Hospitalist Care and Length of Stay in Patients Requiring Complex Discharge Planning and Close Clinical Monitoring

William N. Southern, MD, MS; Matthew A. Berger, MD; Eran Y. Bellin, MD; Susan M. Hailpern, DrPH, MS; Julia H. Arnsten, MD, MPH

Background: Academic medical centers are increasingly employing hospitalists to staff teaching wards. Although studies have demonstrated reduced lengths of stay (LOSs) associated with hospitalist care, it is unclear which patients are most likely to benefit. We sought to determine whether patients with specific diagnoses or discharge needs account for the association between hospitalist care and reduced LOS.

Methods: Hospital admissions were divided into the following 2 groups based on type of attending physician: teaching hospitalist (full-time faculty hospitalist with no outpatient responsibilities) vs nonhospitalist (full-time or voluntary faculty contributing 1 or 2 months of teaching service per year). We included all patients discharged from an academic teaching service for a 2-year period. Data were extracted from the Montefiore Medical Center's clinical information system and the Social Security Death Registry.

Results: Mean LOS was lower for teaching hospitalists than for nonhospitalists (5.01 vs 5.87 days [P < .02]). The reduction in LOS was greatest for patients requiring close clinical monitoring (patients with congestive heart failure, stroke, asthma, or pneumonia) and for those requiring complex discharge planning. There were no significant differences between the groups in readmission, in-hospital mortality, or 30-day mortality.

Conclusion: Teaching hospitalist care was associated with shorter LOS in patients requiring close clinical monitoring and complex discharge planning, without adversely affecting readmission or mortality rates.

Arch Intern Med. 2007;167(17):1869-1874

Pressure to control costs of inpatient care has led many academic medical centers to employ hospitalists to provide care for medical inpatients and to staff medical teaching rounds. Hospitalist care has been associated with shorter lengths of stay (LOSs) and lower costs in a variety of settings, including after adjustment for physician experience. This reduction in LOS has been demonstrated among patients admitted with pneumonia and congestive heart failure. However, whether there are other specific patient diagnoses or discharge dispositions that seem to derive particular benefit from hospitalist care has not been firmly established.

The available data on clinical outcomes associated with hospitalist care are less consistent than the data on LOS. One study noted a 33% decrease in inhospital mortality among patients on the hospitalist service, and this decrease remained significant at 60 days. However, these findings were confounded by non-random assignment to the hospitalist service and major differences between the treatment groups. Another study, in which assignment to the hospitalist service was without preference, found a statistically significant reduction in 30-day mortality in the hospitalist-treated group in the second year of the program, but included only 2 hospitalists. Despite these promising results, randomized studies with long-term follow-up of hospitalist vs non-hospitalist care are lacking.

Our primary objective was to determine which patient groups appear more likely to benefit from hospitalist care by comparing LOS and clinical outcomes (in-hospital mortality, 30-day mortality, and readmission) between hospitalists and non-hospitalists. We compared the following 2 models of care: teaching hospitalist (full-time faculty with no outpatient responsibilities) and nonhospitalist (full- or part-time faculty with no more than 2 months per year on the inpatient service). We hypothesized that hospitalist care would be associated with shorter LOS among pa-
of risk in research settings. The ICD-9 codes were grouped into diagnosis clusters using the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality system. Some of these diagnoses were further collapsed into clinical categories to make data reporting manageable (eg, neoplasm contains several Agency for Healthcare Research and Quality diagnosis classifications). For LOS analyses, only those diagnoses that were among the top 30 causes for hospitalization in the United States were included, to ensure adequate numbers of patients in each category. The major physician-level covariate of interest was the annual number of months on the service. There was no crossover of attending physicians between groups (ie, nonhospitalists never became hospitalists or vice versa).

