

Understanding Surgical Resident Motivation in the Era of Duty Hour Restrictions

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Abstract

Introduction: Intrinsic motivation is essential for learning and has been linked to enhanced knowledge retention and better learning outcomes. Recently, duty hour restrictions (DHRs) have drastically altered the resident training experience. The purpose of this study was to explore the motivational drivers of surgical trainees through the lens of self-determination theory (SDT) and examine the impact of DHRs on motivation for learning.

Methods: The study was conducted at a tertiary care, university-affiliated institution. Ten general surgery residents from PGY-1 to 5 were selected using a stratified sampling technique. Semi-structured interviews were conducted with study participants between December 2014 and March 2015. Interviews were recorded, transcribed, and de-identified. Two study authors independently coded the data using grounded theory methodology, eliciting common themes across interviews to identify factors affecting resident motivation.

Results: Residents most commonly cited the following factors as motivators for training: learning about surgical procedures, developing interpersonal relationships, providing good patient care, receiving recognition from superiors, and having an inherent sense of accomplishment. These experiences can be understood in the context of the core human needs for autonomy, competence or relatedness, the key concepts underlying intrinsic motivation. Residents reported DHRs as negatively affecting motivation by interfering with these three core needs. Specifically, residents reported decreased motivation from lack of patient ownership, decreased longitudinal interactions with colleagues, reduced autonomy in patient care and personal time management, and reduced operative exposure.

Conclusions: Resident motivation is largely driven by intrinsic motivators, and can be well defined through the framework of SDT. The recent implementation of DHRs has negatively impacted resident motivation by interfering with residents' sense of autonomy, competence and relatedness. The findings of this study may be used to inform resident scheduling decisions in order to improve motivation for learning amongst surgical trainees.

Introduction

Surgical training has traditionally been a time-intensive process during which trainees acquire competence through long hours of observation, apprenticeship and graded responsibility. In recent years, concerns regarding resident physician fatigue and safety after long hours of work have led to the implementation of duty hour restrictions (DHRs) throughout North America [1-4]. These changes threaten to affect the training experience of surgical residents [1]. Although studies have yielded varying results regarding the actual impact of DHRs on

resident case volumes [5-8], there is nonetheless persistent concern about resident readiness for independent practice upon completion of training. Experts throughout the surgical community feel that trainees do not have sufficient exposure to many standard general surgery procedures by the end of their training [9-1]. This concern is echoed by trainees, who are more commonly seeking further training through fellowships upon completion of residency [12].

In this training climate, there is increasing need for residents to pursue self-directed study and demonstrate independent motivation for learning. Learner motivation is widely regarded as critical to the learning process. One of the most prominent theories explaining motivational orientation is self-determination theory (SDT) [13,14]. SDT classifies motivation into intrinsic and extrinsic types [15,16]. *Intrinsic motivation* arises from a genuine interest in the task at hand, and fulfills the three core human needs of autonomy, relatedness, and competence. Together, fulfillment of these three needs allows for adaptive functioning, including learning, to be optimal. In contrast, *extrinsic motivation* is driven by rewards and expected gains that are separate from the task itself. Studies across numerous educational settings have shown that intrinsic motivation leads to better learning outcomes compared to extrinsic motivators, including greater depth of learning, enhanced persistence in the face of difficulty, and longer knowledge or technical skill retention [17-20].

In recent years, there has been increasing research on the role of motivation in medical education [14,21,22], however few studies have focused specifically on motivation in the field of general surgery. This topic is of particular importance in the face of the evolving landscape of surgical training. In a healthcare environment where knowledge and surgical techniques are constantly expanding, the increased demand for knowledge and skill acquisition seems to conflict with the decreased clinical exposure available as a result of reduced number of hours on the job. As forced training time is diminished through duty hour restrictions, there is increased demand on the learner to enhance their knowledge independently through reading and deliberate practice.

The purpose of this study was to explore the motivational drivers of surgical trainees and the impact of duty hour restrictions on motivation for learning.

Materials and Methods

Semi-Structured Interview Question Development

Semi-structured interviews were conducted with surgical trainees at a university-affiliated, nationally accredited training program between December 2014 and March 2015 after obtaining ethical approval from the McGill University Institution Review Board. Interview questions were developed in collaboration with all study authors, based on a prior review of the literature. Questions were designed with a goal of eliciting residents' motivational orientation and opinions regarding DHRs. In order to elicit honest and candid responses, care was taken to phrase questions as pertaining to residents in general, rather than solely to the individual being interviewed. Nine open-ended questions were developed with an aim to encompass the key issues while minimizing repetition (Table 1).

