient care is often prioritised above these recommendations, making the application of these guidelines to SA anaesthesiologists unknown.[12]

Previous research has shown a correlation between FAID® Quantum scores and neurobehavioural impairment, psychomotor vigilance, and subjective sleepiness.[7,13-15] FAID® Quantum scores < 80 indicate safe fatigue levels, and scores > 80 indicate dangerous fatigue levels.[7] A FAID® Quantum score > 80 is comparable to being awake for 23–24 hours and is equivalent to having a blood alcohol concentration of more than 0.05%, at which point cerebellar activity becomes compromised.[16,17]

Internationally, a scoping review reported that more than half of "anaesthesia providers" reported excessive daytime sleepiness as a common workplace issue.[18] In the United Kingdom, a retrospective study using the FAID® Quantum scoring system found a significant number of potentially dangerous fatigue levels among anaesthesiology trainees.[19]

Within the SA healthcare industry, there is a growing awareness of the effects of fatigue among anaesthesiologists. A study by Sanders et al.[20] reported that approximately one-fifth of anaesthesiology registrars in Johannesburg hospitals experienced moderate sleepiness (using the Epworth Sleepiness Scale). Studies have reported that fatigue contributed to medication errors within anaesthesiology departments in Johannesburg and Cape Town.[21,22] A study by Adams et al.[23] showed a decline in psychomotor function and attention in anaesthesiology registrars after a single night shift.

While fatigue is recognised as a significant safety concern among anaesthesiologists in SA, its prevalence among anaesthesiologists is unknown. No research could be identified in the literature that used an objective scoring system to identify fatigue levels among anaesthesiologists, specifically during a shift. This study aimed to determine the fatigue scores of anaesthesiology registrars at four academic hospitals in Johannesburg.

Methods

This was a prospective, cross-sectional study. Approval was obtained from the Human Research Ethics Committee (Medical) (reference: M231161), and other relevant authorities. The study population consisted of all anaesthesiology registrars working in the Department of Anaesthesiology at the University of the Witwatersrand, rotating through Charlotte Maxeke Johannesburg Academic Hospital, Chris Hani Baragwanath Academic Hospital, Helen Joseph Hospital, and Rahima Moosa Mother and Child Hospital.

Anaesthesiology registrar allocations and monthly call rosters were obtained from each hospital's anaesthesiology department for a period of three months. Anaesthesiology registrars who were documented to be on extended leave (e.g. maternity leave) and those rotating through the intensive care unit were excluded to preserve the study population's uniformity and ensure that the collected data was relevant to shifts done in the theatre. Eligible anaesthesiology registrars were invited to participate in the study via a WhatsApp® message.

A sample size of at least 380 shifts was calculated in consultation with a biostatistician using the statistical software Stata® version 17.0 (StataCorp, College Station, United States) to achieve a significance level of 0.05 and a statistical power of 0.8, based on findings from a similar study.[19] Data collection occurred during a single rotation from 1 April to 30 June 2024 after all relevant approval was obtained. A rotation was defined as a three-month period during which an anaesthesiology registrar was allocated to work in one of four subspecialty rotations: general, paediatric, neurovascular, or cardiothoracic.

Data collection was concluded after 30 consecutive shifts or at the end of the three-month rotation, whichever came first, for each anaesthesiology registrar to ensure a consistent time frame across shifts. A shift was defined as a scheduled period of work in the Department of Anaesthesiology and was classified as either a day shift (07:00–16:00, nine hours) or a night shift (16:00–07:00, 15 hours). Night and weekend shifts were considered overtime shifts.

No standard protocol governs the number of shifts each anaesthesiology registrar completes per rotation. However, a retrospective analysis of departmental rosters indicated that anaesthesiology registrars work approximately 60 shifts in general and paediatric rotations, 70 in the neurovascular rotation, and 75 in the cardiothoracic rotation. This total includes a combination of day and night shifts. The frequency of overtime shifts per anaesthesiology registrar is governed by a commuted overtime contract with the Gauteng Department of Health, capped at approximately 80 hours per month.

The first author was the sole data collector. Each anaesthesiology registrar completed an informed consent form using an electronic Google Form™. A unique study number was allocated to each consenting anaesthesiology registrar to maintain anonymity. Demographic data (age, gender, rotation, and year of study) were collected using a second electronic Google Form™. Each anaesthesiology registrar then received a third Google Form™ link unique to their study number, which was used to complete a simple questionnaire each time a shift was completed.

