

Strategies Resident-Physicians Use to Manage Sleep Loss and Fatigue

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Abstract: Our purpose is to examine strategies or countermeasures resident-physicians used in dealing with the effects of sleep loss and fatigue during residency training.

A total of 149 residents across five sites and six specialty areas were recruited for the study. Focus groups consisted of an average of 7 individuals in the same year of training and residency program, and included 60 interns and 89 senior residents. Trained moderators conducted focus groups using a semi-structured discussion guide. Transcripts were analyzed using the grounded theory tradition.

The range of strategies adopted was: Chemical, Dietary, Sleep Management, Behavioral, and Cognitive. Residents exhibited a trial-and-error approach to identifying management strategies. None mentioned searching the scientific literature or consulting local sleep medicine experts. Residents relied on putative countermeasures even when they were aware of their negative effects. Our results document the need to educate resident physicians on self-care strategies during residency training.

Research on maintaining healthy lifestyles has documented a divergence between people's understanding of recommended regimens and actual behavior.^{1,2,3} People often modify or tailor recommended health behaviors to fit the constraints and contingencies of their daily lives. In this article, we focus on graduate medical education and explore the impact of demanding work schedules on health-enhancing lifestyles.

Medical residency provides an ideal model for studying how work schedules can affect healthy lifestyle. Recent discussions surrounding the structure of postgraduate medical education have documented the high prevalence of sleep loss and fatigue among residents.⁴ Medical residents recognize that sleep loss can have negative effects on multiple dimensions of their professional and personal lives, including learn-

ing and cognition, professionalism and task performance, and personal relationships.⁵ Studies have also demonstrated that sleep deprivation can impair cognitive functions^{6,7} and immunocompetence.⁸ Yet, the scheduling constraints and work demands of postgraduate medical training limit sleep, the ideal method for managing the expected sleep loss and fatigue.¹¹ Long hours and extended on-call periods have been described by Veasey, Rosen, Barzansky, Rosen & Owens⁹ as a time-honored tradition in most residency programs:

Demanding schedules are often said to be necessary for learning and development of professionalism. The use of residency physicians to provide inexpensive coverage has also become an important

economical factor for teaching hospitals within the United States.

Most medical education health research has focused on acute and chronic sleep deprivation, its prevalence during residency training, and potential administrative remedies. Little is known about the effect that these experiences have on practicing physicians and their self-care habits. There is some evidence that good habits of self-care begin to erode as early as medical school,¹⁰ and Ball and Bax¹⁰ suggest that the health habits medical students develop can have an impact on their future performance as physicians.

The most effective countermeasure for sleepiness is sleep itself, either a two to four hour nap prior to anticipated deprivation or naps as brief as 15 minutes at two to three hour intervals during a period of sleep deprivation.¹¹ However, the demands of graduate medical training and the hospital setting intrude on residents' ability to manage sleep schedules, even if they are aware of their need for sleep and the consequences of chronic sleep loss. Contrary to the claims of some residents that they can adapt to sleep loss, the objective effects of sleep loss appear to be cumulative and negative.⁹ Addressing the limited qualitative research on sleep loss and fatigue in graduate medical education, we previously proposed a new conceptual framework to describe the impact of this process on learning and cognition, job performance, and personal life.⁵ In this article, we report the range of strategies residents report that they use to stay awake and to fall asleep as they cope with the scheduling demands of medical training.

Methods

Study Design - This was a multi-site qualitative study in which medical residents participated in one of 22 focus groups. Eight of the focus groups were comprised solely of interns and the remainder (14) predominantly of senior residents. Six specialties were represented: obstetrics-gynecology [OB] (5 groups), Emergency Medicine [EM] (5 groups), Family Medicine [FM] (4 groups), Internal Medicine [IM] (3 groups), Pediatrics [PE] (3 groups), and Surgery [SU] (2 groups). Data collection occurred for 12 months, May 2001-2002. Groups consisted of an average of seven participants in the same year of training and in the same specialty. The study stop rule was based upon theoretical saturation,¹² i.e., when no new information was forthcoming. A more detailed description of the design is available elsewhere.⁵

Sample - The subjects were 149 residents recruited across six specialties at five US academic medical centers. Each institution obtained IRB approval.

Procedures - Focus group moderators used a semi-structured discussion guide to elicit participants' perceptions of the effects of sleep loss and fatigue on aspects of their lives. Participants were asked to describe any effects of sleep loss and fatigue during their residency training and any strategies or countermeasures they used in dealing with these effects⁵. Moderators were medical education consultants on sleep academic award grants, physicians, or post-doctoral students in the behavioral sciences; moderators did not conduct focus groups within their own departments.

