

# The Impact of an Internal Medicine Nocturnist Service on Quality of Care at a Large Canadian Teaching Hospital

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Funding: Dr. Cram is supported by a grant from the US National Institute of Aging (R01AG058878).

Dr. Wu is supported by an award from the Mak Pak Chiu and Mak-Soo Lai Hing Chair in General Internal Medicine, University of Toronto.

Acknowledgement: None of the other authors declare any conflicts of interest or industry relationships.

We would like to acknowledge and thank Dr. Brian Hodges for helpful comments on the manuscript.

Word Count (excluding headings): 2495

Abstract Word Count: 250

References: 22

2 Tables

## Abstract

### *Background*

Nocturnists (overnight hospitalists) are commonly implemented in US teaching hospitals to adhere to mandated per-resident patient caps and improve care. Nocturnists are rare in Canada with fewer limitations on patient caps or resident duty hours.

### *Objective*

To assess the impact of a newly implemented nocturnist program in a major Canadian teaching hospital on perceived quality of care, code status documentation and patient outcomes.

### *Design, Participants, and Intervention*

Nocturnists were deployed gradually between June 2018-December 2019. Surveys were administered to faculty and residents in General Internal Medicine to assess perceptions of the impact of the nocturnist program. We compared rates of entry of a code-status order, in-hospital mortality, 30-day readmission rate, and length of stay for patients admitted by nocturnists and by residents.

### *Key Results*

From July 2018 until June 2019, nocturnists were on duty for 242/365 nights (66%), reducing the average per-resident patient census from  $40 \pm 4$  to  $25 \pm 5$  ( $p < 0.001$ ). The survey was completed by 15/24 faculty (63%) and 30/102 residents (29%). Both groups perceived improvements in safety and efficiency, with a positive impact on education. Admission code-status entry improved from 35% when patients were admitted by residents to 55% when admitted by nocturnists ( $p < 0.001$ ). The program had no impact on mortality, length of stay, or 30-day readmission rate.

### *Conclusions*

Implementation of nocturnists reduced residents' patient census, improved perceptions of quality, enhanced trainees' educational experience, and improved documentation of code status. Our results should motivate widespread nocturnist implementation in Canadian teaching hospitals.

## Introduction

Nocturnists (overnight hospitalists) have been widely implemented in teaching hospitals in the United States (US) in an effort to meet Accreditation Council for Graduate Medical Education (ACGME) workload standards<sup>1</sup>, improve overnight supervision, and enhance the quality of patient care<sup>2-8</sup>. Recent data suggest that approximately 50% of US teaching hospitals have nocturnists<sup>9</sup>. Several single-center surveys from the US suggest that nocturnist programs improve perceived quality-of-care, increase resident satisfaction of overnight supervision, and may enhance efficiency<sup>3,7</sup>. Alternatively, studies have not demonstrated reductions in hospital length-of-stay, mortality, or hospital readmission<sup>2</sup>.

Canadian teaching hospitals have been slow to implement nocturnists<sup>10</sup>. Canadian resident work hour limits are determined at the provincial level rather than nationally as in the US. Only Quebec has stipulated a maximum shift length (16-hours), with most provinces still allowing 24-hour shifts with an additional 2-hours for handover. In Europe, resident work hours are explicitly restricted to 48-hour workweeks, and 13-hour shift limits are common<sup>11</sup>. Moreover, many Canadian teaching hospitals still rely on residents to cover all admitted medical patients, with no specific caps on the number of patients per resident.

In July 2018, we implemented a nocturnist program at a major University of Toronto teaching hospital to address excessive patient volumes and rapid patient growth associated with our highly successful cancer hospital. As part of our implementation, we surveyed resident and staff physicians to assess their perceptions of the program's impact. We also assessed the impact of the program on documentation of resuscitation status, mortality, length-of-stay and readmissions.