STATISTICAL ANALYSES

First, the 2 groups (teaching hospitalist vs nonhospitalist) were compared with respect to demographic and clinical characteristics using unpaired, 2-tailed t tests; Mann-Whitney tests; or χ² tests. Because DRG weight is not normally distributed, it is reported as a mean (using a t test with unequal variances for comparison between the groups) and as a median (using the Mann-Whitney test for comparison between the groups). Categorical variables are compared using χ² tests. Second, we calculated the Somers D statistic and used it as a rank-based test to compare LOS between the groups, with standard errors robust to the clustering of patients within each physician. The analysis was repeated with and without truncation of LOS to the mean plus 3 SDs to assess the influence of outliers. Then, multivariate linear regression was used to compare LOS between the groups after adjusting for differences in demographic and clinical characteristics. For multivariate analyses, the variables for insurance and race or ethnicity were recoded into multiple dummy variables.

For the dichotomous outcomes of readmission and in-hospital and 30-day mortality, we initially compared rates using χ² tests and then used multivariate logistic regression models to assess the effect of hospitalist care after adjusting for differences between the groups. Variables chosen for multivariate analyses included those that measured a significant difference between the groups (albumin level, DRG weight, and insurance); other variables were added, one by one, keeping those that measured a significant difference after adjusting for differences between the groups. Variables chosen for multivariate analyses included age, sex, race or ethnicity, presence of prior admission, and mix of acute diagnoses. The teaching hospitalist group included more patients with Medicaid, a lower mean albumin level, and a lower mean DRG weight (Table 1).

PATIENT POPULATION

From July 1, 2002, through June 30, 2004, there were 9047 discharges from the teaching service at the Weiler Hospital. Significant data were missing for 10 hospital stays; thus, the study sample included 9037 discharges. This included 2913 discharges from teaching hospitalist teams (32.2%) and 6124 discharges from nonhospitalist teams (67.8%). The patient populations were similar with respect to age, sex, race or ethnicity, presence of prior admission, and mix of acute diagnoses. The teaching hospitalist group included more patients with Medicaid, a lower mean albumin level, and a lower mean DRG weight (Table 1).
The mean±SD LOS was 5.01±6.12 days in the teaching hospitalist group vs 5.87±7.51 days in the nonhospitalist group (P = .02; Table 2). The reduction in LOS was still large and significant after adjustment for potential confounders (unadjusted reduction, 0.86 day [P = .004]; reduction adjusted for race or ethnicity, insurance, DRG weight, albumin level, and prior admissions, 0.78 day [P < .001]). There was a statistically significant negative linear association between LOS (in days) and the number of months the attending physician was on the service per year, with each extra month of service associated with a 0.19-day reduction in LOS (β = −0.19 day per month of service [P < .001]).

To assess the influence of outliers on LOS, the analysis was repeated using the variable LOS truncated at the

### Table 1. Demographic and Clinical Characteristics of Patients Assigned to Teaching Hospitalist vs Nonhospitalist Services