Participants

General surgery residents in good standing were recruited to participate in the interviews, using a stratified sampling technique in order to ensure representation from residents at all levels of training. The resident cohort was divided into 6 groups corresponding to residents from each of the five clinical years and those pursuing graduate

Table 1: Semi-structured interview questions.

Topic	Questions
Questions directly related to motivation	1. What are the most satisfying aspects of surgical training for you? 2. What are some discouraging aspects? 3. What motivates you to improve yourself and to seek mastery in this profession? 4. What motivates you to persevere when you are feeling overwhelmed? 5. What factors do you think motivate surgical residents to increase their knowledge and technical skills? 6. What factors do you think demotivate surgical residents to increase their knowledge and technical skills?
Concrete examples related to motivation	7. What is an instance when you felt competent and powerful in your capacity as a surgical trainee, and why? 8. What is an instance when you felt defeated in your training?
Opinions regarding DHRs	9. What do you think of your work hours? Please comment on what you do and do not like about it and how it compares to the 24 hour system.

degrees. Two residents from each group were selected using a random number generator, for a total of 12 participants. All 12 chosen residents were contacted by e-mail to enlist their participation. The voluntary nature of their enrolment was emphasized and informed consent was obtained. After preliminary analysis of the data, saturation of responses was reached therefore no further participants were recruited. Basic participant demographic data was also collected.

Interview Process

Interviews were performed by a single interviewer who was not involved with the residency training program in order to allow study participants to feel at ease answering questions honestly without impacting their standing within the program. A total interview time of 45 min was targeted. All interviews were recorded and subsequently transcribed verbatim. Identifying information was removed at the time of transcription to preserve participants' anonymity.

Response Coding

Two study authors independently coded the transcribed data using grounded theory methodology [23]. For each of the nine question, all interviewees' responses were broken down into the individual elements or main points. These points were then compared and common topics or themes were identified. This process was completed by both reviewers, and themes which were consistent between the two reviewers were included in the final analysis.

Results

Of the 12 selected participants, a total of 10 interviews were conducted. Although two participants could not be reached for face-to-face interviews, no replacement participants were sought due to response exhaustion based on preliminary analysis after the first 10 interviews. Characteristics of the study participants are presented in Table 2. Representatives from all 6 cohorts (PGY-1 to 5 and research residents) were included. Sixty percent of residents interviewed had experienced both 24-hour as well as 16-hour call systems, with the remaining 40% only having experienced the more restrictive work hour schedule.

Table 2: Demographics.

Males (%)	7 (70)
Median age (range)	28.9 (1.73)
PGY year (n)	PGY1 (2) PGY2 (2) PGY3 (2) PGY4 (2) PGY 5 (1) Research – PGY 3 (1)
DHRs experienced (% both systems)	60%

PGY = post-graduate year

The answers to each of the nine questions were coded according to common themes. These themes are presented in Table 3, along with the frequency with which each theme was referenced. The questions addressed 2 main categories: positive and negative factors impacting resident motivation. Of the five questions addressing positive motivating factors (Q1, 3, 4, 5, and 7), five of the themes were elicited across multiple questions. The most commonly cited motivating factors for residents included: learning about surgical procedures, developing interpersonal relationships, providing good patient care, receiving recognition from superiors, and having an inherent sense of accomplishment (Table 4).

Only three questions addressed factors that negatively impacted motivation (Q2, 6 and 8), from which four main themes arose (Table 5). The following themes were found in answers to both questions 2 and 6: having to perform administrative tasks, having negative interactions with colleagues, and being overworked and fatigued. A fourth theme (not performing to the best of one's ability) was mentioned by 6 out of 10 respondents only when participants were asked to cite instances of feeling defeated.

The topic of DHRs was addressed as a separate question. Eight out of 10 respondents independently listed positive aspects to the change in work hours. All residents but one also had negative things to say as well, with the following themes being the most frequently cited: decreased operative exposure, fragmentation of teamwork and resident responsibilities, fatigue and strain from long, frequent shifts and fewer full days of rest, and increased sign over and lack of patient ownership (Table 6).

