



Exploring the impact of overnight call stress on anaesthesiology senior residents' perceived ability to learn and teach in an Asian healthcare system: A qualitative study

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ABSTRACT

Acute stress can influence clinical performance, reasoning and decision-making. Our Anaesthesiology senior residents encounter physical and psychological stress during the overnight calls. To date, the impact of these stressors on their ability to learn and to supervise is unclear. We explored the nature of these stressors, and their influence on our trainees' perceived learning and teaching.

We conducted this qualitative study from August 2017 to February 2018. We adopted the constructivist approach to explore the participants' experiences, and used focus group interviews to derive the information. An inductive and iterative process of information collection, analysis and thematic classification was employed. 7 senior residents participated in the interviews.

The participants experienced high levels of stress during the calls. Four categories of stressors were identified: (1) emergency work, (2) physical and mental exhaustion, (3) concerns over supervisory roles and incurring clinical risks, and (4) concerns with appearing deficient. Participants' perceived learning was negatively affected, and associated with emotions of frustration, self-doubt, and guilt. Teaching of junior residents was perceived to be impacted negatively. Patient outcomes may be affected by learner demotivation and cognitive errors. We identified the physiological and safety needs of these learners and suggested strategies to overcome them.

Stressors encountered during overnight calls can influence the learning and teaching of trainees. Strategies should be implemented to reduce the impact of these stressors and to enhance the learning experience of trainees, and further work should be done to determine the effectiveness of such measures.

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1. Background

Acute stress can have both positive and negative impacts on the learner. While controlled stress has been shown to enhance cognitive abilities such as memory recall and learning performance [1,2], excessive stress can have detrimental effects on academic learning and diagnostic performance [3,4].

Overnight calls are known to be stressful across most medical specialties [5,6]. The physiological and psychological consequences of these stressors are concerning and can affect the well-being of the physicians [7–9]. In Anaesthesiology, a Finnish study [10] found

that 68% of the participating physicians experienced high levels of stress. Reported symptoms of stress included physical exhaustion, irritation, emotional changes, feelings of guilt and the need for alcohol in order to cope. The study elicited some key factors which included acutely sick patients, unpredictability of emergency work, multiple concurrent clinical demands, time constraints and sleep deprivation. The lack of sleep and the disruption of the sleep circadian rhythm imposed additional load on the ability of the anaesthetists to cope in these situations. There were descriptions of mental impairment, accompanied by deterioration in cognitive performance and changes in behaviour. Indeed, sleep deprivation was found to disrupt physiological attention, delay reaction time [11], reduce cognitive performance and impair clinical reasoning [4,12].

This subject is concerning, as our Anaesthesiology senior residents in Singapore manage 16–24 hours overnight calls as

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specialists-in-training. They care for acutely sick patients in the operating theatres and intensive care units. Their responsibilities includes the resuscitation of rapidly deteriorating patients, and responding to codes within the hospital at the same time. They lead and supervise a team of 3–4 junior residents in providing anaesthesia support. Learning by the senior residents is largely self-directed, through the experiential management of the patients. Consultation and indirect supervision are provided for by an offsite specialist. In addition to providing patient care, the Accreditation Council for Graduate Medical Education International (ACGME-1) stipulates that the senior residents should also “*serve in a supervisory role of junior residents in recognition of their progress toward independence, based on the needs of each patient and the skills of the individual resident*”.

The nature of the stressors and their impact on the senior residents' training was unknown in Singapore. Little information was available in the literature detailing how our specialists in training cope and learn under these stressful conditions. Conversations with our senior residents suggested that their prime motivation was “to get by, or to survive” the call with minimal complications. Moreover, we were unclear of how the junior residents were supervised and taught under these conditions.

