Principles of Fatigue in Residency Education

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Abstract

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Introduction

Fatigue management strategies (FMS) have been proposed in Canada as a viable alternative to the prescriptive resident duty hour restrictions that exist in many other countries. Other risk-adverse industries, such as aviation, transportation and military, have embedded FMS within workplace occupational health and safety programs that identify fatigue as a threat. Without pre-existing models of fatigue management in medical education, it's unclear whether fatigue is similarly conceptualized as hazardous. This study sought to explore how residents understand fatigue in the context of their training environment.

Methods

We interviewed 21 residents across 6 surgical and non-surgical programs, at one Canadian institution in 2014. Data collection and analysis occurred iteratively, in keeping with constructivist grounded theory methodology, and informed theoretical sampling to sufficiency.

Results

Four predominant principles of fatigue captured how the social learning environment shaped residents' perceptions of fatigue. These included the conceptualization of fatigue as: (1) inescapable and therefore acceptable, (2) manageable through experience, (3) necessary for future practice and (4) surmountable when required.

Interpretation

This study elaborates our understanding of how principles of fatigue are constructed and reinforced by the training environment. Whereas fatigue is seen as a collective threat in other industries, our data show that across the principles, fatigue is seen as a personal challenge. FMS approaches that treat fatigue as an occupational threat may ultimately have limited impact on patient safety and resident fatigue.

Introduction

Emerging research has challenged whether resident duty hour restrictions have done more harm than good [1-4]. In Canada, the National Steering Committee on Resident Duty Hours proposed fatigue management strategies (FMS) as a promising alternative to prescriptive "one size-fits-all" resident duty hour restrictions [5, 6]. The final report advocated for new accreditation standards which would require residency programs to "develop, and keep up to date, fatigue risk management plans" [5, 6]. Empirical evidence supports the notion that prolonged sleep deprivation leads to performance impairment [7-10] and FMS would fulfill a need to maintain public accountability in the absence of duty-hour legislation. However, as Pattani and colleagues note, this mandate lacks important details about the design and implementation of FMS [6].

Unlike the explicit policies that limit resident duty hours in other countries, there is no model for FMS in medical education, and research about effectively managing fatigue in residency contexts is scarce. Arora et al found that an educational seminar to improve sleep hygiene practices had minimal impact on residents' behaviour [11]. Policies of protected sleep time during prolonged duty periods have shown inconsistent results [12, 13]. Additional studies have highlighted how the influence of local training culture can trump duty hour policy [14] and alter perceptions of the impact of sleep deprivation [15]. These varied perceptions and cultural influences have received little attention to date amid discussions of anticipated FMS.

In other industries, such as transportation, aviation and the military, fatigue management strategies benefit from a uniform understanding of fatigue as an occupational threat [16]. The fact that residents and faculty hold varied perceptions about the impact of fatigue on clinical performance, particularly within surgical contexts, suggests that fatigue may

not be quite so straightforwardly understood in residency training [15, 17]. Until we know more about how fatigue is understood in residency training across multiple disciplines, we risk developing FMS that are irrelevant and fail to address the existing shortcomings of duty hour restrictions. Thus, this study seeks to explore how residents understand fatigue in the context of their training environment.

Methods

We used a constructivist grounded theory (CGT) approach, which is suitable for socially situated research questions [18]. We conducted 21 individual, semi-structured interviews at three hospitals within a single academic training centre with radiology, psychiatry, critical care, general surgery, pediatrics, internal medicine, and orthopedic surgery residents. We deliberately sampled across these programs because the nature of residents' on-call work varied and we wanted to include programs that have had limited representation in the existing duty hours literature. All participants were routinely scheduled to work 24h call shifts, as per our inclusion criteria. Recruitment, data collection and analysis took place between December 2013 and June 2014. In keeping with CGT methodology, we progressed from convenience to purposive and then theoretical sampling to sufficiency [19]. One co-investigator (TT - a resident at one of the hospitals) conducted 20/21 interviews. A co-investigator (LL – a non-clinician scientist) deliberately conducted one interview for the purposes of rigor [20]. As insider within the research setting, TT followed standard techniques for attending to her insider role throughout the analytical process [18, 21].

Analyzed data included transcripts of the audio-recorded interviews, alongside field notes and analytical memos written by TT. We followed the iterative process of data collection and analysis, which is characteristic of CGT [18]. This required revisions of the semi-structured

interview guide in response to progressive refinement of the emerging theory. We chose not to confine the interviews to any specific definition of fatigue (e.g. physiological, cognitive, emotional, chronic, acute, etc.) to allow for a more inclusive representation of fatigue.

Our analysis had three phases. It began with axial coding, followed by constant comparative analysis, which led to a more conceptual coding framework [18]. Further refinement of this framework through collaborative analysis amongst co-investigators (TT, LL, PT, TD, CW) resulted in the final emergent theory. NVivo® qualitative analysis software and MindNode Pro®, a mind-mapping tool, were used to organize the coding process.

We obtained research ethics approval from the institutional research ethics board at Western University (#102769).