Discussion

The goal of this study was to determine what factors affect the motivation of surgical residents, with a specific focus on the impact of duty hour restrictions on training motivation. Overall, responses from this cohort indicate that surgical residents are primarily driven by intrinsic motivators for learning. DHRs negatively impact motivation for learning by interfering with the achievement of autonomy, competence and relatedness [13].

To properly understand the impact of DHRs on resident motivation, it is important to delineate the nature of the changes that have occurred in surgical training in recent years. Prior to 2011, residents working in the province of Québec had a 72-hour maximum workweek and were allowed to complete 24-hour in house calls [24]. This was already a reduction from the previously allowed 36-hour calls prior to 1990 [2]. However, due to concerns of resident over-fatigue and safety, since July 1, 2012, in house call duration exceeding 16 hours for residents has been prohibited by provincial law [2].

Although this model has now been the standard for over four years in Quebec, there is still no consensus regarding the actual benefits of these changes and their impact on residency training [1,25]. Given that other provinces in Canada do not have such strict DHRs, and in the US the 16-hour work limitation only applies to interns [26], there is

Table 3: Most common motivating and demotivating factors in training.

Topic	Common Responses	Number of Responses
Positive motivators		
Q1 - Most satisfying aspects of training	- Acquiring operative skill and competence - Providing good patient care - Working in or leading a team	10/10 9/10 5/10
Q3 - Factors which motivate resident to seek mastery	- Having an inherent sense of accomplishment - Providing good patient care - Receiving positive feedback or recognition	9/10 8/10 7/10
Q4 - Factors that motivate residents to persevere despite hardship	- Personal relationships (family, friends, colleagues) - Personal motivation/internal narrative - Resetting and disconnecting from work	8/10 5/10 4/10
Q5 - Motivating factors for residents in general	- Personal enjoyment and goals - Relationships with colleagues (peers and mentors) - Providing good patient care	7/10 7/10 3/10
Q7 - An instance when resident felt capable	- Making independent decisions - Earning recognition for competence	7/10 6/10
Negative motivators		
Q2 - Most discouraging aspects of training	- Fatigue from long hours - Wasting time on administrative tasks - Frustrations of not improving technical skills	5/10 5/10 4/10
Q6- Demotivating factors for residents in general	- Wasting time on administrative tasks - Feeling under-appreciated - Receiving negative feedback - Being overworked	6/10 5/10 4/10 3/10
Q8 - An instance when resident felt defeated	Underperforming and technical failures Staff taking over case	6/10 2/10

Table 4: Commonly cited themes positively affecting motivation.

OVERARCHING THEMES	n	Nature of Motivation (I vs. E)	Self-Determination Theory (A/R/C)
Inherent sense of accomplishment	25	I	C
Providing good patient care	22	I	A/C
Interpersonal relationships	17	I/E	R
Learning about surgical procedures	12	I	A/C
Receiving positive feedback from superiors	13	I/E	R/C

I = Intrinsic, E = Extrinsic, A = Autonomy, R = Relatedness, C = Competence

Table 5: Commonly cited themes negatively affecting motivation.

OVERARCHING THEMES	n	Nature of Motivation (I vs. E)	Self-Determination Theory (A/R/C)
Administrative tasks	11	I	C
Being overworked and fatigued	8	E	-
Negative interactions with colleagues	6	I	R
Underperforming	6	I	C

Table 6: Effect of duty hour restrictions on resident training and motivation.

OVERARCHING THEMES	n	Nature of Motivation (I vs. E)	Self-Determination Theory (A/R/C)
Decreased operative exposure	5	I	A
Fragmentation of teamwork and of resident responsibilities	5	I	R/C
Fatigue and strain from long, frequent shifts and fewer full days of rest	4	E	-
Increased sign over and lack of patient ownership	5	I	A/C

very little literature that is specific to this situation. We thus sought to gain better insight into the effect that these changes have on resident motivation.

This study framed motivational drivers for learning based on self-determination theory (Figure 1). SDT is one of the most prominent motivational orientation theories, supported by over 40 years of research across numerous educational settings [13-16]. This theory posits that for learning to be optimal, three core human needs should be fulfilled: competence, relatedness and autonomy. This is more often

achieved when learners are motivated by features intrinsic to the task itself, rather than by extrinsic rewards such as grades or praise [14].