In Anaesthesiology, our residents learn through the application of medical knowledge and performance of clinical tasks. Through the deliberate performance of these real-world tasks, they learn and gain expertise in their anaesthetic skills. The process of their experiential learning is supported by the theory first described by Kolb [13], that “the impetus for the development of new concepts is provided by new experiences”. As the residents manage each anaesthetic case, they should go through the four stages of learning which include: (1) concrete experience (experience), (2) reflective observation (perception), (3) abstract conceptualization (cognition), and (4) active experimentation (behaviour). Kolb viewed effective learning as an integrated process, and opined that effective learning only occurred when the learner was able to follow through all four stages of the cycle. As each stage would lead into the development of the next, no single stage would be effective on its own. We utilised this model to analyse the collective impact of the stressors on the senior residents' learning.

Our current insight into how the senior residents were learning was provided for by the end-of-posting reports. We recognised the shortcomings of these summated quantitative scores to reflect the quality of their learning. Most of the questions were surrogates of learning and the learning environment, such as duty hour and resource reports. Furthermore, the questions did not specifically address the influence of these call stressors on learning and teaching. Hence, we identified the need to derive deeper, meaningful information on this important topic by conducting this qualitative study.

Our research questions were as follows:

1. What stressors did our senior residents perceive during the overnight calls?
2. How did the stressors impact their perceived ability to learn?
3. How did the stressors influence their perceived teaching behaviour?

2. Methods

We conducted this qualitative study from August 2017 to February 2018. We chose the constructivist approach in order to build on our existing knowledge of the stressors encountered by our residents during the overnight duties. Through this inquiry, we aimed to derive new deeper knowledge on how the senior

residents' education was influenced by their interactions in the acute clinical environment. Focus group methodology was chosen to interview the participants to gain rich, in-depth into their shared experiences [14]. We recorded the participants' responses, as well their interactions during the group discussions. We observed and noted their agreements and disagreements, in both verbal conversations and body language. An inductive and iterative process of information collection, analysis and thematic classification was used.

2.1. Data collection

The study was situated at the SingHealth Anaesthesiology Residency Program in Singapore. SingHealth is a healthcare cluster in Singapore comprising of three hospitals - two tertiary institutions (Changi General Hospital, Singapore General Hospital) and a combined paediatric and obstetric hospital (KK Women's and Children's Hospital). Senior residents rotate through these training institutions during their two years of senior residency training.

A purposive homogenous sampling strategy was used for the recruitment of participants [15]. This strategy was selected to fulfil our purpose of exploring the common experiences encountered by the senior residents and their perceptions. The inclusion criterion was senior residents in their first 4 months of Senior Residency. The aim of this study was first presented at the senior residency teaching sessions. Ten eligible senior residents were identified, and email invitations were sent out to them. Participation was voluntary and at the time of the interviews, each participant had completed four months of overnight duties as senior residents at the tertiary centres. Three participants declined participation in the study.

A semi-structured question format was used during the focus groups [16]. We formulated the initial interview questions and probes based on our research questions. There were 5 initial questions and 3–4 probes under each question. Subsequently, we adjusted the questions and probes iteratively to draw out more meaningful information from the participants.

In order to avoid power issues, the focus group interviews were conducted by two senior residents (Lee, Loh) in their final year of training. Individual interviews were further conducted with selected participants to further explore the themes that were uncovered. Individual interviews allowed participants to share freely about sensitive experiences that they may not have felt comfortable sharing in the group setting.

We gathered demographic data of the participants, including their gender, age and their anaesthetic clinical experience. The opening questions were semi-structured in nature, and the interviewers could elicit further elaboration of key aspects using the prepared probe questions. The interviews continued till saturation of information was obtained. Further one-to-one interviews were conducted to allow in-depth exploration of identified themes.

2.2. Data analysis

All interview sessions were audiotaped and transcribed verbatim in their entirety by a transcription staff familiar with medical terminology. The transcripts of the focus group and individual interviews were separately coded by us (Goy, Lee and Loh). We independently categorised the codes into a code table and met regularly in person to compare our findings. Emergent themes were identified and discussed through the analysis of the codes and to discuss emergent themes. We also triangulated the interview data with the observations of agreements and disagreements of the participants. Broad themes capturing these codes were developed. We independently wrote a descriptive summary addressing the key

aspects of the research questions. An independent reviewer checked the coding and thematic approaches. We subsequently discussed these results at the education and faculty meeting for reflexive sharing and to ensure rigor of the results.