The questionnaire included the shift's date, its start and end times, and a subjective fatigue score at the end of the shift using the KSS. The KSS is a nine-point scale developed by the Karolinska Institute in Sweden.[6] A KSS score ≥ 7 indicates a high risk of fatigue-related errors. The KSS is graded as follows:

1. Extremely alert.
2. Very alert.
3. Alert.
4. Fairly alert.
5. Neither alert nor sleepy.
6. Some signs of sleepiness.
7. Sleepy, but no effort to keep alert.
8. Sleepy, some effort to keep alert.
9. Very sleepy, great effort to keep alert, fighting sleep.

Shift rosters were used to track when each anaesthesiology registrar completed a shift (day or night). If a questionnaire was not received from an anaesthesiology registrar, a reminder was sent via a WhatsApp® message at the end of the shift. A shift was excluded if the questionnaire had missing data or duplicate entries.

A research licence for the FAID® Quantum Fatigue Assessment Tool version 1.1 was obtained from the developers. No funding was needed. The shift date and its recorded start and end times on the unique Google Form™ questionnaire were manually entered into the FAID® Quantum program. An objective fatigue score, represented as a "peak" FAID® Quantum score, was generated for each shift. All manually entered data were verified. FAID® Quantum uses biomathematical models to estimate fatigue by analysing work hours and shift patterns, considering the following biological determinants: time of day for work and breaks, duration of work and breaks, work history over the preceding seven days, and biological limits on recovery sleep.[7]

Each shift was described by two sets of fatigue scores: the peak FAID® Quantum score generated by the program and the KSS score provided by the anaesthesiology registrar at the end of the shift.

Data analysis

Data were entered into an Excel spreadsheet (Microsoft, Redmond, United States). A biostatistician assisted with data analysis. The statistical program Stata® version 17 was used. Peak FAID® Quantum and KSS scores were categorised as dangerous if the score was > 80 or ≥ 7, respectively; otherwise, they were categorised as normal.

Categorical data were summarised using descriptive statistics (numbers and percentages). Numerical data were summarised using the mean and standard deviation (SD). Comparisons of the number of shifts, hours worked, FAID® Quantum and KSS numeric scores between shifts (day/night), and anaesthesiologists (junior/senior) were conducted using the independent t-test and Mann–Whitney U test. Comparisons of FAID® Quantum and KSS scores by anaesthesiologists (junior/senior) and rotations were performed using the chi-square test. Individual trend data was plotted using Stata® to analyse the overall trend in peak FAID® scores, represented as a spaghetti plot.

Comparisons of the number of shifts, hours worked, and FAID® Quantum and KSS numeric scores across rotations were conducted using ANOVA and the Kruskal–Wallis test. The Pearson and Spearman correlation coefficients were used to describe the linear relationship between the FAID® Quantum and KSS scores. The Kappa test was employed to assess the agreement between the fatigue classifications of the FAID® and KSS scores. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 47 anaesthesiology registrars participated in the study, resulting in 1 321 shifts analysed (Figure 1). Nine shifts were excluded due to incomplete data or duplicate entries. A total of 45 anaesthesiology registrars (49%) declined participation. Reasons for non-participation were not formally assessed; potential contributing factors may include work and personal constraints, fatigue, reluctance to engage in research, and ongoing examination preparation. Table I shows the demographic characteristics of the 47 participating anaesthesiology registrars from the four academic hospitals.

Table I: Demographic characteristics of the anaesthesiology registrars

Variable	Characteristics	*n* (%)
Gender	Female	27 (57.5)
	Male	20 (42.5)
Age (years)	< 35	37 (78.7)
	≥ 35	10 (21.3)
Year of study	Junior (1–2 years)	27 (57.5)
	Senior (3–4 years)	20 (42.5)
Rotations	General	34 (72.3)
	Cardiothoracic	3 (6.4)
	Neurovascular	7 (14.9)
	Paediatric	3 (6.4)

