

Variable Shift Length Negatively Associated With Emergency Medicine Resident Wellness

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ABSTRACT

Introduction: Burnout is very common in emergency medicine and there has been extensive research evaluating factors that contribute to burnout. We sought to examine the contributions of post-graduate year (PGY), shifts worked per month, patients seen per shift, and length of shifts to emergency medicine resident burnout.

Methods: All emergency medicine residents were surveyed with regards to their PGY, shifts worked per month, patients seen per shift, and length of shifts. They were administered the Stanford Wellness Survey and asked to globally rate their degree of burnout. We then modeled whether consideration of the surveyed factors increased the predictability of the Stanford Wellness Survey to residents' self-assessment of burnout.

Results: Two hundred thirty-six residents completed the survey. The Stanford Wellness Survey indicated that while 93% of respondents met criteria for professional fulfillment, 59% were also at increased risk for burnout. PGY, shifts worked per month, and patients seen per shift did not significantly contribute to burnout. The Stanford Wellness Survey by itself correctly predicted residents' degree of burnout 61% of the time. Incorporating shift length with the Stanford Wellness Survey did improve the model to 65%. Increasing from 8 to 10 hours ($p < 0.05$) and 8 to 12 hours ($p < 0.05$) increased burnout. Variable shift length had the highest odds of predicting burnout ($p < 0.001$).

Conclusion: Longer shifts were associated with a higher chance of burnout. Variable shift lengths had the highest odds ratio of being associated with burnout.

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INTRODUCTION

There is little debate over the fact that the life of an emergency medicine physician is stressful. From working nights and weekends to dealing with daily tragedy and death, emergency physicians must maintain composure in life's most difficult situations. It comes as no surprise that emergency medicine has one of the highest rates of burnout among all specialties. A 2019 Medscape survey report suggests burnout rates as high as 48% in emergency physicians [1]. This same study suggests 14% of physicians as a whole have thoughts of suicide and have approximately twice the rate of suicide as the general population. A 2017 study also points out that the second leading cause of death in resident physicians is suicide [2]. Documentation pressures within electronic health record systems, administrative process, the difficulty of learning the broad field of emergency medicine, and emergency department crowding are only some of the stressors faced by emergency medicine residents. As such, physician wellness has become more important than ever for the continuation and protection of emergency medicine as a profession [3, 4].

Upon examination of current literature, there are several studies that offer some insight into these topics. The American College of Emergency Physicians published updated scheduling guidelines in an effort to optimize longevity and minimize burnout among emergency physicians in 2017 [5]. They suggest avoiding overly long shift length, especially when working nights. This article does not provide insight into optimal shift length, however. It is also directed towards attending physicians and may not be directly transferable to emergency medicine residents. Another study in 2008 looked at productivity in emergency medicine residents and how it relates to shift length, suggesting that shorter shift lengths are associated with increased productivity in patients seen per hour [6]. Rischall et al surveyed emergency medicine residents in 2018 and discovered 71% preferred 10 hour shifts over longer or shorter shift lengths [7].

The current literature seems to support that emergency medicine residents prefer mid-shift lengths and are more productive with shorter shift lengths, but the literature still lacks studies looking specifically at resident wellness when it comes to the factors mentioned above. Our study looked at how certain

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factors of residency life contribute to wellness and burnout in emergency medicine residents. We specifically considered post-graduate year, shifts worked per month, scheduled length of shifts, and average number of patients seen per shift. We hypothesized that lower levels of training, more patients seen per shift, more shifts worked per month, and longer shift lengths would negatively impact resident wellness.

METHODS

Study Design and Population

This was a multi-institutional, cross-sectional study using online surveys. Responses were anonymous. The study was determined to be exempt from informed consent by the Spectrum Health Lakeland Institutional Review Board. Emergency medicine residents from all residency programs in the US were sent the survey using SurveyMonkey by email. The survey was open for response from March 2019 through September 2019 and was sent out on two separate occasions.

Measures

We created a survey (**Appendix 1**) to examine the relation to wellness of four separate factors: post-graduate year, shifts worked per month, scheduled length of shifts, and average number of patients seen per shift. After answering those four questions they were administered the Stanford Wellness Survey, a validated instrument to assess both professional fulfillment and burnout [8]. It asks six questions relating to professional fulfillment and ten questions relating to work exhaustion and interpersonal disengagement (burnout). Finally, residents were also asked to describe their global sense of wellness or burnout.

Data analysis

Statistical analyses were completed using a combination of RStudio and SAS Enterprise Guide. Results from post-graduate year, shifts worked per month, scheduled length of shifts, and average number of patients seen per shift were batched and summarized using counts. The Stanford Wellness Survey responses and global sense of wellness or burnout were converted to a Likert scale using 0-4. A composite score was then calculated for the Stanford Wellness Survey. Cumulative logistic regression models using Wald chi-square testing were created to assess the effect of the measured factors when combined with the composite Stanford Wellness Survey result upon the residents' perception of overall wellness. Thirty percent of the observations were withheld from the training dataset used to create the model to allow it to be tested. Odds ratios with 95% Wald confidence limits for burnout were then calculated for the variable(s) incorporated into the final model.