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Patients (n = 9037)</th>
<th>Teaching Hospitalist Group (n = 2913)</th>
<th>Nonhospitalist Group (n = 6124)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± SD, y</td>
<td>64.9 ± 17.8</td>
<td>65.3 ± 17.6</td>
<td>64.7 ± 17.9</td>
<td>.21</td>
</tr>
<tr>
<td>Female</td>
<td>5254 (58.1)</td>
<td>1639 (57.0)</td>
<td>3655 (58.7)</td>
<td>.12</td>
</tr>
<tr>
<td>Prior admission</td>
<td>2390 (26.4)</td>
<td>797 (27.4)</td>
<td>1593 (26.0)</td>
<td>.18</td>
</tr>
<tr>
<td>Albumin level, mean ± SD, g/dL</td>
<td>3.80 ± 0.70</td>
<td>3.77 ± 0.68</td>
<td>3.82 ± 0.66</td>
<td>.002</td>
</tr>
<tr>
<td>DRG weight</td>
<td>Mean ± SD</td>
<td>1.24 ± 1.56</td>
<td>1.20 ± 1.33</td>
<td>.03</td>
</tr>
<tr>
<td>Median</td>
<td>0.95</td>
<td>0.95</td>
<td>0.96</td>
<td>.90</td>
</tr>
<tr>
<td>Insuranceb</td>
<td></td>
<td></td>
<td></td>
<td>.04</td>
</tr>
<tr>
<td>Self-pay</td>
<td>78 (0.9)</td>
<td>19 (0.7)</td>
<td>59 (1.0)</td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>2964 (32.8)</td>
<td>1008 (34.6)</td>
<td>1956 (31.9)</td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>3964 (44.1)</td>
<td>1244 (42.7)</td>
<td>2740 (44.7)</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>2008 (22.2)</td>
<td>640 (22.0)</td>
<td>1368 (22.3)</td>
<td></td>
</tr>
<tr>
<td>Race or ethnicity*b</td>
<td></td>
<td></td>
<td></td>
<td>.44</td>
</tr>
<tr>
<td>White</td>
<td>2527 (28.0)</td>
<td>786 (27.0)</td>
<td>1741 (28.4)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>2617 (29.0)</td>
<td>847 (29.1)</td>
<td>1770 (28.9)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>2958 (32.7)</td>
<td>964 (33.1)</td>
<td>1994 (32.6)</td>
<td></td>
</tr>
<tr>
<td>Unknown/other</td>
<td>935 (10.3)</td>
<td>316 (10.8)</td>
<td>619 (10.1)</td>
<td></td>
</tr>
<tr>
<td>Diagnosisc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>817 (9.0)</td>
<td>262 (9.0)</td>
<td>555 (9.1)</td>
<td>.92</td>
</tr>
<tr>
<td>Chest pain</td>
<td>679 (7.5)</td>
<td>221 (7.6)</td>
<td>458 (7.5)</td>
<td>.86</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>487 (5.5)</td>
<td>167 (5.7)</td>
<td>330 (5.4)</td>
<td>.50</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>618 (6.8)</td>
<td>180 (6.2)</td>
<td>438 (6.2)</td>
<td>.09</td>
</tr>
<tr>
<td>Asthma/COPD</td>
<td>523 (5.8)</td>
<td>168 (5.8)</td>
<td>355 (5.8)</td>
<td>.96</td>
</tr>
<tr>
<td>Coronary disease without infarction</td>
<td>406 (4.5)</td>
<td>131 (4.5)</td>
<td>275 (4.5)</td>
<td>.99</td>
</tr>
<tr>
<td>Diabetes decompensated</td>
<td>333 (3.7)</td>
<td>96 (3.3)</td>
<td>237 (3.9)</td>
<td>.18</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>294 (3.3)</td>
<td>85 (2.9)</td>
<td>209 (3.4)</td>
<td>.22</td>
</tr>
<tr>
<td>Sepsis</td>
<td>257 (2.8)</td>
<td>79 (2.7)</td>
<td>178 (2.9)</td>
<td>.60</td>
</tr>
<tr>
<td>Gastrointestinal tract bleeding</td>
<td>247 (2.7)</td>
<td>79 (2.7)</td>
<td>168 (2.7)</td>
<td>.93</td>
</tr>
<tr>
<td>Syncope</td>
<td>232 (2.6)</td>
<td>80 (2.7)</td>
<td>152 (2.5)</td>
<td>.46</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>228 (2.5)</td>
<td>82 (2.8)</td>
<td>146 (2.4)</td>
<td>.22</td>
</tr>
<tr>
<td>Fluid/electrolyte disorder</td>
<td>209 (2.3)</td>
<td>76 (2.6)</td>
<td>133 (2.2)</td>
<td>.20</td>
</tr>
<tr>
<td>Neoplasm</td>
<td>200 (2.2)</td>
<td>69 (2.4)</td>
<td>131 (2.1)</td>
<td>.49</td>
</tr>
<tr>
<td>Enteritis/diarrhea</td>
<td>191 (2.1)</td>
<td>55 (1.9)</td>
<td>136 (2.2)</td>
<td>.30</td>
</tr>
<tr>
<td>Renal failure</td>
<td>190 (2.1)</td>
<td>66 (2.3)</td>
<td>124 (2.0)</td>
<td>.46</td>
</tr>
<tr>
<td>Acid/peptic disease</td>
<td>177 (2.0)</td>
<td>71 (2.4)</td>
<td>106 (1.7)</td>
<td>.02</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>175 (1.9)</td>
<td>62 (2.1)</td>
<td>113 (1.8)</td>
<td>.36</td>
</tr>
<tr>
<td>Complication of surgery/procedure</td>
<td>162 (1.8)</td>
<td>57 (2.0)</td>
<td>105 (1.7)</td>
<td>.42</td>
</tr>
<tr>
<td>Hepatitis/cirrhosis</td>
<td>153 (1.7)</td>
<td>53 (1.8)</td>
<td>100 (1.6)</td>
<td>.52</td>
</tr>
<tr>
<td>Acute cerebrovascular accident</td>
<td>129 (1.4)</td>
<td>37 (1.3)</td>
<td>92 (1.5)</td>
<td>.39</td>
</tr>
<tr>
<td>Thromboembolic disease</td>
<td>120 (1.3)</td>
<td>43 (1.5)</td>
<td>77 (1.3)</td>
<td>.40</td>
</tr>
<tr>
<td>Human immunodeficiency virus</td>
<td>119 (1.3)</td>
<td>40 (1.4)</td>
<td>79 (1.3)</td>
<td>.75</td>
</tr>
<tr>
<td>Anemia</td>
<td>101 (1.1)</td>
<td>31 (1.1)</td>
<td>70 (1.1)</td>
<td>.74</td>
</tr>
<tr>
<td>Pancreatitis</td>
<td>72 (0.8)</td>
<td>29 (1.0)</td>
<td>43 (0.7)</td>
<td>.14</td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td>38 (0.4)</td>
<td>13 (0.5)</td>
<td>25 (0.4)</td>
<td>.79</td>
</tr>
<tr>
<td>Other diagnosis</td>
<td>1870 (20.7)</td>
<td>581 (19.9)</td>
<td>1289 (21.0)</td>
<td>.23</td>
</tr>
</tbody>
</table>