Various strategies were employed to establish and ensure quality in our study [17]. We employed strategies of iterative data collection and data triangulation to ensure credibility of our data. Member checking was also performed to ensure participants agreed with the study's findings and conclusions. To facilitate transferability, we described the context, and the experience of the senior residents in great detail. In the discussions, we compared our findings with existing studies from similar and different educational settings. In order to maintain the objectivity of our study, we presented the findings to faculty members at educational meetings. To overcome personal and epistemological reflexivity issues, we formulated the study and questions with the education committee, comprising of educators from different backgrounds. We triangulated our findings with the senior residents' end-of-posting feedback. We maintained our objectivity through the discussion of our findings with our education committee, as well as all faculty members in the training departments.

2.3. Ethics

This study was exempted from a review by the SingHealth Centralized Institutional Board (CIRB Ref: 2017/2582). Participation was voluntary and informed consent was taken from the participants with assurance that their responses during the focus group interviews would be kept confidential, anonymous and will be deidentified. The aim of this study was explained, which was to identify the stressors that they faced during night calls, as well as the impact on their teaching and learning. With this information, strategies could be implemented to mitigate these stressors.

They were assured that their responses would not be used in their performance evaluations and were also given an option to withdraw their participation during the study. At the time of the interviews, both interviewers were second year senior residents (Lee and Loh). This would avoid any conflict of interest as they are not directly involved in the senior residents' performance evaluations.

3. Results

Seven senior residents (3 females, 4 males) participated in two focus group interviews. This constituted seventy percent of eligible participants. Their ages ranged between 28 and 33 years. All the participants were in the first four months of senior residency training. The focus group interviews lasted 55–65 minutes. Four participants from the focus groups (2 females, 2 males) participated in further individual interviews and provided more information. The individual interviews lasted between 35 and 45 minutes. No participants participated twice in any focus group.

The participants concurred that high levels of stress were experienced during the night calls. Four broad themes were identified, which included (1) emergency case presentations, (2) physical and mental exhaustion, (3) concerns over supervisory roles and clinical risks, (4) concerns with appearing deficient. Table 1 summarises the associated factors under each of these themes. These collective factors affected the participants' perceived ability to learn and teach.

3.1. Overnight call stressors

3.1.1. Emergency case presentations

Key clinical stressors included managing sick patients with

complex problems, handling anaesthetic crises and providing anaesthetic care at multiple hospital locations. The unpredictable timings and nature of the clinical responsibilities, coupled with the need for rapid responses presented constant stress throughout the call.

"I keep thinking that something is going to happen."

The participants felt that junior residency training did not prepare them fully to take on these unpredictable situations with confidence. Specifically, the participants found that junior manpower delegation, and unfamiliarity with system resources and processes posed the greatest challenges. One participant recounted his first experience in managing a hypotensive patient with a ruptured abdominal aortic aneurysm.

"Before this, I have never done this by myself."

Multiple simultaneous clinical demands resulted in high tension situations, as close supervision was necessary when running multiple emergency operating theatres. At the same time, they could be called to resuscitate deteriorating patients in other remote locations.

"I do not know the resources that I have ... the emergency department itself is not familiar environment to us."

3.1.2. Physical and mental exhaustion

The participants confirmed that physical fatigue was a stressor during these calls, regardless of age. This was especially so when the calls were frequent and closely spaced. Physical fatigue resulted in greater challenges in performing invasive procedures due to psychomotor impairment. There were higher failure rates and patient complications. They also felt the immense pressure to get the procedures done safely and quickly which resulted in greater stress.

"I have jittery hands whenever I am tired and doing the procedures."

"You feel immense pressure that you need to get the procedures done as soon as possible, and there's no room for mistake"

According to the participants, acute stress could result in, or be a result of poor clinical judgement and decision making. They reported a tendency to make "snap" and instinctive patient care decisions when fatigued or stressed. They remarked that hasty decisions were made (that they would not normally make in a more controlled situation), and that had resulted in undesired patient outcomes. These hasty decisions often affected the participants days after the call, as feelings of guilt, frustration and self-doubt set in.