Autonomy, Competence and Relatedness in Surgical Training

When residents were asked what they found to be the most satisfying aspect of surgical training, 100% of respondents cited developing operative skill as a strong motivator. The desire to be a technically skilled surgeon with good clinical judgment touches both on concepts

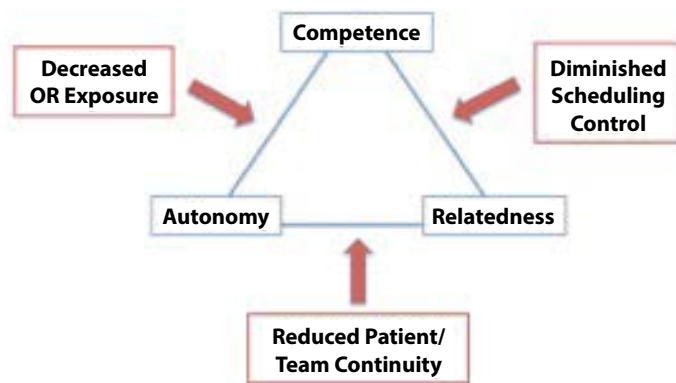


Figure 1: Self-determination theory and resident motivation.

of *autonomy*, the resident's desire to be able to perform an operation or make patient care decisions independently, and *competence*, the desire to perform these tasks with skill.

"Surgery can be complicated, it's technical and the more you do it, the better you get at it. The better you are at something, the happier you are, usually, so I think that's obviously very motivating [...]. You know what you're doing more and more, and you can do more and more of the surgery yourself, and you get good results or you get positive feedback. I mean there's external feedback—there's people that will say okay you're doing well, or they're unhappy with your progress—and there's internal feedback that you're giving yourself. You can see that you're doing things in an easier fashion, or you find that it's a little bit easier to do certain operations. And that's definitely—I think that's the biggest motivator, that you can see your own progress," (Participant 12301).

"I remember one instance when a patient was not doing so well and the fellow on the team came in and she said: "Is everything alright?" I said "Yeah." [...] We went through the case and she said "I think you're doing a good job, I'll be in the back room if you need me, make sure he ends up in the ICU." She went and eyeballed the patient and made sure everything was alright. So it makes you feel good that you did a good job, that you have backup—it makes you feel very capable," (Participant 12261).

These anecdotes demonstrate the concepts of competence and autonomy, with the residents in question feeling capable of managing the situations adequately and independently, but with the appropriate level of support. While there is extrinsic reward when the resident is told that they are doing a good job, it is not the praise as much as the sense of affirmation of competence that is motivating.

Interpersonal relationships, such as working in a team and having positive interactions peers was another main theme that emerged as positively affecting the motivation of surgical trainees. This, in addition to the reported importance of providing good patient care, highlights the role of *relatedness* in motivation:

"We take a lot of decisions, we run a team, we do teaching for students, we do a good part of most surgeries. [...] Sometimes the patients identify us as [...] one of their main doctors [...] It's a whole chain, like everybody does something important, everybody should feel important at some point, I think, during the day." Participant 12301

"I think the most satisfying things are when you are involved directly with patient care. [...] Especially as junior residents I think this is where most of us agree upon—this is how we evaluate rotations, whether we are satisfied or not. The other thing is mentoring, so if a rotation has a very good mentor – staff, then we tend to be more satisfied." Participant 12301

When residents were asked about factors that negatively impacted

their motivation, the most frequently cited situations were those that interfered with intrinsic motivation for learning. These included frustrations with failure to improve technically and receiving negative feedback regarding their performance:

"For example, you go to the OR and you don't do that well and you say, oh I could've easily practiced or trained for that or I could have easily read up on that case and done something differently," (Participant 12262).

"I was operating with somebody very prominent in our division. Somebody we all look up to and want to impress. And it was a very simple case of laparoscopic appendectomy and it was just... I... my performance was just crap," (Participant 02241).

These quotes exemplify how motivation is negatively impacted when residents feel that they are not competent or when their performance diminishes their perceived relationship with someone they respect.

The Effects of Duty-Hour Restrictions on Resident Motivation

In addition to general questions about motivation, residents were specifically asked about their impressions of the changes in DHRs and the impact of these changes on their motivation. We hypothesized that the changes in scheduling that accompanied DHRs, such as the shift-work model, might impact feelings of competence, relatedness, and autonomy.