## Methods

### *Setting*

We implemented our nocturnist service at Toronto General Hospital (TGH), a 471-bed urban quaternary teaching hospital with a mean general internal medicine (GIM) census of 120 patients, mean acute hospital LOS of 6.1 days and an average of 16 new admissions per-day primarily coming from our Emergency Department. GIM patients are managed by four resident teams (called Clinical Teaching Units in Canada [CTUs]) and two Resident Independent Units (Services) (RIUs). CTUs consist of an attending physician, one second-year or third-year resident, and three first-year residents plus medical students. The average census for our CTUs is 20-25 patients, but periodically reaches 30-35. Our two RIUs are staffed by attending physicians supported by a combination of visiting international trainees (fellows), nurse practitioners, and physician-assistants. Each RIUs has a cap of 20 patients. One RIU is an Oncology Team which focuses exclusively on patients with cancer.

Prior to implementation of our nocturnist service, nocturnal coverage for each CTU team would begin at approximately 5PM and be provided by one first-year resident from each CTU team (four on call each night). The on-call resident would be responsible for covering their team's 20-25 existing inpatients and admitting new patients to their team overnight. In addition, two residents were required to cross-cover and admit to the RIUs. Thus, in aggregate the two cross-covering first-year residents were typically covering 35-45 inpatients plus admitting 4-6 new patients per-night.

### *Intervention*

Introduced in July 2018, the nocturnist was responsible for admissions to the Oncology Team plus overnight coverage to both RIUs' existing census; Nocturnist shifts were from 5PM - 8AM, without an expectation of supervising trainees.

Shifts were offered to existing faculty, but with most having significant academic roles, we also developed a pool of independently licensed physicians from the community. Ontario physicians are primarily reimbursed on a fee-for-service basis by the Ministry of Health with supplemental

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3 payments for off-hours work. However, competition in the local markets necessitated hospital  
4 supplementation to entice physicians to cover nights. Our nocturnist model was introduced in a  
5 graduated manner, with nocturnal coverage increasing over time.  
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### 9 10 *Surveys*

11 Between June and December 2019, we emailed surveys to all residents at the end of their four-  
12 week rotation at our hospital. We developed our survey based upon prior studies of nocturnist  
13 programs and adapted questions to our specific needs<sup>7,8</sup>. The survey addressed several different  
14 domains including quality of care, medical errors, and burnout (see Appendix 1) with additional  
15 space for free-text responses. Residents at TGH all regularly work in other University of  
16 Toronto teaching hospitals which all lack nocturnist programs. Thus, our residents are able to  
17 assess the addition of a nocturnist program.  
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25 We administered a modified version of our resident survey to staff physicians in June 2019.  
26 (Appendix 2).  
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### 30 31 *Patient Outcomes*

32 We obtained patient-level data (e.g., age, sex, comorbidity) from our hospital's EHR data  
33 warehouse' comorbidity was captured using the Charlson Comorbidity Index (CCI), with scores  
34 ranging from 0-37, with higher scores representing higher burden of illness<sup>12</sup>. We identified  
35 patients admitted to GIM between July 1, 2018 and June 30, 2019 either by our nocturnists or by  
36 residents. We specifically focused our analysis on patients with cancer because they were  
37 admitted by nocturnists on nights when a nocturnist was on duty and by residents on nights  
38 without a nocturnist; nocturnist availability was quasi-random during our ramp-up phase.  
39 We compared entry of a code-status order in our EHR by 8AM, in-hospital mortality, hospital  
40 length of stay, 30-day readmission rate, for patients with cancer admitted by nocturnists and  
41 residents.  
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51 We used an electronic patient tracking system to determine the daily patient census covered by  
52 each resident. The tracking system indicates the admitted patient census for each of our CTUs  
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3 and RIUs at 8am. We used call schedules to combine censes for residents scheduled to cover  
4 their own CTU plus an RIU.  
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3 *Statistical analyses*  
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5 We compared demographics and comorbidity for patients admitted by nocturnists and residents  
6 using bivariate measures. We compared resident census coverage on nights with and without a  
7 nocturnist using a t-test. We examined survey responses from residents and staff using standard  
8 descriptive statistics (i.e., mean, median, percentages) using Microsoft Excel (Redmond, WA,  
9 USA). For dichotomous (yes/no) questions, we examined the proportion of staff answering  
10 “Yes;” for Likert-like questions (1= strongly disagree, 5= strongly agree) we calculated the mean  
11 score for each item for each respondent group. We compared unadjusted outcomes for patients  
12 admitted on nights with and without nocturnist coverage and adjusted analyses using logistic  
13 regression to control for differences in age, sex, and CCI (SPSS Software, IBM Inc., Armonk,  
14 NY, USA). We compared CCI and acute hospital length of stay for patients admitted by  
15 nocturnists and those admitted by residents using t-tests in SPSS. Our survey was considered  
16 quality improvement and deemed exempt by our institutional review board.  
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## Results