"I fear that my decision now might be detrimental to the patient, fear that my decision may be wrong."

3.1.3. Concerns with supervisory roles and clinical risks

The participants also experienced stress from being the anaesthetic team leader. It was stressful to be accountable for the performance of the whole team, and be responsible for all potential medical errors made by junior doctors. It was particularly challenging as the junior doctors were at different levels of training and had varying degrees of anaesthetic experience. Factors contributing to the challenges included an inexperienced team, unfamiliarity

Table 1
Thematic classification of the stressors experienced by the senior residents on overnight duties.

Themes	Associated Factors
Emergency case presentations	<ul style="list-style-type: none"> - Dynamic, unpredictable clinical care demands - Emergent care in multiple hospital locations - Critically ill patients
Physical and mental exhaustion	<ul style="list-style-type: none"> - Inexperience with resource management and manpower delegation - Physical fatigue and psychomotor impairment - Failed procedures on sick patients and complications - Cognitive overload and mental exhaustion
Concerns with supervisory roles and clinical outcomes	<ul style="list-style-type: none"> - Impairments in information processing, clinical judgement and decision making - Hasty and “instinctive” decisions - Supervision of multiple residents in separate locations - Varying experience of the on-call juniors - Concerns with clinical risks and incurring complications
Concerns of appearing deficient to the supervising consultant	<ul style="list-style-type: none"> - Societal expectations - “Asian” culture - Strong hierarchical influences reporting structures - Uncertain boundaries for reporting to the faculty - Disruptive communications leading to surgeons’ complaints - Concerns of poor training feedback - Competitive specialist employment - Competitive subspecialty training in anaesthesiology

with their capabilities, simultaneous demands for their assistance at multiple locations as well as remote locations in the hospital (such as the angiography suite, radiological suite). The main concern was the delegation of direct or indirect supervision to the junior doctors, which has to be appropriate for the latter’s experience and the complexity of the case.

“I’ll find it hard to forgive myself if there is patient harm.”

The participants were also concerned about the impact of exhaustion on their own performance and clinical risks. They cited poorer information processing and clinical judgement as well as making hasty decisions, as a consequence from the collective stressors. According to them, these impairments stemmed not only from physical fatigue and diminishing concentration, but were also consequences of emotive changes, such as anxiety, hostility, self-doubt and diminished self-confidence. As a result, less attention was devoted to details, decisions tended to be instinctive, and communications abrupt.

“I tend to have tunnel-vision, trying to focus on one thing and forget the bigger picture.”

3.1.4. Concerns with appearing deficient

In the setting of limited manpower and resources, there were tensions in making decisions on the prioritization of emergency cases. Stress arose from the conflicts in managing the expectations of the surgical colleagues, especially when their assessment of the urgency of the case differed from the senior resident. The pressure was exacerbated whenever the surgeon was more senior in hierarchy. The participants were concerned that the surgeon would escalate the delays to their consultant, and they would appear incapable of managing the situation.

“The stress is when they (the surgeons) are unhappy, they would escalate the situation to my consultant.”

The participants voiced their concerns about consulting the supervising consultant for advice on the management of challenging patients. They shared their belief that the supervising specialist would view them as deficient in their clinical ability.

Various reasons were offered, including concerns with poor impressions, performance feedback, and progress reports.

“It is stressful for me seek advice on from the consultant ... we’ll be judged for calling.”

3.2. Impact on the senior residents’ perceived ability to learn

Motivation to learn was transiently increased at the start of the calls. Their clinical judgement and decision making improved initially, due to the clinical stimulus. But their performance deteriorated rapidly as the call progresses, as stress and fatigue set in.

“You feel sharp and alert when your adrenaline is pumping, but as the cases keep coming, you find that your mind jams”.