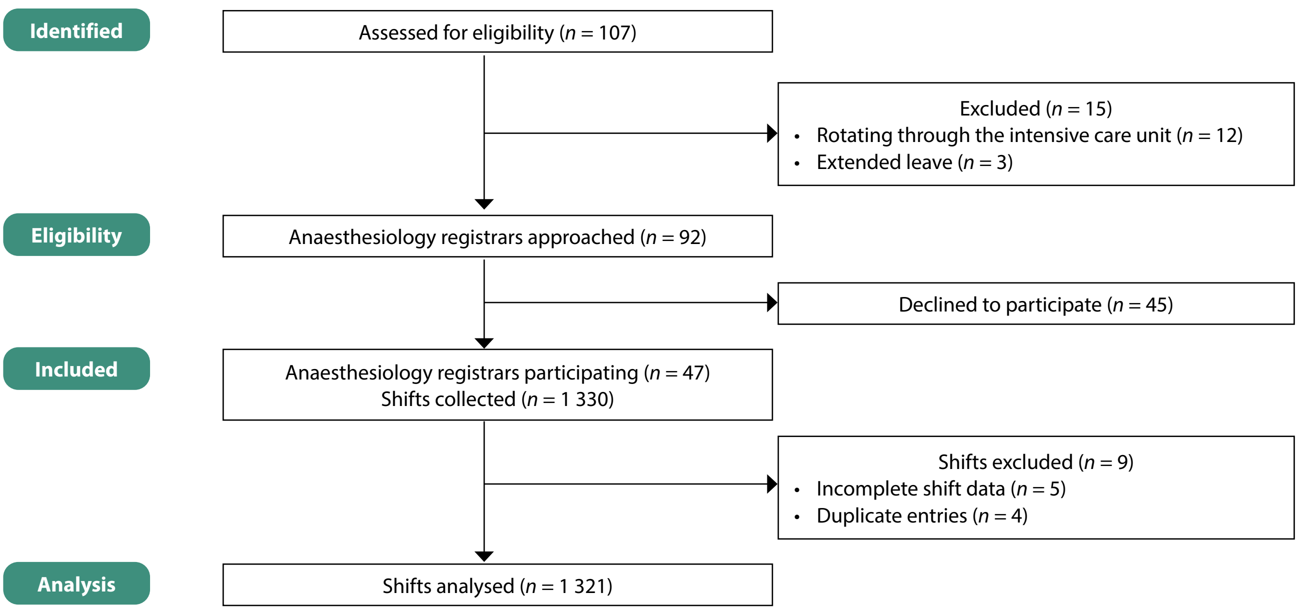

Figure 1: Anaesthesiology registrar and shift selection process

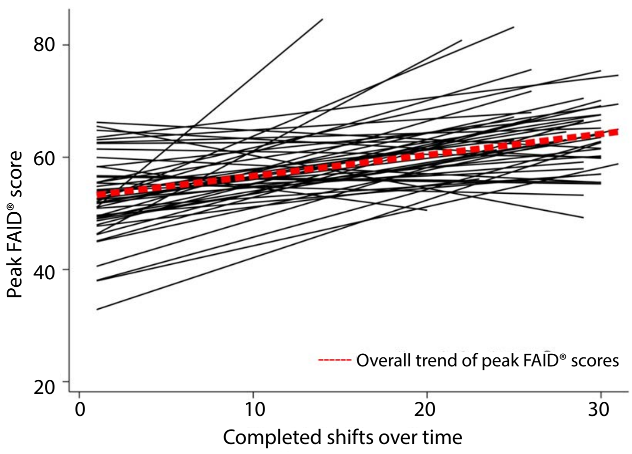

Figure 2: Peak FAID® Quantum scores over time

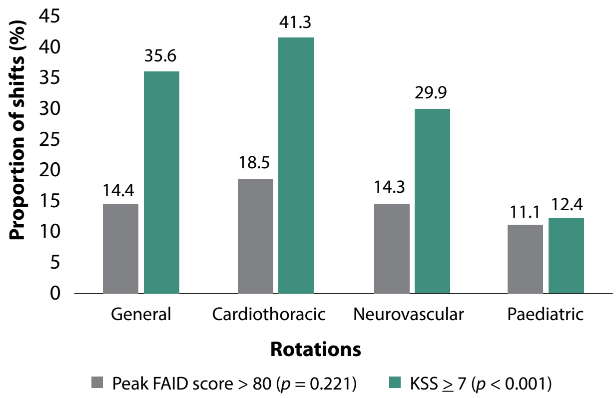

Figure 3: Comparison of proportion of shifts with peak FAID® Quantum scores > 80 and KSS scores ≥ 7 between rotations

Anaesthesiology registrars' ages ranged between 28 and 41 years, with a mean age of 32.6. The total number of shifts analysed was 1 321, of which 1 037 (78.5%) were day shifts and 284 (21.5%) were night shifts. The average number of shifts for each anaesthesiology registrar was 28.5. The mean number of shifts analysed per anaesthesiology registrar in each rotation was as follows: cardiothoracic 30.7 ± 0.5, neurovascular 28.9 ± 4.2, general 28.3 ± 2.5, and paediatric 27.2 ± 2.2. These differences were statistically significant ($p < 0.001$).