Nocturnist coverage was present for 241 of 365 nights (66%) between July 1, 2018 and June 30, 2019, with 19% covered by faculty and 81% by temporary staff. 30 physicians (5 faculty, 25 temporary) performed nocturnist shifts with a median of 5.5 shifts per physician during the study period (interquartile range (IQR) 2.0-9.8). Among the 123 nights without a nocturnist, the two residents required to cross-cover our RIUs had a mean overnight census ( $\pm$  standard deviation) of  $40.0 \pm 3.9$  patients, while two residents not required to cross-cover had a mean census of  $25.2 \pm 4.7$  ( $p < 0.001$ ) reflecting the incremental work of covering two teams.

### *Faculty and Resident Surveys*

We received responses from 15 of 24 faculty (response rate = 63%) with 73% being full-time faculty members with median time on faculty 9.0 years (IQR 3.5-15.0). 73% felt that the nocturnist program had improved quality, 60% perceived a reduction in medical errors and 73% reported an improvement in resident educational experience (Table 1). The perceived benefits of the nocturnist program included a reduced need for residents to handover to multiple different teams in the morning, a reduced number of admissions per resident, less cross-coverage of RIU teams with resultant improvements in care for patients on the RIUs. Most respondents indicated a reduction in their own burnout and perceived a reduction in burnout on the part of residents.

We received completed surveys from 30 of 102 residents (response rate = 29%). Most (87%) were enrolled in internal medicine residency. The median number of four-week blocks done previously at TGH was 2 (IQR 1-2). Resident respondents were mainly first-year residents (57%) and second-year residents (33%). 93% of respondents felt that the nocturnist program had improved overall care at TGH with 87% agreeing that the program had reduced medical errors (Table 1). 93% agreed that the nocturnist program reduced delays in overnight evaluation of acute issues arising in already admitted patients, and 97% felt that the nocturnist program allowed for more rapid evaluation of new admissions. All respondents (100%) reported an improvement in their educational experience. Residents reported reduced burnout (Table 1). Responses from residents mentioned additional benefits including fewer handovers and the ability for them to spend more time evaluating new admissions. Narrative comments were positive, without any concerns brought forth regarding decreased autonomy.



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3 *Patient Outcomes*  
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5 Patients admitted by nocturnists (N=339) and residents (N=133) were similar with respect to age  
6 sex, and CCI score (Table 2).  
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10 Unadjusted and adjusted in-hospital mortality was not statistically significantly different for  
11 patients admitted by residents (10.5%) as compared to nocturnists (5.6%) (Adjusted OR 1.90 (CI  
12 0.91, 3.95) (Table 2). Among patients admitted by residents, 8.3% were readmitted to our  
13 hospital within 30 days of discharge as compared to 5.9% admitted by nocturnists (adjusted OR  
14 1.34, 95% CI 0.62-2.92) (Table 2). Acute length of stay ( $\pm$  standard deviation) for patients  
15 admitted by residents was  $7.2 \pm 7.0$  days as compared with  $6.4 \pm 7.8$  days for those admitted by  
16 nocturnists ( $p = 0.30$ ) (Table 2). Code status orders were more common for admissions  
17 performed by nocturnists (186/339 patients, 55.0%) than residents (47/133 patients, 35.3%) ( $p <$   
18 0.001) (Table 2).  
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## Interpretation