Abbreviations: COPD, chronic obstructive pulmonary disease; DRG, diagnosis related group.

SI conversion factor: To convert albumin to grams per liter, multiply by 10.

a For categorical variables, data are expressed as number (percentage) of patients and compared using the χ² test. For continuous variables, data are expressed as mean ± SD and compared using the unpaired, 2-tailed t test with equal or unequal variance, as appropriate. Median values were compared using the Mann-Whitney test.

b For zero-sum variables, results of χ² tests are reported for the whole group and by category.

c Diagnoses are grouped by International Classification of Diseases, Ninth Revision code according to clinical classifications by the Agency for Healthcare Research and Quality and collapsed into clinical categories.

d Includes diabetic ketoacidosis, hyperosmolar nonketotic syndrome, and hyperglycemia.
mean plus 3 SDs. In the truncated analysis, teaching hospitalist care was associated with reduced LOS when compared with nonhospitalist care (4.82 vs 5.54 days [P = .02]).

To assess the influence of patients returning with multiple admissions, the analysis was performed using only the first admission for each patient during the time period (n=6883). This first-admission analysis also yielded significant reductions in LOS for teaching hospitalists vs nonhospitalists (4.96 vs 5.69 days [P = .04]).

### LOS AMONG PATIENTS WITH SPECIFIC DIAGNOSES AND DISCHARGE DISPOSITIONS

To determine whether reduction in LOS is more pronounced among patients with specific diagnoses, level of acuity, or discharge needs, LOS data were analyzed after stratifying by clinical conditions, DRG weight, and discharge disposition (Table 3). Reductions in LOS associated with hospitalist care were most pronounced in patients with diagnoses of cerebrovascular accident (stroke), sepsis, asthma/chronic obstructive pulmonary