At the conclusion of each group, participants completed a 30-item questionnaire assessing daytime sleepiness, workplace sleep attitudes, and perceptions of how, if at all, sleep loss and fatigue affected their personal life and well-being. The first 8-items are the Epworth Sleepiness Scale,¹³ an eight-item survey asking respondents to rate situations on a 0-3 scale for the likelihood of falling asleep during the day. The Epworth total scores are 0-5 = desirable, 5-10 = mild sleepiness, 11-15 = moderate sleepiness, and 16-24 = severe sleepiness, usually associated with impaired performance. Clinical intervention is typically suggested for scores of 11 or more. The Epworth has good internal and test-retest reliability and has also shown moderate correlation with objective sleep-propensity tests.^{14,15}

Four supplemental residency-specific items were paired with the ESS response scale: "During grand rounds or noon conferences," "Writing up patient history and physical," "Talking on the telephone," and "Preparing for a presentation;" these ratings were also summed to create a residency-specific supplement to the ESS (ESS-Res). Finally, 18 items requested respondents to indicate their extent of agreement with statements about the impact of sleep loss and fatigue using 5-point Likert-type scales. Item phrasing was counterbalanced to include both positively and negatively worded items and coded such that when items were summed, higher scores indicated greater concern and perceived problems due to sleep loss and fatigue. Scores ranged from 18 to 90.

Data Analysis - We employed a grounded theory framework¹⁶ for analyzing the qualitative data. Transcription of focus group discussions yielded 306 pages of text that were analyzed by four investigators (KKP, EPS, BOE, KPS) independently reading and

identifying strategies for managing sleep loss and fatigue.⁵ As our catalog of management strategies evolved, additional focus groups were analyzed to challenge, expand, and refine the categories. The resulting coding scheme was refined through comparison and discussion of the interpretation of these strategies. The final confirmed coding structure was then applied to the entire set of transcripts by two members of the team using NVivo (QSR International, Melbourne, Australia) qualitative data management software. Application of the coding structure resulted in moderate agreement between these two coders ($Kappa = 0.703$, $p < .001$).

We conducted a parallel analysis of the questionnaire data. To protect confidentiality and an environment in which focus group participants were more likely to share their perceptions and experiences, no identifying information about speakers was included in the group transcripts. In the qualitative analysis below, illustrative quotations are identified by focus groups (specialty and year of training only). While we believe this approach encouraged candid reports of countermeasure use, it precluded linking the qualitative and quantitative data at the individual level.

Results

Analysis of our quantitative data reflected relatively high levels of sleep loss and fatigue among residents participating in the focus groups. All 149 residents who participated in focus groups completed the 30-item questionnaire. On the ESS, only two (1%) participants scored in the “desirable” range and 22 (15%) scored in the “mild sleepiness” range. The remaining 125 (84%) scored in the range for which clinical intervention is typically indicated, with 61 (41%) falling in the “moderate” category and 64 (43%) falling in the “severe” category.

The ESS scores were normally distributed, ranged widely (from 1-23), and averaged 14.6 ($SD = \pm 4.4$). The supplemental ESS-Res scale was one-dimensional (Cronbach's $\alpha = .74$ for 4 items), ranged from 0 to 10, and had a mean of 4.3 (± 2.4). As described elsewhere,⁵ principal components factor analysis was conducted to reduce the set of Perceived Impact items into empirically defined dimensions. Five readily interpreted factors emerged: Personal Impact (5 items), Performance Disruption (5 items), Denial of Performance Disruption (3 items), Perceived Adaptation to Sleep Loss (3 items), and Family Empathy (2 items).⁵ In this article, we focus on the fourth factor, Perceived Adaptation to Sleep Loss. This factor incorporated the following items: (1) My body has adapted to less sleep; (2) I have ef-

fective countermeasures to sleep loss; and (3) I can tell when I am too tired to drive home. The skewness index for this factor was greater than 0.4, so the factor was converted to ranked scores for analysis.

Although the structured questionnaire did not ask residents about specific countermeasures, one item tapped residents' perceptions of the overall efficacy of their countermeasures. Slightly over one-third (35%) agreed that they had effective strategies for managing sleep loss. An additional 35% disagreed with the statement that their strategies were effective, and the remaining 30% selected the neutral response (neither agreed nor disagreed). The mean rating on this five-category Likert item was 3.0, the midpoint, with a standard deviation of 1.0. However, only 5% of residents “strongly agreed” that the countermeasures that they were using were effective.