RESULTS

Survey respondents

A total of 241 responses were obtained from multiple institutions across the US (totaling 9.4% of residents). Of these 5 surveys were incomplete. The specific institutions were not identified in this study in hopes of increasing the honesty in responses, however IP addresses were recorded in the

spreadsheet to ascertain at least that unique computers were used by respondents. Ninety-nine cities spanning 32 states were represented through review of the IP addresses. Responses of the respondents with regard to post-graduate year, shifts worked per month, schedule length of shifts, and average number of patients seen per shift are reported in **Table 1**.

Table 1: Survey results

Parameter	Number of Respondents (n=241)
<i>Post-graduate year</i> (n=240)	
PGY 1	93 (39%)
PGY 2	73 (30%)
PGY 3	52 (22%)
PGY 4	22 (9.1%)
<i>ED Shifts per month</i> (n=241)	
12-15	14 (5.8%)
15-18	110 (46%)
>18	117 (49%)
<i>Length of shifts</i> (n=241)	
8 hours	34 (14%)
9 hours	46 (19%)
10 hours	86 (36%)
12 hours	25 (10%)
Variable	50 (21%)
<i>Patients seen per shift</i> (n=241)	
<10	38 (16%)
10-15	100 (41%)
16-20	71 (29%)
21-25	30 (12%)
>25	2 (0.83%)

Stanford Wellness Survey

The first six questions of the scale focus upon professional fulfillment, of which 92.5% of respondents achieved the survey's previously validated cut-point to project fulfillment. However, 58.9% of respondents met the survey's previously validated cut-point for having a higher risk of overall burnout on the next ten questions of the Stanford Wellness Survey. A composite score was calculated using this survey, following Jrockel et al, [8] and the results are presented in **Figure 1**. These results appear to show a normal distribution. Higher scores correlate with higher burnout.

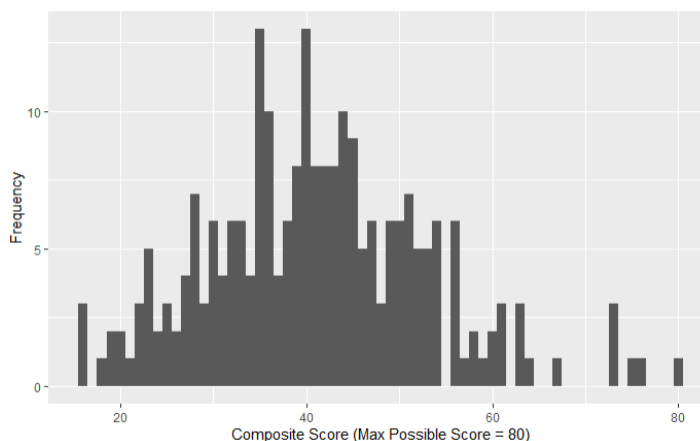


Figure 1: Histogram of Stanford Wellness Composite Score

Individual Perception of Burnout

Residents were also surveyed upon their global self-perception of burnout. Results are displayed in **Table 2**.

Table 2: Individual Perception of Burnout

Individual Perception of Burnout	Count
I enjoy my work. I have no symptoms of burnout	22
Occasionally I am under stress, and I don't always have as much energy as I once did, but I don't feel burnt out	125
I am definitely burning out and have one or more symptoms of burnout, such as physical and emotional exhaustion	70
The symptoms of burnout that I'm experiencing won't go away. I think about frustrations at work a lot	16
I feel completely burned out and often wonder if I can go on. I am at the point where I may need some changes or may need to seek some sort of help.	8

Cumulative Logistic Regression Model

Due to the category “12-15” Emergency Department Shifts per month having 14 observations, this category was combined with “15-18” for the regression analysis. Due to the category “>25” patients per shift having 2 observations, this category was combined with “20-25” for the regression analysis. Similarly, the final two categories in the individual perception of burnout were combined.