Results

Twenty-one participants were sampled from a range of postgraduate years (1-7) and included 13 male residents, 12 married residents, 6 residents with children and 13 senior-level residents, as defined by the individual programs.

Residents referred to various features of their training environment that informed how they recognized, discussed, and responded to fatigue in the context of residency training. The implicit aspects of the learning environment had more to say about fatigue than anything that was explicitly said. Given the lack of explicit dialogue about fatigue, residents referenced tacit messaging that remained embedded within role-modeled behaviour, professional identity constructs, and normative expectations to understand what fatigue in residency was all about.

Four "principles of fatigue" captured these socially informed ways in which residents made sense of fatigue. Fatigue was seen as: (1) inescapable and therefore acceptable, (2) manageable through experience, (3) necessary for future practice, and (4) surmountable when

required. Each principle is described below and illustrated with salient quotations from the interviews, which are provided in Table 1.

According to the principle of fatigue being inescapable and therefore acceptable, it was so pervasive that it was simply part of the job. Predominantly senior residents endorsed the notion that fatigue is manageable through experience; they suggested that working while sleep deprived was a skill to be honed with practice. The principle that fatigue is necessary for future practice meant that working while fatigued was a valuable rite of passage to prepare for similar realities after residency. Residents across all sampled programs reinforced the idea that fatigue is surmountable when required, by suggesting that they could willfully persevere and continue to function in spite of fatigue.

The principle that fatigue is surmountable when required warrants further elaboration because it was prominent in participants' responses and is relevant to the concept of fatigue management. For many residents, fatigue was simply another challenge to overcome: "I think as long as you can stand up and stay awake and physically manage, then you can usually force your brain to work, even if it is harder to do and you may be more prone to mistakes…" (017) Surmounting fatigue wasn't always presented as onerous. At times, participants implied that it was a natural response to workplace demands: "Usually when the volume is high and you know you have that pressure, it's almost like there's so much adrenaline, that I don't really feel as fatigued at that point" (010).

While most residents agreed that fatigue would not stand in the way of doing what needed to be done, the principle of surmounting fatigue was not necessarily synonymous with providing high quality care. One resident reflected on this by saying, "Obviously we say we think we are doing a good job. But I think, maybe, you are just a little bit slower, less efficient. You could get things done faster and maybe more safely if people weren't as tired." (015)

Various strategies within the workplace environment allowed participants to "push through" (018) in spite of fatigue. They described "filtering more to critical versus non-critical issues" (005), relying on "little check boxes" to remember details (017), deciding to "distribute the workload" (014), and going "into auto pilot" mode (010). Residents frequently spoke about how fatigue affected their mood and interactions with others: "I think we can all agree that the more fatigued we are, the more likely we are to have our social skills compromised." (010) And yet, strategies for overcoming this interpersonal aspect of fatigue were noticeably absent from their responses, often because it was not thought to affect patient care or interactions to a degree that mattered: "I'm probably less articulate on a post-call breaking bad news but at the same time, I'll just slow down and it may seem like I'm more empathetic…which is really just because I'm having a hard time coming up with the words" (007)

In keeping with the principle that fatigue is surmountable when required, few residents directly attributed near misses or medical errors to fatigue. Residents' comments suggested that they typically needed to have negative outcomes drawn to their attention before they would attribute them to fatigue: "Until it was obvious that I was making technical mistakes, I probably wouldn't recognize it."(013) It seemed that fatigue was not a legitimate reason for making mistakes because it was deemed surmountable: " You know, being tired might be a valid excuse to put things off that can wait, but it's not an acceptable excuse for poor decision making. At least not in the medical culture, I think." (006)

Some residents pointed to systems-based limitations that implied that surmounting fatigue was something they felt "forced to do" (008). For instance, one resident commented on the lack of "resources in place for staff physicians to be able to say, 'hey I am tired today'…our groups aren't built that way… your colleagues will have to pick up the slack and you can't call in a substitute like you might in another profession."(003) Thus, residents' workplace learning

environments reinforced the idea that it is both necessary and plausible to "tough it out" (003) and overcome the effects of fatigue.

There were discrepancies across these four principles, where residents either challenged the prevailing principle or offered a variation. One questioned how the pervasiveness of fatigue has remained acceptable in medical training: "But at what point do we become where that is okay? Because in other professions, it is not okay, so pilots or truck drivers… (018) A few residents disputed the idea that fatigue served a training purpose: "I don't believe we need to train people to perform well when we're tired…." (013) There were a few, typically extreme, scenarios in which residents described insurmountable fatigue. This resident recalled a time when his attending physician, as he put it, "pulled the parachute and left" (020):

> [My staff] operated all day and then he was on call with me all night and operated and then the next day he operated all day… I think it was 42 hours straight in the operating room… He called another staff to help finish the [last] case for him because he couldn't go on anymore. He was pooched… (020)

By pushing the limits of these socially-accepted principles of fatigue, residents were reinforcing the existence of these principles while questioning their merit in the training environment.

Interpretation

Our study describes 4 principles of fatigue that residents use to make sense of fatigue within the training environment: fatigue is understood as inescapable, manageable, necessary and surmountable. These principles are more than individual beliefs; they are deeply engrained in the local training culture. And they reveal three serious problems, which

must be faced before we can ensure the successful design and implementation of FMS in residency education.