---

**Table 2. Length of Stay (LOS) Among Patients Assigned to Teaching Hospitalist vs Nonhospitalist Teams**

<table>
<thead>
<tr>
<th>Admission</th>
<th>All Patients</th>
<th>Teaching Hospitalist Group</th>
<th>Nonhospitalist Group</th>
<th>P Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>All admissions, No.</td>
<td>9037</td>
<td>2913</td>
<td>6124</td>
<td></td>
</tr>
<tr>
<td>LOS, mean ± SD, d</td>
<td>5.59 ± 7.10</td>
<td>5.01 ± 6.12</td>
<td>5.87 ± 7.51</td>
<td>.02</td>
</tr>
<tr>
<td>Truncated LOS, mean ± SD, d</td>
<td>5.31 ± 5.24</td>
<td>4.82 ± 4.80</td>
<td>5.54 ± 5.42</td>
<td>.02</td>
</tr>
<tr>
<td>First admissions, No.</td>
<td>6883</td>
<td>2150</td>
<td>4733</td>
<td></td>
</tr>
<tr>
<td>LOS, mean ± SD, d</td>
<td>5.46 ± 7.10</td>
<td>4.96 ± 5.93</td>
<td>5.69 ± 7.56</td>
<td>.04</td>
</tr>
<tr>
<td>Truncated LOS, mean ± SD, d</td>
<td>5.17 ± 5.09</td>
<td>4.79 ± 4.76</td>
<td>5.34 ± 5.23</td>
<td>.04</td>
</tr>
</tbody>
</table>

a Rank-based testing using the Somers D statistic, with standard errors robust to clusters of patients by physician.

b Length of stay was truncated at mean + 3 SDs.

**Table 3. Length of Stay (LOS) Among Patients With Specific Diagnoses, Levels of Overall Acuity, and Discharge Dispositions Assigned to Teaching Hospitalist vs Nonhospitalist Services**

<table>
<thead>
<tr>
<th>Diagnosisb</th>
<th>Teaching Hospitalist Group</th>
<th>Nonhospitalist Group</th>
<th>Difference, d</th>
<th>P Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute cerebrovascular accident (129)</td>
<td>8.59 ± 7.46</td>
<td>12.45 ± 8.74</td>
<td>3.86</td>
<td>.001</td>
</tr>
<tr>
<td>Sepsis (257)</td>
<td>8.63 ± 8.25</td>
<td>12.33 ± 16.58</td>
<td>3.70</td>
<td>.03</td>
</tr>
<tr>
<td>Pneumonia (618)</td>
<td>6.97 ± 8.40</td>
<td>8.35 ± 10.05</td>
<td>1.38</td>
<td>.13</td>
</tr>
<tr>
<td>Congestive heart failure (817)</td>
<td>4.63 ± 3.72</td>
<td>5.81 ± 5.63</td>
<td>1.18</td>
<td>.06</td>
</tr>
<tr>
<td>Asthma/COPD (523)</td>
<td>3.53 ± 2.69</td>
<td>4.46 ± 4.29</td>
<td>0.93</td>
<td>.009</td>
</tr>
<tr>
<td>Urinary tract infection (228)</td>
<td>4.48 ± 4.61</td>
<td>5.31 ± 6.21</td>
<td>0.83</td>
<td>.05</td>
</tr>
<tr>
<td>Diabetes decompensatedc (333)</td>
<td>4.50 ± 6.12</td>
<td>5.03 ± 6.47</td>
<td>0.53</td>
<td>.31</td>
</tr>
<tr>
<td>Cellulitis (176)</td>
<td>5.15 ± 7.66</td>
<td>5.66 ± 9.06</td>
<td>0.51</td>
<td>.17</td>
</tr>
<tr>
<td>Fluid/electrolyte disorder (209)</td>
<td>4.26 ± 2.55</td>
<td>4.62 ± 4.03</td>
<td>0.36</td>
<td>.54</td>
</tr>
<tr>
<td>Acute myocardial infarction (497)</td>
<td>7.11 ± 6.22</td>
<td>7.44 ± 6.48</td>
<td>0.33</td>
<td>.57</td>
</tr>
<tr>
<td>Gastrointestinal tract bleeding (247)</td>
<td>5.25 ± 4.68</td>
<td>5.44 ± 5.99</td>
<td>0.19</td>
<td>.73</td>
</tr>
<tr>
<td>Chest pain (679)</td>
<td>1.76 ± 1.50</td>
<td>1.85 ± 1.36</td>
<td>0.09</td>
<td>.04</td>
</tr>
<tr>
<td>Coronary disease without infarction (406)</td>
<td>3.56 ± 3.27</td>
<td>3.62 ± 3.36</td>
<td>0.06</td>
<td>.43</td>
</tr>
<tr>
<td>Arrhythmia (294)</td>
<td>4.27 ± 4.73</td>
<td>4.03 ± 3.39</td>
<td>−0.24</td>
<td>.35</td>
</tr>
</tbody>
</table>