Residents reported a range of strategies for managing the consequences of sleep loss and fatigue. Our qualitative analysis of the focus group transcripts yielded five types of strategies, including Chemical strategies (caffeine, medications, tobacco), Dietary strategies, Activity Level, Sleep Management techniques, Other Behaviors, and Cognitive strategies. Table 1 reflects the contexts in which residents reported using each strategy as well as any reports of negative effects.

Strategies for Staying Awake

Chemical Strategies. (Mentioned in 22 of 22 Focus Groups)

Caffeine - References to caffeine, the most frequently mentioned countermeasure, most often involved reports of coffee consumption, but residents also relied on tea, soft drinks, chocolate, and over-the-counter caffeine tablets. For some residents, drinking coffee was described as part of their daily routine:

I come from a family who drinks a lot of coffee as part of our morning, and I've just accelerated the habit so that I probably have two or three cups of coffee in the morning and throughout the day when I'm on call [EM, 1st yr.]

Another resident diagnosed himself as “addicted to caffeine” and needing “my couple of cups of coffee in the morning or I'm slow and I have a headache that day” [EM 1st yr.].

Focus group participants described regimens of caffeine intake designed to counteract the effects of sleep loss. Several reported a pattern of steady consumption to stay awake, but others drew on a discourse of medical management in which doses of caffeine are administered based on their monitoring of symptoms of fatigue. One resident related an incident of falling asleep while talking to a patient:

I said I'd be right back. I got a couple of cups of coffee and some chocolate bars and I was able to treat her appropriately, very professionally. [FM 3rd yr.].

Caffeine consumption also varied by time of day. Residents described using caffeine before starting a shift [EM 3rd yr.], in the afternoon when "facing another 24 hours on call" [EM 1st yr.] or the next day post call "when you're starting to drag" [SU 3rd yr.]. Several residents said they limited coffee consumption to avoid becoming resistant to caffeine:

I mean when I need a cup of coffee, I want it to work. I don't want to be immune to caffeine. [OB 1st yr.].

Reports of caffeine were tempered by comments acknowledging negative effects. Some participants spoke of not being able to sleep when they had the opportunity if they drank too much coffee or caffeinated soda:

I don't drink caffeine during the nighttime when I'm on call, because, just in case there's a chance that I get a little bit of time to fall asleep, I want to be able to try to fall asleep. [FM 3rd yr.].

Others described caffeine as a quick but only temporary fix:

Caffeine gets me jazzed initially, but then I kind of come off it and sort of burn bad. It'll give me about an hour or two if I'm lucky. [IM 1st yr.].

Several residents linked caffeine consumption to poor performance. A comment that surgical residents can't drink coffee "because you have to go in the operating room" was greeted by laughter and several voices describing hands that shake [SU 3rd yr.]. An OB/GYN resident described his decision not to use caffeine:

I thought I would use caffeine but there is nothing worse than when you pick up a needle driver and you sit there with caffeine and you sit there going like this (mimics hand tremor). I just can't stand it. [OB 3rd yr.].

Several residents spoke of headaches accompanying caffeine withdrawal [IM 3rd yr.]. A resident in internal medicine reported having dental caries from drinking Mountain Dew and "sipping on cokes every few minutes" [IM 3rd yr.].

Use of Medications.- Although the issue of medications was raised in 15 of the focus groups, relatively few residents reported reliance on medications themselves. Indeed, use of drug-based strategies were more often attributed to other people than to the focus group participants themselves

Use of over-the-counter medications was more prevalent than reliance on prescription drugs. As indicated above, some residents reported taking caffeine tablets. Others used over-the-counter medications to minimize negative effects of sleep deprivation. For example, a family medicine resident reported, "I tend to be OK with lack of sleep, I can go a day or two and pop a Tylenol and a cup of coffee and still be able to function" [FM 3rd yr.]. An emergency medicine resident reported witnessing another resident "taking Vivarin regularly so that he could do his surgery and come home and read about his surgery when he finished. [EM 3rd yr.], but she stated that she had not used this medication herself. An emergency medicine resident said he had tried Melatonin a couple of times and found it effective in managing changes in sleep schedules [EM 1st yr.]. Decongestants were also used to stay awake. One resident discovered this strategy serendipitously:

I developed seasonal allergies a couple of years ago, and I started taking Claritin-D(sic) in the springtime and, like the Sudafed(sic) part just really kind of like wakes you up. And I don't know if I ended up taking it longer than I would have you know normally, like I definitely only took it for a season, but...like I looked forward to like starting it next year. Like when are my allergies going to kick in so I can feel like totally awake [FM 3rd yr.].