Throughout the course of the interviews, several residents independently mentioned DHRs as a source of decreased motivation. They spoke about fragmentation of patient care and decreased patient ownership as consequence of DHRs. Both of these concepts affect motivation by negatively impacting residents' sense of relatedness:

"There may be a component of the current paradigm of training where there's a lot of shift work, there's a lot of... it's hard for people who've never worked 24h in a row or more to sometimes have a sense of ownership of the patients. Like if you're always on nights for example, these patients don't belong to you. You don't round on them. It's a bit hard to take ownership of them. And I think if you don't feel the patients belong to you and it's your responsibility to do something good for them, sometimes that can be a little hard. It feels like you're just doing scut, it feels like you're just doing stuff to do it. Whereas if you feel okay this is my patient, my service, then you feel like I owe this to this patient. If something bad happens to them, it's on me," (Participant 12253).

In some respects, DHRs have been shown to have positive effects on residents, improving sleep and wellbeing, as well as decreasing fatigue [27]. Nonetheless, the majority of comments about the 16-hour model in our study were negative. Four main issues emerged: decreased sense of teamwork and resident responsibility, decreased operative exposure, increased sign over and lack of patient ownership, and finally fatigue and strain from long, frequent shifts and fewer full days of rest.

Decreased sense of teamwork and resident responsibility affected motivation by negatively impacting the sense of relatedness when covering shifts:

"I did a month of night shifts in a little institution where I didn't really know the residents, I didn't know the staff at all, I hadn't worked there at all and you can feel extremely isolated from them. So, I mean, you can talk about patient care and that's one aspect to it but in terms of just being in R1 and feeling that you're learning and feeling that you're part of the team. Shift work, especially if you're doing shift work at night and you're always changing staff and senior residents, then you end up finding yourself lost and having no idea what expectations are, you know what I mean?" (Participant 12262).

This quote explains how junior residents are affected by DHRs.

However, this spills over, affecting senior residents as well. With fewer junior residents present during the day, seniors are required to complete more junior tasks, thus diminishing their sense of competence and autonomy:

“It used to be that as a senior, you cared about the global picture [...]. Now [...] there is no junior so you are so exhausted doing junior things that you can't see the big picture. Now, I am replacing magnesium, potassium, sitting in the computer, going through [medical records],” (Participant 12252).

“You very rarely have juniors on a lot of services, which did not use to be the case. It fragments teams and it puts an undue strain on the senior. Undue and actually dangerous, because the senior should be reading and being in the OR. And making the decisions about patients, not replacing magnesium and potassium on the floor. And the seniors are doing that right now. They are writing discharge summaries, they are replacing magnesium and potassium. [...] But I think if we're going to become competent and confident, you need to learn. I think we've learned how to do summaries, I think it's time to actually learn the medicine, or surgery,” (Participant 12253).

The second issue was a concern over decreased operative exposure in the era of DHRs:

“If you were on call during the day, [...] and you seen an appendectomy, it always goes after elective OR is done, 5-6pm, so the majority of the residents stay. When I was doing ACS, I stayed until 10 pm every day to do my cases because you won't get the operative exposure. You do consults but at R3, you are fed up with consults and you have mastered that skill but you want to operate, so you need to stay for your cases or somebody else will do it,” (Participant 03111).

Given the technical nature of surgery, becoming competent and autonomous are inherently tied to the acquisition of operative skills. The resident above explains how shift work can lead to decreased operative exposure on certain rotations and thus negatively impact core motivational values. Several studies looking at the 80-hour workweek confirm that DHRs lead to decreased operative exposure [8,28,29]. Given the more extreme nature of the 16-hour shift limitations that applies to residents in this study, it is likely that operative exposure is even further impacted, hence decreasing feelings of competence and thus motivation for training.

Another negative consequence of DHRs that emerged was an increase in sign over and lack of patient ownership.

“You don't really know anyone and instead of having a list of 12 patients, you have 3 lists of 48 patients total and you don't really know the patients. [...] You're less likely to have that feeling [of patient ownership] if you do shift work especially if you're on nights where you're mainly putting out fires,” (Participant 12262).

“The disadvantage is that you book someone in the morning and you don't get to operate. Or you start your shift you're supposed to operate on a patient but haven't seen them before,” (Participant 12261).

These comments again touch on the concept of relatedness, this time relatedness to the patient. As exemplified earlier in this study, providing patient care is a strong intrinsic motivator for residents, and central to their identity as physicians. Thus when residents have to work night shifts and only cover emergencies for patients that they don't know, or are expected to operate on patients whose care they have not been a part of, this decreases their feelings of motivation.