The participants agreed that the major impediments to their learning were poorer physical dexterity, poorer concentration, lapses in memory and declining cognitive performance. While physical stress, sleep deprivation and fatigue were important factors, the participants felt that the emergent nature of the work contributed to the perceived uncertainties in learning. The high load of emergency cases and supervision of the junior residents in multiple locations limited the opportunities for observations and reflections on their decisions. They recognised that the reluctance to seek advice, validate their clinical judgement and decision making with their consultant reduced the opportunities for feedback, reflection and learning.

3.3. Impact on the senior residents’ perceived ability to teach

The participants were less inclined and motivated to teach the junior residents. They were of the opinion that the supervision of the junior doctors constituted their primary responsibility, in order to ensure patient safety. Teaching, on the other hand, was deemed to be secondary. All participants agreed that their primary purpose was to “get by the call” with minimal complications and poor outcomes.

“Very often, teaching gets the second priority in most of my calls.”

As a result, the senior residents devoted less resources and attention to teach, especially when physical and mental fatigue set in as the call progresses. They agreed that they would also become more impatient.

“There is less time allocated, (or less energy) spent at educating, but I guess the juniors can learn through observing what you do to manage each case.”

The senior residents' concerns with clinical complications influenced their perceived teaching behaviours negatively. They were hesitant in allowing junior residents to perform the more invasive procedures. They were also more likely to take over the procedure at the first indication of trouble and difficulty. Significant factors included emergency or crisis situations, sick patients, lack of confidence and self-doubts.

“I am less willing for juniors to try something new on call, just to reduce the chance of something happening to the patient.”

4. Discussion

Four categories of stressors affecting Anaesthesiology senior residents were found in our local context. They included the nature of emergency case presentations, exhaustion due to sleep deprivation and cognitive overload, concerns over supervisory roles and clinical risks as well as concerns about appearing deficient to the supervising consultant. These stressors paradoxically enhanced learning at the start of the overnight call but diminished as the call progressed. There was also less guidance and teaching of the junior residents on call.

Our results provided four important insights into the clinical question. Firstly, other than the predictable stressors (demands of emergency work and fatigue), we also identified other issues related to the learners' sense of safety and security in the learning environment. Secondly, we reaffirmed the findings from other studies—that elevated levels of uncontrolled stress contributed to the impairment of all aspects of clinical performance (task performance, attention, information processing, decision making and memory) [4,11,12]. Thirdly, concerns with impaired performance elicited undesirable feelings of worry, frustrations, self-doubt and fear in our learners. These self-doubts could in turn result in medical errors [18], and compromise patient safety [12]. Finally, we believed this was the first study to establish the direct negative relationship between uncontrolled stress, and experiential learning and teaching.

Acute stress resulting from emergency work and fatigue was predictable. Each physician would have encountered stressful challenges that were unique in their clinical context. However, some stressors were universal. They included high emergency load [19], time constraints [20], unpredictable nature of patient status [10], critically ill patients [19,20], and sleep deprivation [21]. Given that stress perceived by our participants was due to the combination of these dynamic factors, we were unable to identify the predominant stressors with the most impact on learning and teaching. Nonetheless, these stressors affected their perceived ability of our senior residents to learn and teach because of exhaustion both physically and cognitively.

Reluctance of the senior residents to consult their faculty for fear of appearing deficient and their concerns with clinical risks appear to be contradictory. When encountered with a difficult situation, one would expect a concerned senior resident to consult more readily. Instead, in our situation, the senior residents were not

seeking advice even when they were concerned. There could be multiple barriers to faculty consultation, which we postulated were predominantly socio-cultural in nature. It was observed that Asian learners had different problem-solving approaches and communication styles as compared to their Western counterparts [22,23]. The former were perceived to have an “excessive regard for authority” and could naturally be more reticent in escalating the issues and clarifying doubts [24]. The established hierarchical structure in the Singapore healthcare system could have impeded open communication. Self-doubts and fear were also prevalent themes in our study. The senior residents' fear of patient mismanagement and poor outcomes was constantly being weighed against the fear of appearing deficient by the faculty when seeking advice. These concerns stemmed from the extremely competitive specialist employment and anaesthesia subspecialty training in Singapore.