In contrast, use of prescribed stimulants was rare. Reports of reliance on prescription medications like amphetamines or Ritalin was most often attributed to

other residents. Residents may have been more reluctant to admit prescription medication use than other strategies, as suggested by an emergency medicine resident, who said that he was “sure there are some people that probably would not admit to using prescription medicines ”but I don’t know of anyone” [EM 1st yr.]. However, the focus groups provided no evidence of widespread reliance on prescription medications and no other strategy for staying awake yielded as many comments indicating that respondents did not use these strategies themselves.

Smoking. - Some residents described cigarette smoking, either themselves or by other residents. Several residents [Internal Medicine [IM] 1st yr., PE 1st yr., SU 3rd yr.] said they had quit or cut back on smoking, only to return to cigarettes during residency. However, time constraints and regulations prohibiting smoking inside the hospital limited reliance on smoking as a countermeasure to fatigue. Several residents also reported chewing Nicorette gum [IM 1st yr].

Dietary Strategies (17 of 22 focus groups)

As indicated in the discussion of caffeine-laden food and beverages, dietary strategies figured heavily in residents’ strategies for staying awake. Dietary strategies included both overall eating patterns and consumption of specific foods.

Overall Eating Patterns - Several residents underlined the importance of healthful eating patterns, including eating a good breakfast [OB 3rd yr.], not skipping meals [PE 3rd yr.], and limiting carbohydrates [SU 3rd yr.]. Most often residents said they ate just to stay awake. As one resident quipped, “It’s hard to fall asleep while swallowing!” [Pediatrics (PE) 1st yr.].

Specific Foods - Discussions of eating to stay awake sometimes mentioned specific foods. In addition to caffeinated food (e.g., chocolate) and beverages (e.g., coffee, tea, Coke, Mountain Dew), residents said they rely on “comfort foods” [EM 1st yr.], “snack foods” [IM 1st yr.], or “junk food” [FM 3rd yr.]. However, these references more often reflected limited alternatives than preferences. As an internal medicine resident explained:

You start gorging on snack food, because there’s nothing healthy to eat at night, so you can stay awake [IM 1st yr.].

Staying awake was not the only benefit residents attributed to food consumption. Eating was described as a way to break up the day [IM 1st yr.] and as a source of pleasure [IM 1st yr.] or fun [FM 3rd yr.]. As one surgical resident explained, “I eat junk. I eat crap because it’s like the only happiness in my day right now” [SU 3rd yr.]. Another resident added that she sees food as a reward for the stresses of residency:

I have this idea that just because I’m up all night, I’m allowed to eat whatever I want and usually whatever I want includes candy bars, fries, anything I see, because I think somehow I’m rewarding myself. Even though I know that I don’t normally eat like that, I don’t like that stuff, but I’m rewarding myself by eating terribly fatty foods [OB 1st yr.].

Consumption of high fat, high sugar, and caffeine-laden foods is not without negative consequences. Residents recognized that these eating patterns were not healthy [EM 1st yr.], contributed to high cholesterol [OB 3rd yr.], and, occasionally, made them even more tired [SU 3rd yr.]. They reported headaches from caffeine withdrawal [EM 1st yr., IM 3rd yr., PE 3rd yr.] and, as mentioned above, dental caries from candy and soft drinks [IM 3rd yr.]. The most frequently mentioned problem was weight gain, ranging from 15 to 20 pounds. The female resident who experienced the 20-pound weight gain reported:

It’s horrible because when you’re outside of work and you see people that haven’t seen you, they go, “Oh, are you expecting? Are you pregnant?” And you’re like no, I’ve gained weight. And they don’t believe it. [FM 3rd yr.]

Several residents indicated that these negative outcomes resulted in an improvement in eating patterns. An emergency medicine resident started bringing his own food, because “that way I know I can eat in five or ten minutes, because I know what I have... I don’t have to go anywhere to get it” [EM 1st yr.]. Several others reported adopting more healthful eating habits to avoid the “highs and lows” that followed concentrated consumption of carbohydrates:

One of the things I do is avoid sugars, because sugars give you an immediate rush and you’ll be OK for the next half hour but then you’ll crash. I think that’s what affects a lot of people early afternoon, because for breakfast they’ve had donuts and tons of sugar in their coffee.

They make it through the morning, but once you get into it, it's pretty bad. [FM 3rd yr.]