As expected, there was strong evidence that the Stanford Wellness composite score predicted individual perception of burnout (**Table 3**). Cumulative logistic regression was used to create models assessing if any of the four separate factors reported (post-graduate year, shifts worked per month, scheduled length of shifts, and average number of patients seen per shift) predicted individual perception of burnout, when combined

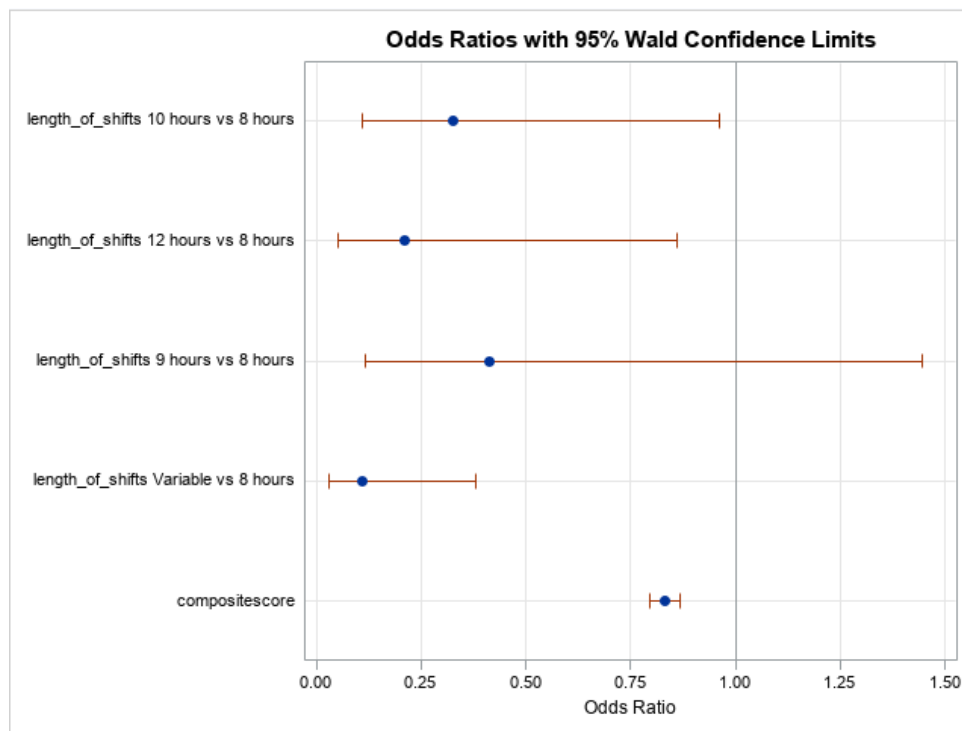
with the Stanford Wellness composite score, than did the Stanford Wellness composite score alone. Using the withheld 30% of the data to test the model, the Stanford Wellness composite score correctly classified a resident’s individual perception of burnout 61% of the time. The model which best predicted an individual’s self-assessed degree of burnout used only the Stanford Wellness composite score and the length of shifts that residents worked. This model correctly classified individual perception of burnout 65% of the time.

Table 3: Model Predictability Table

Variables in Model	Predictability
Composite Score	61.11%
Composite Score, Length of Shifts	65.28%
Composite Score, Length of Shifts, Post-graduate Year	63.89%
Composite Score, Length of Shifts, Patients per Shift	63.89%

Odds ratios were then evaluated for different shift lengths. Eight-hour shifts were found to be associated with the least amount of burnout when coupled with the composite score calculated from the Stanford Wellness Survey. Eight-hour shifts were then used as the baseline in comparison to the other shift lengths. An increase in shift length from 8 to 9 hours non-significantly increased the odds of burnout. Further increases from 8 to 10 hours (P value = 0.04) and from 8 to 12 hours (P value = 0.03) significantly increased burnout. Variable shift lengths had the greatest increase in burnout (P value = 0.0005) (**Figure 2**).

Figure 2: Odds ratios of burnout reported on resident self-assessment based on shift length as well as the odds ratio of burnout reported on resident self-assessment based on Stanford Wellness Survey (composite score)



DISCUSSION

Lin et al found a 76% prevalence of burnout in American emergency medicine in 2017 [9]. In our study slightly less than 60% of residents met the Stanford Wellness Survey criteria for burnout. Our hope is this reduction reflects progress with systematic improvements to decrease burnout. Identifying areas for further improvement is therefore important. Total duty hours and shift work strategies for managing night shifts have been reviewed previously [10, 11]. We found that emergency medicine resident physicians experience less burnout with shorter shift lengths, and appear more burnt out with longer and variable shift lengths.

We believe recognition that variable shift lengths are a contribution to burnout is a novel finding in the emergency medicine literature. The Emergency Medicine Residents Association (EMRA) in their medical student advising guide makes no mention of variable shift length, other than that they exclude those from their figure detailing average shift lengths of different programs. Variability in work hours has been previously recognized as negatively affecting well-being in a large survey of workers (not necessarily in health care) in Europe [12]. Rischall et al found that EM residents' preference was for 10 hours shifts, which would initially seem to run counter to this study's finding that eight hour shifts are least associated with burnout. Shorter shift lengths have also been shown to decrease medical errors in both the physician and nursing setting [13, 14]. However, recognition that variable shift lengths are what contribute most to burnout of the variables assessed could explain why residents prefer 10 hour shifts: the contrast between a ten hour shift and other possibilities is less than the contrast between an eight hour and a 12 hour shift.