The total number of hours analysed was 13 644. The average number of hours worked by each anaesthesiology registrar was 281.6 in total. The average number of hours worked per shift for each anaesthesiology registrar was 10.3. The average number of hours worked during the day and night shifts for each anaesthesiology registrar was 8.7 and 16.2, respectively.

Peak FAID® Quantum scores > 80 (dangerous objective fatigue) were identified during 183 shifts (13.9%, 95% CI 12.0 to 15.8). Of these, 27 (2.6%) were day shifts, and 156 (54.9%) were night shifts. The mean peak FAID® Quantum score during day shifts was significantly lower (52.3) than night shifts (80.8), with a statistically significant difference of 28.5 (95% CI 26.3 to 30.7; $p < 0.001$).

Figure 2 illustrates a spaghetti plot of individual peak FAID® Quantum scores among the 47 anaesthesiology registrars throughout the study. The dotted line represents the overall trend in peak FAID® Quantum scores. The data indicate a general increase in peak FAID® Quantum scores over time with each successive shift worked by all anaesthesiology registrars.

Overall, the mean KSS score was lower after day shifts (4.8) than night shifts (7.4), with a mean difference of 2.6 (95% CI 1.6 to 3.6). These differences were significant ($p < 0.001$). Post-shift KSS scores ≥ 7 were identified during 446 shifts (33.8%, 95% CI 31.2 to 36.4). Of these, 214 (20.6%) were day shifts and 232 (81.7%) were night shifts.

The number of shifts, number of hours per shift, and the peak FAID® Quantum and KSS scores between the junior and senior anaesthesiology registrars are represented in Table II. The analysis showed no statistically significant difference between junior and senior anaesthesiology registrars in peak FAID® Quantum or KSS scores. Figure 3 compares the percentage of shifts with a peak FAID® Quantum score > 80 and a KSS score ≥ 7 across the four rotations.

The cardiothoracic rotation had the highest proportion of shifts with peak FAID® Quantum > 80 (18.5%) and KSS scores ≥ 7 (41.3%). The paediatric rotation had the lowest proportion

Table II: Comparison of junior and senior anaesthesiology registrars

	Overall	Junior registrar	Senior registrar
Number of shifts, *n* (%)			
Total	1321 (100)	773 (58.5)	548 (41.5)
Number of hours per shift			
Mean (SD)	10.3 (3.4)	10.4 (3.4)	10.3 (3.5)
Peak FAID score, *n* (%)			
Normal (≤ 80)	1138 (86.1)	671 (86.8)	467 (85.2)
Dangerous fatigue (> 80)	183 (13.9)	102 (13.2)	81 (14.8)
Mean (SD)	58.4 (21.1)	58.1 (20.7)	58.9 (21.8)
KSS score, *n* (%)			
Normal (< 7)	875 (66.2)	514 (66.5)	361 (65.9)
Dangerous fatigue (≥ 7)	446 (33.8)	259 (33.5)	187 (34.1)
Mean (SD)	5.3 (2.1)	5.3 (2.2)	5.4 (2.1)

FAID – Fatigue Audit InterDyne, KSS – Karolinska Sleepiness Scale, SD – standard deviation

Table III: Correlation and agreement between peak FAID® Quantum and KSS scores across all shifts

	Overall	Day shift	Night shift
Correlation			
Pearson (*p*-value)	0.35 (< 0.001)	0.10 (< 0.001)	0.12 (< 0.041)
Spearman (*p*-value)	0.36 (< 0.001)	0.11 (< 0.001)	0.13 (0.035)
FAID < 80; KSS < 7 *n* (%)	835 (63.2)	809 (78.0)	26 (9.2)
FAID < 80; KSS ≥ 7 *n* (%)	303 (22.9)	201 (19.4)	102 (35.9)
FAID > 80; KSS < 7 *n* (%)	40 (3.0)	14 (1.4)	26 (9.2)
FAID > 80; KSS ≥ 7 *n* (%)	143 (10.8)	13 (1.3)	130 (45.8)
Agreement			
Percentage	978 (74.0%)	822 (79.3%)	156 (54.9%)
Kappa value	0.32	0.06	0.04
p-value	< 0.001	< 0.001	0.215

FAID – Fatigue Audit InterDyne, KSS – Karolinska Sleepiness Scale

of shifts with peak FAID® Quantum > 80 (11.1%) and KSS scores ≥ 7 (12.4%). There were no statistically significant differences in dangerous objective fatigue across the rotations. However, the dangerous subjective fatigue differences across rotations were statistically significant ($p < 0.001$).