There was no evidence that residents were unaware of sound nutritional practices. Dietary strategies were often described as “not healthy” or “not a really good pattern” [EM 1st yr.]. Nevertheless, residents develop eating strategies that they believe help them manage fatigue within a context in which they need to be awake.

Exercise and Maintaining Activity Levels (14 of 22 focus groups)

Fourteen of the focus groups mentioned managing activity levels as a strategy for staying awake. These conversations addressed both regular exercise and recommendations to “keep moving” or “stay active.”

Regular Exercise Regimen - Several residents said they try to maintain a regular program of exercise to bolster energy levels [PE 3rd yr.]. Others emphasized how much better they felt when they were able to stick to a regular exercise regimen [IM 1st yr.]. One resident argued that exercise had multiple benefits, including “building up endurance to stay awake all night” and “relieving the stress and tension that builds up while you are on call” [PE 1st yr.].

Keep Moving. - Although not describing regular exercise programs, other residents emphasized the importance of staying active [SU 1st yr.] and keeping busy [OB 3rd yr.]. As an emergency medicine resident explained:

When you're on your feet, it's hard to fall asleep, but I think once you sit down it's a different story. [EM 1st yr.]

Several residents added that the demands of patient care kept them awake. For example, residents reported that “in the ER you are so keyed up because, man, things are just happening at such a clip, your mind is working really fast” [IM 1st yr.] and that “it seems like when we're here there are too many things to do to fall asleep” [PE 1st yr.]. Several OB residents reported that the need to perform a C-section “gets you going again” [OB 3rd yr.].

Managing Sleep (19 of 22 focus groups)

Strategies for managing sleep schedules were discussed in 19 of the focus groups. Devising schedules that maximized residents' ability to handle over-

night shifts and irregular schedules was described as a matter of “trial and error:”

I'm still playing with different ways of handling overnight shifts. You know; whether you sleep a few hours before an overnight shift, sleep a few hours after an overnight shift, things like that. [EM 1st yr.]

Over time, experimenting led to what residents perceive as more effective management strategies. “You get better at it,... so it affects you less,” explained a surgical resident [SU 1st yr.].

Adapting Schedules: Front Load or Catch Up on Sleep - Some residents tried to proactively “front load” or “load up” on sleep before being on call [EM 1st yr.], whereas others tried to retroactively rest or catch up on sleep after being on call [IM 1st yr.]. Other members of the same focus group argued that “there is no such thing as loading up. Like you can't just sleep for 24 hours and be like I'm good to go” [IM 1st yr.]. Another asserted that the notion of catching up on sleep is an illusion. “We delude ourselves into accepting the system. It's just that we think, oh, I'll catch up later.”

Napping - Napping was discussed in all but two of the focus groups. Napping was part of the front-load and catch-up behaviors described above. Short “power” naps were also advocated by a number of residents, several of whom claimed that they had taught themselves to fall asleep easily in a variety of locations. Some sleeping was unplanned and unanticipated. Residents reported falling asleep when there was a slow moment or when they sat down for a few minutes. A surgical resident explained that he “when I'm falling asleep looking at labs, my body's telling me I need sleep. There's nothing I can do” [SU 1st yr.]. Most residents reported that power napping is effective. “Twenty minutes and all of a sudden I felt like I slept eight hours,” reported a surgical resident [SU 3rd yr.].

But not all residents agreed that napping was an effective strategy, particularly while on call. Some argued that there is no time to nap while at the hospital. A pediatric resident reported that “it is easier for me to be up all night and never see a bed than it is to be asleep for 15 minutes [PE 1st yr.] An OB resident added that “it is much harder to say I'm just going to lay down for half an hour, because you get up and your eyes are blurry” [OB 3rd yr.].

Features of the hospital environment can make it difficult for some residents to nap while on call. Some complained about too much noise [IM 1st yr., IM 3rd yr.] or uncomfortable, unfamiliar beds [EM 3rd yr.]. An internal medicine resident complained that “all the rooms are different temperatures. Sometimes you’re freezing, sometimes you’re super hot” [EM 1st yr.]. Regardless of environmental impediments, naps were frequently interrupted by patient needs and other work demands. “I get what I like to call ‘nurse-induced sleep apnea,’” quipped one resident. “Every hour you’re paged and you’re woken up, you know, constantly answering questions, doing this and...” [IM 3rd yr.].

