

Kelly-Schuetz K, Shaker T, Carroll J, Davis AT, Wright P, Chung M. A prospective observational study comparing effects of call schedules on surgical resident sleep and physical activity using the Fitbit. *J Grad Med Educ.* 2021;13(1):113–118.

Supplementary Data

TABLE 1
Minutes of Sleep by PGY

Year	Marginal Mean (min)	95% Confidence Interval^a
PGY1	363	294–433
PGY2	311	261–361
PGY3	304	248–360
PGY4	265	224–306
PGY5	271	217–325

Abbreviation: PGY, postgraduate year

^a No pairwise comparisons were statistically significant ($P > .05$).

Note: Obtained from the mixed effects negative binomial regression model, where minutes of sleep was the dependent variable, while the independent variables were timeframe type, surgical service, post-graduate year (PGY), and sex. The random effect was the individual. Marginal means are shown. The marginal means are the average means for each PGY, averaged for all levels of the other factors (eg, surgical service, timeframe type, sex).

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TABLE 2

Minutes of Sleep by Surgical Service

Surgical Service	Marginal Mean (min)	95% Confidence Interval^a
GS 1	273	213– 332
Emergency GS	332	282–382
GS 2	309	259– 359
Trauma	276	221– 332
Elective	317	178– 457
Colorectal	288	215–361
Vascular 1	349	215–484
Vascular 2	422	216– 628
Pediatric surgery	241	147– 336
Breast	234	126– 343
SICU	243	194– 292
Thoracic	289	154– 423
Safety/research	324	156– 491
Endoscopy	344	174–514
Surgical oncology	343	242– 444
Chief clinic	422	215– 629

Abbreviations: GS, general surgery; SICU, surgical intensive care unit.

^a No pairwise comparisons were statistically significant ($P > .05$).

Note: Obtained from the mixed effects negative binomial regression model, where minutes of sleep was the dependent variable, while the independent variables were timeframe type, surgical service, post-graduate year (PGY), and sex. The random effect was the individual. Marginal means are shown. The marginal means are the average means for each Rotation type, averaged for all levels of the other factors (eg, surgical service, timeframe type, sex).

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TABLE 3
Steps by PGY

Year	Marginal Mean	95% Confidence Interval^a
PGY1	8789	7285– 10291
PGY2	8605	7349– 39862
PGY3	8257	7106– 9408
PGY4	9467	8188–10746
PGY5	9388	7900– 10877

Abbreviation: PGY, postgraduate year.

^a No pairwise comparisons were statistically significant ($P > .05$).

Note: Obtained from the mixed effects negative binomial regression model, where steps was the dependent variable, while the independent variables were surgical service, timeframe type, post-graduate year (PGY), and sex. The random effect was the individual. Marginal means are shown. The marginal means are the average means for each PGY, averaged for all levels of the other factors (eg, surgical service, timeframe type, sex).

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TABLE 4
Steps by Surgical Service

Surgical Service	Marginal Mean	95% Confidence Interval^a
GS 1	8571	7322 - 9819
Emergency GS	8577	7529 - 9624
GS 2	8909	7808 - 10009
Trauma	10089	8582 - 11595
Elective	7413	5169 - 9657
Colorectal	7528	6322 - 8734
Vascular 1	8415	6351 - 10479
Vascular 2	10767	7818 - 13716
Pediatric Surgery	10977	8487 - 13467
Breast	9117	6847 - 11387
SICU	9077	7680 - 10475
Thoracic	10637	7809 - 13465
Safety/Research	10279	7226 - 13332
Endoscopy	7851	5623 - 10078
Surgical Oncology	8118	6595 - 9640
Chief Clinic	9274	6548 - 12001

Abbreviations: GS, general surgery; SICU, surgical intensive care unit.

^a No pairwise comparisons were statistically significant ($P > .05$).

Note: Obtained from the mixed effects negative binomial regression model, where steps was the dependent variable, while the independent variables were timeframe type, surgical service, post-graduate year (PGY), and sex. The random effect was the individual. Marginal means are shown. The marginal means are the average means for each Rotation type, averaged for all levels of the other factors (eg, surgical service, timeframe type, sex).

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Additional Data Regarding REM and Deep Sleep

Based on current literature and the manufacturer data the FitBit Charge 2 is only accurate for measuring total sleep time and efficiency.¹⁻³ Given the inaccuracy of sleep stages and transitions (REM and deep sleep) the authors have chosen to include this data as supplementary.

The variations in minutes of Rapid Eye Movement (REM) sleep and deep sleep are described in Supplementary Table 5. Analyses were run as mixed effects negative binomial regression models. The FitBit® data variable (REM sleep, deep sleep) was the dependent variable, while the independent variables were timeframe, rotation type, post-graduate year (PGY), and sex. The random effect was the individual.

IHC had significantly less REM than home call (IHC 116 vs. home call 146 minutes; $P < .001$). NF had significantly less REM sleep than home call (NF 125 vs. home call 146 minutes; $P = .004$). Similarly, IHC and NF were the call shifts with the least amount of deep sleep (11 min. and 24 min., respectively). However, only the difference between IHC and home call was statistically different. Minutes of deep sleep and REM sleep for off-call shifts are shown in Supplementary Table 5. PC24 had significantly more REM sleep than other off-call shifts. Deep sleep was not different across all off-call shifts when compared to PC24.

References

1. Liang L, Chapa-Martell MA. Accuracy of FitBit wristbands in measuring sleep stage transitions and the effect of user-specific factors. *JMIR Mhealth Uhealth.* 2019;7(6):e13384. doi: 10.2196/13384.
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TABLE 5
Rapid Eye Movement (REM) and Deep Sleep^b

	REM (min)^{c, d}	95% CI	Deep Sleep (min)^{c, e}	95% CI
On-Call Timeframes				
Home Call	146	138 - 154	46	32 - 61
NF	125	116 - 133	24	14 - 34
IHC	116	110 - 123	11	7 - 15
Off-Call Timeframes				
PC24	184	173 - 194	68	45 - 91
PCHC	157	147 - 167	57	34 - 80
Not on Call	156	151 - 162	50	41 - 60
Not Working	153	147 - 159	42	32 - 52

Abbreviations: CI, confidence interval; NF, night float; IHC, 24-hour in-house call; PC24, post call from 24-hour in house call; PCHC, post call from 24-hour home call.

^b Each timeframe includes 24-hours and the designated type of shift.

^c Values represent the marginal means obtained from the mixed effects model analysis.

^d Significant differences: In House Call had significantly less REM Sleep than Not Working, Not on Call, Post Call (in house call), Home call, and Post Call (home call), $P < .001$; Post Call (in house call) had significantly more REM sleep than Not Working, Not on Call, Night Float, and Home Call ($P < .001$), and Post Call (home call) ($P = .003$). Night Float had significantly less REM Sleep than Not working, Post call (home call) and Not on Call ($P < .001$), and Home Call ($P = .004$). Home Call had significantly less REM Sleep than Post Call (in house call) ($P < .001$). No other pairwise comparisons were statistically significantly ($P > .05$).

^e Significant differences: In House Call had significantly less Deep Sleep than Not Working, Not on Call, Post Call (in house call), Home call, and Post Call (home call), $P < .001$; Post Call (in house call) had significantly more Deep sleep than Night Float ($P = .001$). Night Float had significantly less Deep Sleep than Not on Call ($P = .013$). No other pairwise comparisons were statistically significant ($P > .05$).