We implemented a nocturnist program at a large Canadian academic medical centre to address concerns about resident workload and patient safety. Our nocturnist program reduced the number of patients residents were managing overnight and improved both resident and faculty perceptions of patient safety and educational experience. Our nocturnist program was associated with increased documentation of resuscitation status, an important process measure, but, as expected, had no impact on mortality, hospital readmission rate, and hospital length of stay. In aggregate, our results suggest that implementation of a nocturnist program can address several pressing concerns facing Canadian teaching hospitals<sup>13</sup>.

Several of our findings warrant elaboration. First, it is important to describe the current staffing models for medical inpatients in teaching hospitals. In Canada, nocturnal coverage is typically provided by first year residents with staff available by telephone. Nocturnists are rare and typically all admissions are performed by residents without caps on volumes of existing patients or new admissions. This contrasts with US hospitals in which first-year internal medicine residents can manage a maximum of 10 patients<sup>1</sup>. Our finding that our nocturnist program reduced the patient census for trainees, while expected, is dearly needed. In addition to sleep deprivation and its inherent effect on cognitive performance<sup>14</sup>, patient complexity is increasing<sup>15</sup>, and both societal and physician norms and expectations are changing with respect to work. In the United Kingdom, nocturnal reliance on physicians-in-training has motivated Hospital at Night programs<sup>16</sup>. In this model, specialty-specific nocturnal physician care was replaced by multidisciplinary teams sometimes led by nurse practitioners. Overnight staffing changes were only part of the model, which demonstrated improvements in hospital-wide care with net cost reduction<sup>16</sup>.

Second, our study adds to existing literature regarding the impact of nocturnists on quality. A survey by Trowbridge found that their nocturnist program was perceived by both residents and faculty to improve quality and safety<sup>7</sup>. A 2012 survey of US academic hospitalist program directors found that 61% of programs had nocturnists and 24% functioned independently from the teaching teams<sup>8</sup>. These authors found perceived improvements in patient safety, but potential reductions in resident autonomy<sup>8</sup>, while a more recent study reported similar findings<sup>9</sup>.

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3 Residents and faculty also felt that introduction of nocturnists allowed for more rapid evaluation  
4 of both new and existing patients.  
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8 Third, our finding that residents and faculty found that our nocturnist program had favorable  
9 impacts on education and training is somewhat consistent with prior literature<sup>7</sup>. For example, a  
10 survey of residents by Haber et al reported that nocturnists enhanced trainee perceptions of  
11 overnight supervision<sup>4</sup>. Conversely, Devendra et al reported reduced resident comfort with  
12 asking questions of nocturnists as compared with their resident counterparts, suggesting a  
13 potential educational cost to nocturnist supervision<sup>17</sup>.  
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20 Fourth, our finding that nocturnists did not improve mortality by a statistically significant  
21 amount, hospital length of stay, or readmissions is similar to prior studies<sup>2</sup>. Alternatively, it is  
22 interesting to note that while not statistically significant, the difference in mortality for patients  
23 admitted by residents and nocturnists (10.5% vs 5.6%) was clinically quite large. It is plausible  
24 that, given the higher census and longer shifts for Canadian residents when compared to their US  
25 peers, nocturnist programs could afford larger benefits in Canadian hospitals. Further study is  
26 warranted to see if these differences are replicated in other Canadian centres. Patients admitted  
27 by nocturnists were significantly more likely to have their code status entered into our EHR  
28 relative to patients admitted by residents. Documentation of code status is recognized as an  
29 important process measure in hospital medicine and provides tangible evidence of improvements  
30 in quality<sup>18,19</sup>. While not altogether surprising, this finding reinforces the potential benefits of  
31 reducing resident workload and shifting some proportion of new admissions onto experienced  
32 hospitalists.  
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44 There are several other findings regarding physician and program finances, wellness and  
45 education. It is important to recognize the financial support required to implement our program  
46 its potential impact on the “day-time” physician’s income. Having an in-house attending  
47 physician likely reduced the total amount billable to the attending physicians on our RIUs.  
48 Incentivizing night work also required a significant monetary stipend paid by our hospital.  
49 While residents are important care providers, the cost (their salaries) comes from provincial  
50 monies rather than hospital budgets. Therefore, employing nocturnists to supplement resident  
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3 shortages represents a net new cost to Canadian hospitals. With respect to wellness, burnout is a  
4 large problem for physicians and may be linked to workload<sup>20,21</sup>. All respondents in our study  
5 (though faculty less so) endorsed a reduction in burnout, with the limitation that no validated tool  
6 was used to objectively assess this. Some faculty respondents mentioned potential drawbacks  
7 including additional handovers, less daytime accountability for overnight issues, and lower  
8 billings, highlighting the importance of early faculty engagement in similar interventions.  
9 Graded responsibility is a hallmark of resident education, and no survey respondents perceived  
10 the nocturnist as an impediment to development of clinical independence.  
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### 19 *Limitations*