Other Behavioral Strategies (15 of 22 focus groups)

Showering - Residents also relied on a range of behavioral strategies to cope with sleep deprivation and fatigue at the hospital and at home. Several residents said that showering and changing clothes is an effective strategy to alleviate sleepiness while on call. One Emergency Medicine resident, who had selected an apartment close to the hospital, would go home, shower, and change clothes if he had a 30-minute break. Another member of the same focus group said she knew that:

There were people who would bring in an entire outfit for the next day and they would take a shower and sort of show up in new clothes. It was almost as if they were trying to trick themselves into the fact that they hadn’t actually been up for 24 hours or whatever. [EM 3rd yr.].

Slapping and Splashing. Several residents also described slapping their faces or pinching themselves to combat sleepiness. For example, an internal medical resident described the difficulty he had staying awake on rounds and the strategy he used to avoid “falling asleep in front of an attending:”

I’ve actually come to the point where I keep my hand, you know kind of like this (he demonstrates) here behind my back and I just pinch myself as hard as I could to stay awake, literally. [IM 3rd yr.].

Others reported splashing cold water on their faces or trying to stay cold by either not wearing a coat or stepping outside [PE 1st yr.].

Musical Strategies - Music was used as a resource for staying awake. At the hospital, residents reported thinking about songs or even singing. One family medicine resident reported dancing to stay awake:

I tend to find myself thinking of songs and then trying to dance by the nurses’ station. Delirium. When I’m dancing, it’s been a rough night. [FM 3rd yr.].

Cognitive Strategies (9 of 22 focus groups)

In addition to the behavior-based strategies reported above, some residents relied on cognitive or attitudinal strategies to combat fatigue. A surgical resident said he forced himself to stay awake.

There’s no way... you know, if I’m actually operating, I’d fall asleep operating. Maybe it would be different if I was riding a tractor for four hours. But if you need to be up, you can be up. You get that adrenaline going [SU 3rd yr.].

Several residents emphasized the importance of just “plowing” or “powering” through nights on call. As a surgical resident explained:

You stay up all night but you know you’re going home the next day or you know you’re going to be able to sleep the next day, that’s fine. I can work throughout the night... You can make it through as long as you know you’re going to sleep at some point” [SU 3rd yr.].

Knowing in advance that residency would involve sleep deprivation made fatigue more tolerable for some residents. An emergency medicine resident reflected this attitude:

I knew exactly what I was getting myself into, been building up for it for many years and then your internship, one of the hardest years I’ve ever done in my life. And when I have to spend that night out, I’m not cursing the world because I know what I got into. I mean I’m an adult, I made the rational decision to do this and this is just part of the dues we have to pay [EM 1st yr.].

Staying awake was described as a fight or a battle. An internal medicine resident found himself say-

ing, “All right, stay awake, stay awake, stay awake, don’t fall over” [IM 3rd yr.].

Don’t Give in to Fatigue - Other residents appear determined not to give in to fatigue. As an Internal Resident commented, “I’m not going to let the hospital beat me” [IM, 1st yr.]. A family medicine resident echoed a similar sentiment, although with less confidence of long-term success.

One way I deal with it is to fight it. I’ll come home, this is on our typical night float, and I won’t go to sleep. I’ll only sleep three hours and I’ll run and I’ll carry out my daily life like I want to. And it lasts for about... a week and I crash after that. It’s almost like I fight this schedule that has been imposed on me and I say I’m not going to let it take over my life... [FM 3rd yr.]

Some residents, however, believed they develop a tolerance for sleep deprivation. As an obstetrical resident explained:

There’s a certain level of habituation that takes place. When I started out, I thought I couldn’t stand staying awake and that it was just killing me. But you get used to being chronically fatigued [OB 3rd yr.].

Staying Awake While Driving

Consistent with other research on the impact of fatigue on motor vehicle accidents^{17,18}, the risk of driving while fatigued emerged as a major concern. In responding to the structured questionnaire, over half of the residents reported that they have worried about having a car accident driving home post-call (28% strongly agreed with the statement and an additional 28% agreed). Residents were also asked to assess the likelihood that they would doze while stopped in traffic for a few minutes; 11% reported that there was a high chance, 16% said there was a moderate chance, and 34% said there was a slight chance; the remaining 39% said they would never doze.

Most residents described situations in which their driving ability had been impaired by sleep deprivation and fatigue.² Residents reported falling asleep at red lights [IM 1st yr., OB 1st yr.], not remembering driving home [SU1, IM1], and being awakened by the car of their sound crossing “rumble strips” on the edge of the highway [EM 1st yr., FM

3rd yr.]. As one resident summarized, “Driving while sleep deprived is worse than being legally drunk” (OB 3rd yr..]