The mean KSS scores for each rotation were: cardiothoracic 5.7 (95% CI 4.8 to 6.6), general 5.4 (95% CI 4.4 to 6.4), neurovascular 5.4 (95% CI 4.5 to 6.3), and paediatric 4.0 (95% CI 3.2 to 4.8). The mean FAID® Quantum scores for each rotation were: cardiothoracic 62.8 (95% CI 55.4 to 70.2), general 58.6 (95% CI 51.0 to 66.2), neurovascular 55.0 (95% CI 47.3 to 62.7), and paediatric 60.0 (95% CI 53.3 to 66.7). The mean FAID® Quantum score differences were statistically significant between rotations ($p < 0.022$). Table III presents the correlation and agreement between subjective fatigue (KSS score) and objective fatigue (peak FAID® Quantum score) for each shift.

Pearson (0.35) and Spearman (0.36) coefficients indicated a moderate positive correlation between peak FAID® Quantum and KSS scores across all shifts. These results were statistically significant ($p < 0.001$). The Kappa value demonstrated a fair level of agreement between the FAID® Quantum and KSS classifications.

Discussion

This study found that 13.9% of all shifts had a peak FAID® Quantum score > 80, and 33.8% of all shifts had a KSS score ≥ 7, indicating that a significant proportion of shifts worked by anaesthesiology registrars occurred under dangerously high levels of objective and subjective fatigue, respectively. Nearly half (49%) of eligible anaesthesiology registrars declined participation in this study, introducing the possibility of selection bias. Formal reasons for non-participation were not assessed; however, registrars experiencing higher fatigue may have been less likely to participate, potentially leading to an underestimation of subjective fatigue levels. Shifts with missing or duplicate data were excluded to ensure accuracy and reliability. While this reduced the total number of analysed shifts, only 0.7% were excluded. Given the low proportion, these exclusions are unlikely to have affected the results or introduced significant bias.

Fatigue in anaesthesiology is a complex issue influenced by various factors, complicating its management. Anaesthesiology is comparable to other safety-critical industries, where a single lapse in judgment may lead to severe consequences. Fatigue impairs critical cognitive functions, such as vigilance, memory, and decision-making, placing patients at risk under a fatigued anaesthesiologist's care.[1,3] Furthermore, fatigue affects an anaesthesiologist's physical health, psychological well-being, and personal relationships.[24]

Roche et al.'s[19] retrospective analysis of work rosters for 122 anaesthesiology trainees in the United Kingdom found that 12.7% of shifts worked exceeded a peak FAID® Quantum score of 80. The present study adopted a prospective approach to attempt to represent variations in shift work and hours in a resource-limited setting. The finding of 13.9% of shifts having a peak FAID® Quantum score > 80 was not significantly higher than in Roche's study, suggesting that the SASA guidelines on working hours may effectively contribute to managing fatigue in SA anaesthesiologists.[11]

The average day and night shift duration was 8.7 and 16.2 hours, respectively, consistent with SASA guidelines.[11] In the present study, 54.9% of night shifts demonstrated a peak FAID® Quantum score > 80, indicating that the highest fatigue risk was during a night shift. Furthermore, 2.6% of day shifts had a peak FAID® Quantum score > 80, highlighting the potential for fatigue-related errors during daytime hours.

KSS scores indicated that 33.8% of all shifts scored ≥ 7, reflecting an elevated level of subjective fatigue. Of these, 81.7% were night shifts, with a mean KSS score of 7.4. This demonstrates that night shifts significantly impact anaesthesiology registrars' subjective fatigue despite a mandated pre-call rest period. While it may be assumed that anaesthesiology registrars rest during this period, it is more probable that some of this time is allocated to fulfilling additional academic or personal responsibilities.

The perceived degree of consultant supervision may influence anaesthesiology registrars' subjective fatigue. Overtime shifts may contribute to a burdened mindset for some anaesthesiology registrars, who may struggle to decide when to call a consultant with a problem or whether to call one at all. An off-site consultant supervising an overtime shift may increase the anaesthesiology registrar's decision-making burden, workload, and stress. An on-site consultant managing a theatre complex may require a senior anaesthesiology registrar to perform remote-site emergency anaesthesia, further adding to the decision fatigue.