20 Our study has important limitations that should be considered. The low survey response rate  
21 from residents could potentially introduce non-responder bias, while social desirability bias  
22 could influence how respondents answered our survey questions. That said, survey responses  
23 were consistent with prior survey-based findings of nocturnist programs from the US. Secondly,  
24 these results come from a single Canadian teaching hospital and must be generalized with care.  
25 Third, we did not assess the impact of nocturnists on patient satisfaction or other patient-reported  
26 outcomes that might be improved by nocturnists<sup>22</sup>.  
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### 34 *Conclusion*

35 In conclusion, implementation of nocturnists reduced resident workload, improved resident and  
36 staff perceptions of quality and safety, enhanced trainees' educational experience, and improved  
37 documentation of code status. Our findings, in combination with the existing literature, make a  
38 compelling case for widespread implementation of nocturnists across Canadian teaching  
39 hospitals.  
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**Table 1** – Selected combined survey responses from faculty and residents from June 2019 to December 2019. Survey invitations were sent to 102 residents who rotated through internal medicine between June and December 2019, and 24 faculty members in June 2019. 30 responses were received from residents (response rate = 29%), and 15 responses were received from faculty (response rate = 63%). Likert-type responses ranged from “strongly disagree” (1) to “strongly agree” (5).

Question	Response	
	Faculty	Resident
In your clinical experience, were you aware of the TGH-GIM-Oncology Overnight Hospitalist?	Yes (100%), No (0%)	Yes (100%), No (0%)
Are you satisfied with the overall quality of care delivered at TGH? <i>Mean Likert ± Standard Deviation</i>	3.6±1.7	4.4±0.9
Since development of the Overnight Hospitalist program, the quality of care delivered at TGH GIM has:	Improved (73%) Stayed the same (13%) Decreased (13%)	Improved (93%) Stayed the same (7%) Decreased (0%)
The Overnight Hospitalist program has decreased medical errors. <i>Mean Likert ± Standard Deviation</i>	3.6±1.2	4.4±0.9
The Overnight Hospitalist program leads to faster overnight evaluation of patients who are already admitted on the wards. <i>Mean Likert ± Standard Deviation</i>	4.6±0.9	4.6±0.9
The Overnight Hospitalist program leads to faster evaluation of new patients in the emergency department. <i>Mean Likert ± Standard Deviation</i>	4.5±0.9	4.9±0.7
The educational experience on the internal medicine CTU has improved as a result of the Overnight Hospitalist / “nocturnist” program. <i>Mean Likert ± Standard Deviation</i>	4.1±1.3	4.8±0.4
The Overnight Hospitalist/“Nocturnist” Program has had which of the following effect on your medical billings ( <i>Faculty Only</i> ):	Increase (0%) No change (47%) Decrease (13%) Not Sure (40%)	--
What do you think are the benefits of the Overnight Hospitalist / “nocturnist” program? Please select all that apply from the reasons below.		