As indicated above, residents relied on a number of strategies to drive home safely post-call. Several reported pulling over and taking a nap [SU 3rd yr.]; one resident even kept a sleeping bag in the back of his car [EM 3rd yr.]. Others turned up the AC or rolled down the windows [SU 1st yr.]. Another strategy was listening to loud music [SU 1st yr.] or singing familiar songs [FM 3rd yr.]. A third year family medicine resident relied on caffeine: “the coffee and chocolate thing.” As indicated above, talking on cell phones was another strategy mentioned by several residents. A family medicine resident said that he has a list of people in his head that he can call depending on the hour:

One day I got down to calling my brother in Seattle, you know for him it was 6 a.m. but I needed someone to talk to, um I mean it’s crucial. We talked for 30 to 40 minutes and he got me almost home. [FM 3rd yr.]

The Relationship between Residents’ Perceived Adaptation to Sleep Loss and Reported Sleepiness.

We used the quantitative data to examine the relationship between Perceived Adaptation to Sleep Loss and indicators of sleepiness. Multivariate analysis of covariance (MANCOVA) was conducted, with ESS and ESS-Res as dependent variables and with institution, program specialty, and intern-Vs. resident) as categorical independent variables and year of residency and the Impact factors (i.e., Personal Impact, Perceived Disruption, Denial of Performance Disruption, Perceived Adaptation, and Family Empathy) as continuous independent variables. There were significant multivariate effects for all predictors except Perceived Adaptation and Family Empathy.

The absence of a statistically significant relationship between Perceived Adaptation and the two indicators of sleepiness is of substantive significance for our analyses. Despite the range of countermeasures reported in the focus group, the quantitative data give no indication that residents’ level of confidence in their ability to assess their level of sleepiness (when driving), to adapt to sleep loss and fatigue, or to apply countermeasures for managing sleep loss has any impact on reported sleepiness. Since direction of causality cannot be inferred with cross-sectional data, these results can also indicate that level of sleepiness

does not affect residents' level of confidence in their ability to manage sleep loss and fatigue. Given the relatively low reliability of the Perceived Adaptation Index, we replicated the multivariate analyses substituting individual items for the factor score. Once again, no significant multivariate effects were found.

Discussion

Sleep loss and fatigue were prevalent problems among study participants. Indeed, ESS scores indicated that 84 percent of these physicians-in-training were experiencing levels of sleepiness for which clinical intervention is indicated.

Residents reported a wide range of strategies for managing the consequences of disrupted sleep associated with the demands of residency. The most frequently mentioned strategies for staying awake involved caffeine and managing sleep schedules, including napping. Both of these countermeasures have some support in the literature. However, although caffeine and other stimulants appear to promote alertness and vigilance, high doses of caffeine are contraindicated for chronic sleep loss.⁹ Napping prior to sleep loss and short naps at two to three hour intervals during a period of sleep deprivation can be effective countermeasures, but there is no evidence to support residents' beliefs that they can acclimate to chronic sleep loss. Furthermore, despite this evidence that napping and occasional low-dose caffeine may be effective in ameliorating the effects of sleep loss, Veasy and colleagues⁹ caution that "their effectiveness remains to be evaluated in rigorous scientific protocols of residents."

Perhaps the most striking finding is the wide range of strategies residents used to manage sleep loss and fatigue. While some strategies were mentioned in most focus groups, others were mentioned in only three or four. Residents exhibited a trial-and-error approach to identifying management strategies. Despite training in evidence-based medicine, none of the focus group participants mentioned searching the scientific literature for information on managing sleep loss; even when strategies (like napping) were reported as effective, evaluations were based on personal experience rather than scientific evidence. Neither did respondents appear to share information on effective strategies or to consult with senior residents or attending physicians about the best ways of managing sleep deprivation. Indeed, there is some evidence that residents perceived admitting to fatigue as a sign of weakness.⁵

Respondents also varied in their approach to utilizing counter-measures. Some residents used self-care strategies to minimize the symptoms of sleep loss after they occurred. For example, some residents used caffeine in a reactive fashion, monitoring their bodies for signs of fatigue and administering "doses" of caffeine as necessary. In contrast, other residents engaged in proactive behaviors in an effort to prevent symptoms of fatigue from developing. For example, some residents reported "staying active" or "keep moving" as a way to maintain wakefulness and forestall symptoms of fatigue.

Many of the participating residents were aware of negative effects of some counter-measures. For example, some residents limited caffeine to avoid addiction or habituation or because of its negative impact on performance of specific procedures. Eating "junk" or "comfort" food was recognized as undermining health but was explained in terms of the limited availability of alternatives during the middle of the night. Several residents who reported smoking cigarettes to stay awake indicated that they had quit smoking in the past but resumed the habit in medical school or residency. These unhealthy decisions do not result from inadequate information; these graduate physicians indicated that they understand the negative health consequences of these countermeasures.