4.1. How did the stressors affect the perceived learning of the senior residents?

The stressors disrupted the senior residents' perceived learning at every stage of the experiential learning cycle. Table 2 illustrated our analysis of the disruptions, using the Kolb's experiential learning model as a framework, which include: (1) concrete experience (experience), (2) reflective observation (perception), (3) abstract conceptualization (cognition), and (4) active experimentation (behaviour) [13]. Our senior residents did not have the opportunity to complete their learning for the cases they managed. Of particular concern, incomplete learning resulted in demotivation and emotions of fears, frustrations, and self-doubts. These factors typically resulted in the phenomenon of premature closure [4], which constituted one of the top cognitive errors in anaesthetic practice [25]. We are of the opinion that the most critical (and the most remediable) stage in the learning cycle was the reluctance to “call, consult and discuss”. There were missed opportunities to engage in guided learning and decision-making with faculty during these acute situations.

4.2. How did the stressors affect the perceived teaching abilities of the senior residents?

We believe that these were the first detailed descriptions of how stressors could have influenced the perceived teaching of junior doctors. Stress and time constraints resulted in less interactions and communication between the senior and junior residents [26]. We conceded that it was not reasonable to expect the senior residents to teach well in these circumstances, where they could be struggling with their own challenges to cope and to learn. A vicious cycle could ensue, where the main objective was to “get by” the call and adopt non-teaching as the cultural norm. These beliefs self-perpetuated the situation, where the junior residents would progress into senior residency without the grounding of systems-based learning. Unless measures are taken to “break” this cultural belief, resident uncertainty in their practice could result in patient harm [27].

4.3. Recommendations

Strategies to reduce the stress associated with night calls and improve the education of the residents should be based on meeting their needs for physiological well-being, safety and self-esteem.

4.3.1. Physiological well being

While it may not be possible or feasible to eliminate overnight calls, training programs can look into the frequency and spacing of

Table 2
The impact on the learning abilities of the senior residents.

Stage	Positive Impact	Negative Impact
Concrete experience (experience)	- Motivation and drive to learn was increased for short periods at the start of the calls (before stress and fatigue set in).	- Physical stress and fatigue resulted in poorer clinical judgement and reduced psychomotor dexterity. - Mental stress culminated in poorer memory, concentration and cognitive lapses. - Cognitive overload resulted in tunnel vision and hasty decisions.
Reflective observation (perception)	–	- Reduced time and cognitive bandwidth limited reflective learning.
Abstract conceptualization (cognition)	–	- Poorer communications limited opportunities for observations and reflections. - Reluctance to consult seniors reduced feedback and validation of competence.
Active experimentation (behaviour)	–	- Concerns with poor outcomes reduced experimentation. - Self-doubts limited innovation and exploration.

the calls, implementation of the shift system [28], and the re-engineering of duty coverage [29]. Indeed, reduction of a 24-h to a 16-h call model for anaesthesiology residents resulted in less fatigue, improved resident wellness, and improved satisfaction with their educational experience [30]. Importantly, half of the respondents indicated that patient safety was improved. Innovative sleep intervention strategies, such as on-duty protected napping had reduced fatigue during and after the calls [31]. There should be a wellness program and social support systems in the work place [32,33].

4.3.2. Safety

Our learners need to feel safe in their working and learning environment. This is especially important in our context where there are strong socio-cultural and hierarchical influences on the residents' learning strategies. The senior residents should be encouraged to seek advice whenever in doubt. A safe and secure learning environment should be established [34], in order to reassure the learners that consultations will not be viewed as being deficient. Clearly defined, but non-exhaustive, guidelines can provide guidance to senior residents on the need for phone consultations with supervising faculty. In addition, the faculty should be briefed on the importance of flattening the hierarchy in teams [35], in order to encourage consultations, promote better communication between team members and timely specialist advice for patient care.