Additionally, variations in consultant supervision across rotations may also impact fatigue scores. While the KSS measures an individual's state of sleepiness at a specific moment, its effectiveness is limited, as it does not consider factors such as health conditions, psychological stress, or sleep disorders. Therefore, the subjective fatigue experienced by the anaesthesiology registrars cannot be attributed solely to their work schedule. In this study, 9.2% of night shifts with peak FAID® Quantum scores > 80 were found to have KSS scores < 7. This highlights the limitations of self-assessment, as individuals may not be fully aware of their fatigue impairments.[3]

An analysis of peak FAID® Quantum scores over time showed a general increase with each successive shift, indicating an expected accumulation of fatigue among most anaesthesiology registrars. This highlights the importance of taking regular annual leave and ensuring it is of sufficient duration for adequate recovery and rest.[25] A few anaesthesiology registrars exhibited a decreasing trend in peak FAID® Quantum scores, which may have been influenced by variability in shift scheduling, particularly night shifts.

There was no significant difference in peak FAID® Quantum scores between junior and senior anaesthesiology registrars. The junior registrars worked more hours with less responsibility, while seniors worked fewer hours with more responsibility. This could explain why scores are not different because rostering considers the "cognitive load" of seniors. This result is consistent with Veasey et al.,[26] who found no difference in the performance of several psychomotor tasks performed after a 24-hour call between junior (1st and 2nd year) and senior (3rd and 4th year) non-surgical physicians. This may indicate that senior anaesthesiology registrars do not develop a significant ability to adapt to sleep deprivation and fatigue over time.[26]

A comparison between the four rotations revealed no statistically significant difference in objective FAID® Quantum scores. This may be due to the disparity in the number of shifts analysed within each rotation. The study was limited to 47 anaesthesiology registrars, with a predominance of anaesthesiology registrars in a general rotation, compared to the other three rotations, which accommodate fewer anaesthesiology registrars at a time. However, there was a statistically significant difference in dangerous subjective fatigue (KSS scores) across the rotations, reflecting how each rotation contributed to individual subjective fatigue. The cardiothoracic rotation had the highest proportion of shifts associated with dangerous objective (18.5%) and subjective (41.3%) fatigue, which was expected given the demanding nature of the rotation.[27]

The correlation between peak FAID® Quantum and KSS scores revealed a weakly positive correlation of 35%. This suggests a general agreement between the two scores, indicating that the KSS score reflects the level of objective fatigue assessed by the FAID® Quantum. This correlation may provide a practical approach to utilising the KSS to gauge fatigue levels among anaesthesiology registrars during working hours.

FRMS are well-established in other safety-critical industries; however, their application in the healthcare industry is relatively novel, with limited data on their effectiveness in this field.[28] Consensus from studies in safety-critical industries indicates that longer shifts, especially those exceeding 12 hours, are associated with a 25–30% higher risk of accidents or injuries than shorter shifts.[29] In this study, the average number of hours worked per shift for each anaesthesiology registrar was 10.3. Despite this being fewer than 12.5 hours (per SASA guidelines), managing fatigue among healthcare workers is particularly challenging, especially among anaesthesiology registrars in a resource-limited setting. Financial constraints and staff shortages are common problems in state healthcare.[30] Besides adhering to SASA guidelines on working hours, changes will be required at organisational, behavioural, environmental, and educational levels.[5]

Study limitations

This study is limited because it was conducted contextually within the Department of Anaesthesiology of one university. Therefore, it cannot be generalised to other anaesthesiology departments. Additionally, potential recall bias and variability in self-reported data could not be controlled. Limitations of the FAID® Quantum program include disregarding personal factors (such as sleep disorders or health conditions), the assumption that recovery occurs solely during non-working periods, and considering an individual's fatigue only over the preceding seven days. Future studies with longer durations across multiple anaesthesiology departments are recommended.

Conclusion

This study showed that a significant proportion of shifts worked by anaesthesiology registrars occurred under dangerously high fatigue levels. Furthermore, the study demonstrated a correlation between objective and subjective fatigue scores and a general increase in objective fatigue scores over time.

The field of anaesthesiology has much to learn from other safety-critical industries. Integrating FRMS tools into organisational strategies could support the assessment of future work schedules, identifying individuals and shifts at increased risk of dangerous fatigue levels. Emphasis should be placed on reducing the duration and frequency of night shifts, particularly those scheduled in close succession, as a potential consideration in departmental call roster planning. However, these recommendations may not always be feasible within specific hospital settings.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

This was a prospective, cross-sectional study. Ethical approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (Medical) (reference: M231161).

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