We did not ask residents why they persisted in what they know are unhealthful practices, but prior literatures suggest several possible explanations. Residents may see few alternatives for managing fatigue within a work context in which they need to be awake and a cultural context in which admitting to fatigue is viewed as a sign of weakness. They may view sleep loss as a time-honored feature of residency training that will disappear as they launch their future careers, so the impact of negative behaviors are viewed as time-limited. Consistent with Backett and Davison,¹⁹ they may believe that their relatively young age buffered the negative effects of unhealthy behaviors. The emphasis on clinical experience and an activist orientation in medical education can also encourage physicians-in-training to test various strategies for maintaining effective performance. From this perspective, the repertoire of strategies for managing sleep loss can reinforce residents' sense of active agency in the face of demands that constrain their ability to choose optimal countermeasures²⁰. We encourage future studies to explore these possibilities.

During times when they are on call, residents get less than the optimal amount of sleep, have frequent

interruptions during sleep, or skip a night's sleep altogether. Even if they understand that regular sleep, averaging eight hours per night, is the most effective antidote to sleep deprivation and fatigue, they also know that regular sleep is not an option for physicians in many residency programs. Faced with this constraint, residents use countermeasures even when their comments during the focus groups indicate that they are aware of negative side effects or contraindications. This interpretation is supported by the quantitative analyses that failed to find a significant relationship between countermeasures use factor and level of sleepiness. An unanswered concern centers on the extent to which these unhealthy practices become habitual responses to managing the stress of excess demands on available time.

We consider these results exploratory; our purposive sampling design and semi-structured data collection strategy do not permit us to provide estimates of the frequency or distribution of our findings. Our study is also limited by the fact that residents may have been inhibited in disclosing certain practices (e.g., self-medication) in the presence of their peers. Our efforts to create a safe environment for disclosing such practices also precluded our ability to link focus group statements with the quantitative questionnaire data. Training at academic medical centers that were institutional recipients of "K" awards called Sleep Academic Awards may have also increased the sensitivity of participating residents to sleep loss.

Nevertheless, our mixed method study provides insights into the range of strategies residents have developed for managing professional performance, educational progress, and personal lives under what has been described as "chronic sleep debt." This article adds to the growing literature on sleep loss and fatigue in graduate medical education by presenting the range of management strategies that residents implement. Our results document the need and suggest some of the content for interventions designed to alleviate the impact of sleep loss and fatigue in graduate medical training.

These interventions may range from implementation of policy at the national level (work hour regulations) to operational changes at the institutional level (provision of call rooms for napping, scheduling of shifts according to principles of circadian biology) to individual countermeasures (judicious use of caffeine, planned napping).⁹ There is a substantial body of literature from other industries such as aviation and transportation that document the effectiveness of a variety of countermeasure in the occupational setting that could be applied in the healthcare setting as

well.^{21,22,23, 24, 25} A more detailed understanding of the strategies currently employed by residents and their perception of the relative efficacy of those strategies is key to implementing policies and procedures that will be effective and accepted.²⁶

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Table 1.

SLEEP MANAGEMENT STRATEGIES

Strategy	Uses Strategy to <u>Stay Up</u>	<u>Uses Strategy When?</u>				<u>Negative Effects?</u>	
		<u>On Call</u>	<u>Pre Call</u>	<u>Post Call</u>	<u>Post Call Driving</u>	<u>On Call</u>	<u>General</u>
Chemical Strategies							
Caffeine	X	X	X	X	X	X	
Medications (OTC & Rx)	X	X		X		X	
Smoking	X	X					X
Dietary Strategies							
Keep eating anything	X	X					X
Eat specific foods	X	X				X	X
Activity Level							
Regular Exercise	X		X	X	X		
Keep moving	X	X		X			
Sleep Management							
Manage Sleep Schedules	X		X	X		X	X
Napping	X	X	X	X	X	X	X
Behavioral Strategies							
Showering Changing Clothes	X	X					
Slapping, Pinching Oneself	X	X					
Music: Listen, Sing, Dance	X	X			X		
Cold Air or AC	X				X		
Talking on the Phone	X				X		
Watching TV				X			
Cognitive Strategies	X	X					

X = Mentioned by at least one person in one focus group.

Keywords: Resident Physicians, Work Hours, Working Conditions, Sleep loss and fatigue, Professionalism, Self Care.