<i>No need to obtain handover from a team while still managing my own patients from the day (R)</i>	--	77%
<i>No need to “double cover” or cross-cover teams overnight</i>	80%	90%
<i>No need to handover in the morning to separate teams when cross-covering</i>	73%	87%
<i>No need to admit to more than one team overnight.</i>	60%	83%
<i>Fewer patients to evaluate/admit from the ED overnight</i>	80%	87%
<i>Fewer transfers from other hospitals to the ward to evaluate/admit overnight</i>	40%	50%
<i>More time to spend in the emergency department with fewer distractions</i>	73%	80%
<i>There is a dedicated physician in-house to cover the GIM-Oncology patients (Team 10)</i>	87%	87%
<i>There is a dedicated physician in-house to admit the GIM-Oncology Patients (Team 10)</i>	93%	77%
<i>There is a more experienced physician in-house to manage GIM-Oncology (Team 10) patients and to admit new GIM-Oncology (Team 10 patients)</i>	80%	90%
<i>Greater likelihood of being able to rest/sleep overnight</i>	27%	17%
<i>There is a greater likelihood that the attending will be able to rest overnight (F)</i>	40%	--
<i>Less need for communication with attending physician overnight</i>	40%	33%
<i>Nurses have improved access to physicians overnight regarding patient issues</i>	53%	47%
Do you think the overnight hospitalist program makes the hospital more attractive to residents? <i>Mean Likert ± Standard Deviation (Faculty only)</i>	4.0±1.7	Yes (97%), No (3%)
The overnight hospitalist program reduces resident burnout on the CTU. <i>Mean Likert ± Standard Deviation</i>	4.1±1.0	4.8±0.6

1 2 3 4 5 6 7 8 9	The Overnight Hospitalist / "Nocturnist" Program has reduced faculty/attending physician burnout. ( <i>Faculty Only</i> ) <i>Mean Likert ± Standard Deviation</i>	3.5±1.0	--
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	The Overnight Hospitalist / "Nocturnist" Program improves my satisfaction while attending at Toronto General Hospital. ( <i>Faculty Only</i> ) <i>Mean Likert ± Standard Deviation</i>	4.1±1.1	--
	Has the overnight hospitalist program improved the attractiveness of the hospital to patients? ( <i>Resident Only</i> )		Yes (80%) No (7%) Unsure (13%)

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**Table 2** – Baseline characteristics and outcomes of patients admitted to the Oncology Team by residents as compared to nocturnists. Sex differences, in-hospital mortality, and readmission rate as well as proportion of patients with documented code status by 8am the day following admission were compared with a chi-square tests, while age and Charlson Comorbidity Index were compared with independent samples t-tests.

Factor	Admitted by Residents n = 133	Admitted by Nocturnists n = 339	
Age (mean years $\pm$ standard deviation)	61.7 $\pm$ 14.5	60.4 $\pm$ 14.7	p = 0.36
Sex (% female)	43.6	46.9	p = 0.52
Charlson Comorbidity Index (mean score $\pm$ standard deviation)	4.58 $\pm$ 3.0	4.40 $\pm$ 3.1	p = 0.58
In-hospital Mortality (n, %)	14 (10.5%)	19 (5.6%)	p = 0.06
Readmission Rate (n, %)	11 (8.3%)	20 (5.9%)	p = 0.35
Acute Length of Stay (mean days $\pm$ standard deviation)	7.2 $\pm$ 7.0	6.4 $\pm$ 7.8	p = 0.30
Documented Code Status (n, %)	47 (35.3%)	186 (55.0%)	p < 0.001