Quartiles of DRG weight

| 1 (2309) | 2.22 ± 2.00 | 2.68 ± 2.51 | 0.46 | <.001 |
| 2 (2210) | 4.14 ± 3.72 | 4.58 ± 3.94 | 0.44 | .07 |
| 3 (2259) | 4.96 ± 4.22 | 5.59 ± 5.03 | 0.63 | .12 |
| 4 (2259) | 8.74 ± 9.59 | 10.69 ± 11.97 | 1.95 | <.001 |

Dispositiond

| Home (5175) | 3.40 ± 3.13 | 3.80 ± 3.59 | 0.40 | .02 |
| Home care (1601) | 5.24 ± 4.42 | 6.25 ± 5.18 | 1.01 | .005 |
| SNF (1402) | 8.21 ± 9.56 | 10.22 ± 10.74 | 2.01 | .005 |

Abbreviations: COPD, chronic obstructive pulmonary disease; DRG, diagnosis related group; SNF, skilled nursing facility.

a Rank-based testing using the Somers D statistic, with standard errors robust to clusters of patients by physician.

b Grouped by International Classification of Diseases, Ninth Revision code according to clinical classifications by the Agency for Healthcare Research and Quality and collapsed into clinical categories.

c Includes diabetic ketoacidosis, hyperosmolar nonketotic syndrome, and hyperglycemia.

d Home indicates discharged home without services; home care, discharged home with arranged visiting nurse.
disease, or urinary tract infection, without appreciable differences in LOS among patients with diagnoses of acute myocardial infarction, coronary disease without myocardial infarction, arrhythmia, or gastrointestinal tract bleeding. Lengths of stay were marginally shorter in patients with pneumonia (P = .13) and congestive heart failure (P = .06). The mean LOS was low for patients admitted with chest pain in both groups, but was slightly lower in the teaching hospitalist group (P = .04). Differences between hospitalists and nonhospitalists were significant in patients with lower overall acuity (DRG weight quartiles 1-3; mean difference, 0.49 day [P = .02]), but widened and remained significant in patients with the highest overall acuity (DRG weight quartile 4; mean difference, 1.95 days [P < .001]). Significant differences between groups were smaller in patients who were discharged home with self-care, widened when home services were required, and were largest when transfer to a nursing facility at the time of discharge was required.

**READMISSION AND MORTALITY RATES**

After adjustment for demographic and clinical characteristics, there were no differences between the groups for readmission, in-hospital mortality, or 30-day mortality (Table 4). In first-admission-only analysis, after adjustment, there were no differences between the 2 groups for readmission (odds ratio, 0.92; 95% confidence interval, 0.80-1.06), in-hospital mortality (odds ratio, 0.95; 95% confidence interval, 0.72-1.27), or 30-day mortality (odds ratio, 0.99; 95% confidence interval, 0.82-1.18).

**COMMENT**

Our experience with a teaching hospitalist service confirmed several now-familiar findings of hospitalist care, including shorter LOS for patients treated by teaching hospitalist teams. We further showed that teaching hospitalist care seems to have a stronger association with LOS in patients requiring specialized services on discharge, such as home care services or transfer to a nursing facility. We were able to measure discharge planning needs with the use of a separate discharge disposition code, which was assigned independent of billing at the time of discharge. We believe that the greater reduction in LOS associated with complex discharge planning reflects hospitalist skills in working with ancillary staff, such as social workers or discharge planners.

In addition, we found that hospitalist care had the strongest association with LOS in patients with the highest acuity, as measured by the DRG weight. This important finding might help guide the use of hospitalist services, given that small numbers of patients at the highest acuity levels account for disproportionate numbers of total hospital days.27

Hospitalist care had the strongest association with LOS in patients with specific diagnoses, including cerebrovascular accidents (strokes), congestive heart failure, pneumonia, sepsis, urinary tract infections, and asthma/chronic obstructive pulmonary disease. These findings may reflect hospitalists’ ability to closely monitor patients with dynamic conditions such as congestive heart failure, pneumonia, sepsis, urinary tract infections, and asthma/chronic obstructive pulmonary disease. The close monitoring and continuous presence offered by hospitalists may allow for earlier discharge because hospitalists are more likely to detect clinical improvement in real time and to make appropriate adjustments in treatment regimens. For patients with stroke, in particular, shorter LOS associated with hospitalist care may also reflect more effective attention to complex discharge needs such as rehabilitation services.