Principles or Myths?

The first problem is that the principles of fatigue have been discredited as 'myths' in other high performance industries such as aviation and transportation [22]. There are both regulatory and organizational reasons for why these industries have outgrown the principles of fatigue that residents in our study subscribe to. At a regulatory level, fatigue was first legitimized as a safety priority during a Department of Transportation/Federal Highway Administration Safety Summit twenty years ago [22]. Since then, high profile disasters such as, "the Chernobyl nuclear reactor meltdown, the Exxon Valdez catastrophe, the Three Mile Island nuclear power station accident..." have clearly implicated fatigue as a "causal or contributory factor" [23].Therefore, organizations that fail to implement sufficient fatigue management systems are liable to be found "criminally negligent in the event of an on-the-job mishap"[22]. Public visibility may be one distinguishing feature that has prompted other industries to adopt the stance that fatigue is an occupational safety threat, which in turn supports an explicit and formalized approach to fatigue management. By contrast, the consequences of fatigued residents, are generally less public with fewer casualties per fatigue-related incident, enabling continued skepticism in medical education about whether fatigue is dangerous in residency training [24].

Challenge or Threat?

The second problem is that the principles revealed in our study characterize fatigue not as a threat, but as a challenge. Previous research has shown that surgical residents believe

themselves to be resilient to the effects of sleep deprivation [15] and that general surgery residents and faculty believe fatigue is irrelevant to patient care [17]. Our research suggests that this belief may permeate residency more broadly. Even residents who perceived that their performance was negatively affected by fatigue, nevertheless believed there had been no meaningful impact on patient care. In addition to not seeing fatigue as a threat, our participants perceived it as a challenge: the ability to keep working while fatigue was presented as a necessary skill. One implication of this is that the responsibility for this skill lies primarily with the resident. This is in stark contrast to other industries, such as transportation and aviation [25], that approach fatigue as a collective threat, not as a personal challenge.

Persevere or … ?

The third problem is that residents cannot be expected to view fatigue as a threat when the working environment presents no acceptable alternative to working fatigued. Residents noted that there weren't any explicit provisions for addressing fatigue in the workplace, although there were established conventions for dealing with overwhelming patient volume, clinical uncertainty or procedural supervision. Studies of residency as a workplace training environment have shown that the workplace can implicitly preserve the status quo [26]. As our data demonstrated, the unspoken message from the training environment was that fatigue must be surmountable, because it could not be helped.

Limitations

We conducted this research using a constructivist grounded theory methodology. This methodology is not intended to create a generalizable theory but, rather, to offer in-depth insight into a social phenomenon within a given context. We performed this research at a

single centre and so we cannot explicate the local training culture from our results. Further research that explores our emergent theory in other contexts is needed. We relied on individual residents' account of experiencing fatigue rather than an objective measurement of fatigue because this was most salient to our research question. Consequently, this study does not quantify the prevalence of fatigue or attempt to measure its impact on patient care. We benefitted from having an insider (TT) who could provide analytical insights that were accessible to someone with lived experience [21] as part of the research team. To remain reflexively aware of how her insider experience informed the analysis, she made regular memos and co-analyzed with non-insider members of the research team [18].

Implications

The success of FMS in other industries is based on the assumption that fatigue is uniformly understood as an occupational threat. Our results suggest that this assumption does not hold in residency. Under present conditions, the implementation of FMS in residency training is unlikely to have a significant impact on fatigue or patient safety.

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Table 1. Four Principles of Fatigue	
Principle	**Quotation (Anonymous Resident #)**
Fatigue is inescapable and therefore acceptable	…I think it's kind of expected. Everyone knows you're going to be tired (012) I don't think, culturally, talking about being tired is really appropriate in my program. We accept it… (013)
Fatigue is manageable through experience	You just can't stand up anymore. You can't keep your eyes open anymore. You feel like you are going to pass out or whatever. A lot of people have those sensations after staying up for 24 hours. We learn to manage that. (017) It's when you're really pulling through the full 24-hours that it gets challenging. Everyone is like, 'you just need to build stamina.' I say, you just need to rethink how you redistribute your manpower in order to make it realistic (008)
Fatigue is necessary for future practice	I'm hoping when I'm a consultant I'll be more rested when I'm postcall, because there will be residents hopefully, doing more patient care and the difficult decisions are basically being filtered through the residents…(006) … in times of crisis, you need to still be able to make decisions and not freeze and be like, oh, I'm tired. I have to go to bed. I think that is what part of this training is…we all learn to manage this in some way, I think. We all learn. (005)
Fatigue is surmountable when required	I think recognizing that you are tired but then, also recognizing that there is a job to be done. You are looking after patients. And so someone is there for your services…So, you just get to a point where … you are just able to put your own needs secondary. 'hey I'm tired. I'm not thinking quite the same and all of those things. But I have a job to do here.' (018) Recently, as a senior resident you don't have as many nights where you are up all night but you have way more longer stretches where you are going three or four hours a night every night for 7 or 8 days. And you are amazed at the levels you can push yourself (019)