Finally, residents commonly talked about fatigue and strain from long, frequent shifts and fewer full days of rest. While this concept seems counter-intuitive, given that the purpose of the 16-hour shift was to lessen resident fatigue, the fatigue inherent to shift-work has been previously reported [24]. Shiftwork fragments residents' sleep patterns and lifestyle:

“In the long run, for the resident, [shiftwork is] more exhausting I think. Because [...] you do nothing. You go sleep and come back to work. It's more exhausting and I think you feel more depressed than if you did one 24h shift then continue your regular [schedule],” (Participant 12253).

This causes feelings of low relatedness, not only at work but in residents' personal lives, as well as low autonomy from having minimal control over one's schedule. In addition, adjusting to working nights can take several days [30]. As residents often switch back and forth between day and night shifts, this can also negatively impact their overall clinical experience:

“[Shift work] doesn't let you be in the team, you miss a lot of the elective procedures, things that happen in your service. When changing from morning to nights to morning again, you lose some days also after and before,” (Participant 02251).

Taken together, these data suggest the 16-hour call schedule interferes with intrinsic motivation for training among surgical residents, affecting all three core needs.

Limitations

The results of the study are limited by several factors. The participant sample was confined to residents from one training program. The issues that arose might thus be program-specific, limiting the generalizability of the results. It is possible that a more diverse sample of residents from multiple training programs may have yielded different results. In addition, although DHRs are a reality for trainees throughout North America and beyond, the 16-hour call system only applies to residents in the province of Quebec [2] and interns in the United States [6]. Therefore the results may not be relevant to residents subject to different working conditions. Finally, the qualitative nature of the study lends room for interpretation, leading to subjectivity in the coding as well as interpretation of the data collected. Nonetheless, this study gets at many of the key issues that residents currently face and can serve as a guide for future research.

Conclusion

In conclusion, we found that surgical resident motivation is mainly intrinsically oriented. Residents reported greatest satisfaction in training when the three core human needs of competence, relatedness and autonomy are met. This is accomplished through developing operative skill (competence), working in a team (relatedness), and being trusted to provide good patient care (autonomy). Factors that negatively affect motivation are ones that fail to meet these needs: failure to improve, inability to provide independent patient care, receiving negative feedback, lack of patient ownership and fragmented team interactions. Stringent DHRs, such as those leading to shift work, seemed to negatively affect resident motivation for training by decreasing teamwork, patient ownership and operative exposure while increasing fatigue. The findings of this study may be used to inform resident scheduling decisions in order to improve motivation amongst surgical trainees.

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References

- Ahmed N, Devitt KS, Keshet I, Spicer J, Imrie K, Feldman L, et al. A systematic review of the effects of resident duty hour restrictions in surgery: impact on resident wellness, training, and patient outcomes. *Annals of Surgery*. 2014; 259:1041-53.
- Dussault C, Saad N, Carrier J. 16-hour call duty schedules: the Quebec experience. *BMC Medical Education*. 2014; 14 Suppl 1:S10.