Our results are consistent with Wrenn et al who found that total patients seen during a shift did not seem to add to overall stress of emergency medicine residents [15]. Similarly we did not find a difference for number of shifts worked per month. It is possible that this is because while working shorter shifts would likely be associated with working more shifts in a month, the wellness gains of a shorter shift more than offset having to work more days. That post-graduate year was not a significant factor in burnout was a somewhat surprising finding to us as we would have expected this to increase. However, the Stanford Wellness Survey assesses both professional fulfillment as well as burnout. We suspect that fulfillment increases as residents gain greater experience and expertise. Most residents surveyed showed high levels of fulfillment, though greater than half were also at risk of burn-out. The higher fulfillment rates may account for residents reporting less global burnout than the Stanford Wellness Survey would predict. Weidel, et al, found that 23% of health care workers who met their index's criteria for burnout did not self-report burnout; health care workers may underestimate their burnout [16]. In contrast, Goldeberg, et al, found that attending emergency medicine physicians experiencing burnout were able to self-identify burnout [17]. Goldberg's study group also self-assessed their productivity and effectiveness as low which could support that higher fulfillment can be somewhat protective from burnout.

There is significant variability in scheduling practices in residency programs [18]. Consideration of shifts, both in total

length and variability, may be a question which prospective 4th year medical students evaluating choices in residency programs should consider. Similarly, this is valuable information for an emergency medicine residency program director to help care for his or her residents, and may assist with the recruiting process.

LIMITATIONS

Our study is subject to some limitations. First, since this is a survey-based study, it is subject to self-reporting bias by the participants. By using a validated wellness survey this bias was minimized as much as possible. Second, we had 241 responses from the 2,567 residents in the United States. A larger response rate may shed more light on the factors we studied and their relation to resident wellness. This response rate is comparable to other wellness/burnout survey type projects that had 11% and 14% response rates respectively [16, 19]. We do not know geographic locations or whether residents were training in an academic or a community system. We also relied on residents to accurately estimate their number of patients seen per shift and shifts per month, it is possible that if program directors supplied this data for their residents that different numbers would have been obtained. We did not control for shift length on off-service rotations or whether the resident was currently on-service in the ED or if they were training in an off-service rotation. However, it is very possible that shift length would vary on off-service rotations and contrast with shift lengths in the ED and so could contribute to residents' perception of shift length tolerability.

CONCLUSION

In conclusion, our study demonstrated that variable shift lengths, and to a lesser extent longer shift lengths contribute to decreased resident wellness. We were unable to demonstrate a negative relationship between resident wellness and number of patients seen per shift, number of shifts worked per month, and level of training. Future studies evaluating resident wellness where programs have switched from longer or variable shifts to shorter length shifts would help in the validation of this study. Based on the results of this study, medical students and program directors should carefully evaluate how schedules are constructed in their potential residency programs to minimize burnout during the stressful years of training.

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Appendix A: Survey questions

What is your current PGY#?

- PGY#1
- PGY#2
- PGY#3
- PGY#4

On average, how many ED shifts do you work per month?

- 12-15
- 15-18
- >18

What is the scheduled length of your ED shifts?

- 8 hours
- 9 hours
- 10 hours
- 12 hours
- Variable

On average, how many patients do you see per shift?

- <10
- 10-15
- 15-20
- 20-25
- >25

How true do you feel the following statements are about you during the past 2 weeks?

I feel happy at work

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

I feel worthwhile at work

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

My work is satisfying to me

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

I feel in control when dealing with difficult problems at work

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

My work is meaningful to me

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

I'm contributing professionally (e.g. patient care, teaching, research, and leadership) in the ways I value most

- Not at all True
- Somewhat True
- Moderately True
- Very True
- Completely True

During the past 2 weeks, to what degree have you experienced the following?

A sense of dread when I think about work I have to do

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Physically exhausted at work

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Lacking in enthusiasm at work

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Emotionally exhausted at work

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less empathetic with my patients

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less empathetic with my colleagues

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less sensitive to others feelings/emotions

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less interested in talking with my patients

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less connected with my patients

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Feeling less connected with my colleagues

- Not at all
- Very little
- Moderately
- A lot
- Extremely

Using your own definition of "burnout," please select one of the following responses:

- I enjoy my work. I have no symptoms of burnout
- Occasionally I am under stress, and I don't always have as much energy as I once did, but I don't feel burnt out
- The symptoms of burnout that I'm experiencing won't go away. I think about frustrations at work a lot
- I am definitely burning out and have one or more symptoms of burnout, such as physical and emotional exhaustion
- I feel completely burned out and often wonder if I can go on. I am at the point where I may need some changes or may need to seek some sort of help.