4.3.3. Guided independence, confidence, achievements and self esteem

Case-based discussions of previous challenging cases may promote deeper learning, critical evaluation, and appreciation of the available system resources. New senior residents can be tagged onto the experienced counterparts during the initial calls, thus allowing guided progressive independence. While this would not eliminate some of the stressors, this mentorship would allow them to learn how to manage the multitude of demands during subsequent overnight duties. Debriefing can be done with the supervising consultant for discussions of the events, feedback, reflection, and learning [36]. In-situ simulations could serve as an invaluable preparation to new senior residents embarking on independent overnight duties as team leaders [37]. Simulation training allows for repeated practice on less frequent emergent or crisis situations. It allows for learning of team management, effective resource management and communication. Through team-based simulation, senior residents can be empowered to become effective team leaders, gaining confidence and self-esteem.

4.4. Cognitive errors and non-technical skills in anaesthesiology

Cognitive errors are errors in the thought process, which can occur even though there is sufficient knowledge and data available

to the healthcare professional. Such errors in anaesthesiology occurs because of failure of heuristics or biases [38]. One such error is 'anchoring', or fixation error, that occurs when one is focused on a particular detail and fails to take the entire situation into consideration [38]. This has been reported by Anaesthesiology senior residents during overnight duties as a consequence of physical exhaustion. This error is not a result of knowledge gaps, but can nonetheless impair clinical judgement and affect patient safety. Another such error is 'premature closure', which occurs when the clinician neglects to consider other differential diagnoses when faced with a clinical problem [38]. This could occur because of physical fatigue, which negatively impacts learning on call, as well as the lack of timely faculty consult when faced with an unfamiliar clinical situation because of fears of appearing deficient. Ultimately, inappropriate clinical decisions and treatment may be made, which could result in adverse patient outcomes.

Performance of tasks safely in anaesthesiology has been shown to be dependent on both technical and non-technical skills. Errors in anaesthesiology have been increasingly attributed to deficiencies in non-technical skills in anaesthesiology (ANTS) [39], which involves task management, team working, situational awareness and decision making [40]. In the NAP4 audit on major airway complications [41], poor communication (especially between specialties) and heavy workloads were among some of the factors that were identified to have resulted in human error. Fatigue reduces vigilance, slows cognition, increases reaction time and worsens decision making abilities [39]. Conflicts in communication between surgeons more senior in hierarchy as well as the multiple simultaneous demands from managing sick patients faced by Anaesthesiology senior residents, could potentially compromise patient care during overnight duties.

4.5. Limitations

Our study has a number of limitations. Firstly, this research was conducted in the context of anaesthesiology senior residents performing their overnight duties in major tertiary centres in Singapore. As the resultant stressors could be unique to the Asian cultural context, we urge our readers to assess the transferability of our results to other systems [42]. Different work practices, training processes and supervision requirements could result in unique challenges and varying outcomes in learning and teaching. We also note the small numbers of participants in the study which limits generalisability, though this constitutes a seventy percent participant rate among eligible candidates. We acknowledge that some of the perceived stressors and their effects may have been contributed to by the process of transition and not solely attributed to the overnight duties, and could possibly diminish as these novice senior residents gain more clinical experience. Also, our findings on the impact on senior residents' learning and teaching on overnight duties is limited to the experiences perceived and reported by

participants as we did not measure their ability to learn, or observe the teaching behaviour. Finally, our study did not aim to elicit the other non-work-related stressors, such as poorer social support [10], having children [43], perceptions of calls encroaching on family time as well as the presence of “critical life events” [20].

5. Conclusions

Anaesthesiology overnight call stress has a perceived negative impact on learning and teaching. Importantly, we identified that stressors stemmed not only from the emergency workload, sleep deprivation and fatigue, but also from socio-cultural and work place hierarchical barriers. There are knowledge gaps on the subject that we could investigate further. These include the impact of the same anaesthesiology overnight call stressors on the coping and learning of novice (or inexperienced) learners as well as how concerns with clinical risks influence clinical teaching and learning. These are fundamental issues concerning patient care and safety in anaesthesiology residency training that require our urgent attention.

Declarations of interest

None.

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Declarations

Ethics approval and consent to participate

This study was exempted from review by the SingHealth Centralised Institutional Review Board (CIRB) (Ref: 2017/2582) on 4 July 2017.

Informed consent was obtained from the participants prior to their participation in the study.

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