3. Ayas NT, Barger LK, Cade BE, Hashimoto DM, Rosner B, Cronin JW, et al. Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA: the journal of the American Medical Association*. 2006; 296:1055-62.
4. Barger LK, Ayas NT, Cade BE, Cronin JW, Rosner B, Speizer FE, et al. Impact of extended-duration shifts on medical errors, adverse events, and attentional failures. *PLoS Medicine*. 2006; 3:e487.
5. Condren AB, Divino CM. Effect of 2011 Accreditation Council for Graduate Medical Education Duty-Hour Regulations on Objective Measures of Surgical Training. *Journal of Surgical Education*. 2015; 72:855-61.
6. Dennis BM, Long EL, Zamperini KM, Nakayama DK. The effect of the 16-hour intern workday restriction on surgical residents' in-hospital activities. *Journal of Surgical Education*. 2013; 70:800-5.
7. Scally CP, Reames BN, Teman NR, Fritze DM, Minter RM, Gauger PG. Preserving operative volume in the setting of the 2011 ACGME duty hour regulations. *Journal of Surgical Education*. 2014; 71:580-6.
8. Fairfax LM, Christmas AB, Green JM, Miles WS, Sing RF. Operative experience in the era of duty hour restrictions: is broad-based general surgery training coming to an end? *The American Surgeon*. 2010; 76:578-82.
9. Bell RH, Jr. Why Johnny cannot operate. *Surgery*. 2009; 146:533-42.
10. Bell RH Jr, Biester TW, Tabuenca A, Rhodes RS, Cofer JB, Britt LD, et al. Operative experience of residents in US general surgery programs: a gap between expectation and experience. *Annals of Surgery*. 2009; 249:719-24.
11. Mattar SG, Alseidi AA, Jones DB, Jeyarajah DR, Swanstrom LL, Aye RW, et al. General surgery residency inadequately prepares trainees for fellowship: results of a survey of fellowship program directors. *Ann Surg*. 2013; 258:440-9.
12. Borman KR, Vick LR, Biester TW, Mitchell ME. Changing demographics of residents choosing fellowships: longterm data from the American Board of Surgery. *Journal of the American College of Surgeons*. 2008; 206:782-8; discussion 8-9.
13. Ten Cate TJ, Kusurkar RA, Williams GC. How self-determination theory can assist our understanding of the teaching and learning processes in medical education. *AMEE guide No. 59. Medical Teacher*. 2011; 33:961-73.
14. Cook DA, Artino AR, Jr. Motivation to learn: an overview of contemporary theories. *Medical education*. 2016; 50:997-1014.
15. Deci E, Ryan, R. *Intrinsic motivation and self-determinism in human motivation*. New York, New York: Plenum Press; 1985.
16. Ryan RM, Deci EL. *Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions*. *Contemporary educational psychology*. 2000; 25:54-67.
17. Benware C, Deci, E. Quality of Learning with an Active versus passive motivational set. *Am Educ Res J*. 1984:755-65.
18. Grolnick W, Ryan, RM. Autonomy in children's learning: an experimental and individual difference investigation. *J Pers Soc Psychol*. 1987; 52:890-8.
19. Guay F, Vallerand, R. Social context, student's motivation and academic achievement: toward a process model. *Soc Psychol Educ*. 1997; 1:211-33.
20. Kage M, Namiki, H. The effects of evaluation structure in children's intrinsic motivation and learning. *Japanese J Educ Psychol*. 1990; 38:36-45.
21. Orsini C, Binnie VI, Wilson SL. Determinants and outcomes of motivation in health professions education: a systematic review based on self-determination theory. *Journal of educational evaluation for health professions*. 2016; 2:13:19.
22. Ng JY, Ntoumanis N, Thogersen-Ntoumani C, Deci EL, Ryan RM, Duda JL, et al. Self-Determination Theory Applied to Health Contexts: A Meta-Analysis. *Perspectives on psychological science: a journal of the Association for Psychological Science*. 2012; 7:325-40.
23. *Qualitative Research in Health Care: John Wiley & Sons; 2013.*
24. Hamadani FT, Deckelbaum D, Sauve A, Khwaja K, Razek T, Fata P. Abolishment of 24-hour continuous medical call duty in quebec: a quality of life survey of general surgical residents following implementation of the new work-hour restrictions. *Journal of surgical education*. 2013; 70:296-303.
25. Jamal MH, Wong S, Whalen TV. Effects of the reduction of surgical residents' work hours and implications for surgical residency programs: a narrative review. *BMC Medical Education*. 2014; 14 Suppl 1:S14.
26. Hanna J, Gutteridge D, Kudithipudi V. Finding the elusive balance between reducing fatigue and enhancing education: perspectives from American residents. *BMC Medical Education*. 2014; 14 Suppl 1:S11.
27. Harris JD, Staheli G, LeClere L, Andersone D, McCormick F. What effects have resident work-hour changes had on education, quality of life, and safety? A systematic review. *Clinical Orthopaedics and Related Research*. 2015; 473:1600-8.
28. Hope WW, Griner D, Van Vliet D, Menon RP, Kotwall CA, Clancy TV. Resident case coverage in the era of the 80-hour workweek. *Journal of Surgical Education*. 2011; 68:209-12.
29. Christmas AB, Brintzenhoff RA, Sing RF, Schmelzer TM, Bolton SD, Miles WS, et al. Resident work hour restrictions impact chief resident operative experience. *The American Surgeon*. 2009; 75:1065-8.
30. Puddester D. Managing and mitigating fatigue in the era of changing resident duty hours. *BMC Medical Education*. 2014; 14 Suppl 1:S3.