When we analyzed LOS by the number of months the attending physician spent on the service per year, we showed a statistically significant negative linear trend toward shorter LOS with increasing numbers of inpatient months. This suggests that extra inpatient experience is associated with even larger reductions in LOS and supports earlier findings that reductions in LOS with hospitalist care were greater14 or became significant11 in the second year of hospitalist programs.

In contrast to other analyses, the patients in our 2 groups were largely similar, but some differences persisted. Slightly sicker patients may have been assigned to teaching hospitalist teams because, at any given time, the existing census was likely to be lower for a teaching hospitalist team owing to the shorter LOS of their patients.

Despite the strengths of our study, it has some limitations. Similar to other studies of hospitalist care, the groups of attending physicians were small (5 teaching hospitalists and 54 nonhospitalists); thus, an individual outlier may have had a significant effect on the outcomes. Given the large number of diagnoses examined, the results of LOS for specific diagnoses need to be interpreted with caution. In addition, we had limited power to detect small differences in mortality rates. While it is reassuring that we did not find a statistically significant difference in readmission or mortality rates associated with hospitalist care, it would be erroneous to infer that there is no difference. Given our sample size and the event rates...

---

**Table 4. Clinical Outcomes Among Patients Assigned to Teaching Hospitalist vs Nonhospitalist Services**

<table>
<thead>
<tr>
<th>Clinical Outcome</th>
<th>Teaching Hospitalist Group</th>
<th>Nonhospitalist Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Day readmission</td>
<td>0.97 (0.88-1.08)</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>1.03 (0.83-1.28)</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>30-Day mortality</td>
<td>1.05 (0.88-1.26)</td>
<td>1 [Reference]</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; OR, odds ratio.

a The 95% CIs reported cluster robust for clusters of patients by physician.
b Adjusted for age, sex, insurance, diabetes mellitus, albumin level, diagnosis related group (DRG) weight, and number of admissions in the preceding 90 days.
c Adjusted for age, sex, race or ethnicity, insurance, diabetes mellitus, albumin level, and DRG weight.
d Taken from the Social Security Death Registry using Social Security number matching and adjusted for age, sex, insurance, albumin level, DRG weight, and number of admissions in the preceding 90 days.

---

©2007 American Medical Association. All rights reserved.
in the nonhospitalist group, and requiring a power of 80%,
we found minimal detectable odds ratios of 1.18 for re-
admission, 1.38 for in-hospital events, and 1.24 for 30-
day mortality. The strongest claim that can be inferred
from this analysis is that if there is a difference in these
outcomes with hospitalist care, it is likely less than these.
Smaller differences in mortality rates would be detect-
able only with a larger sample. Finally, although our data
were collected in 2002 to 2004, they reflect a practice in
common use today, namely, hospitalists being used for
inpatient teaching service in academic medical centers.

In conclusion, teaching hospitalist care was associ-
ated with reduced LOS on an academic teaching ser-
vice, but not with increased readmission or mortality rates.
We identified several patient groups in whom this asso-
ciation was particularly strong; patients who require close
clinical monitoring, those in whom real-time adjust-
ment of therapy is critical, those with high overall acu-
ity, and those in whom complex discharge planning is
necessary.

Accepted for Publication: May 17, 2007.
Correspondence: William N. Southern, MD, MS, De-
partment of Medicine, Weiler Hospital of Albert Ein-
stein College of Medicine, 1825 Eastchester Rd, Bronx,
NY 10461 (wsouther@montefiore.org).

Author Contributions: Study concept and design: Sou-
thern, Berger, Bellin, and Arnsten. Acquisition of data: Sou-
thern, Berger, and Bellin. Analysis and interpretation of data:
Southern, Bellin, Hallipern, and Arnsten. Drafting of the
manuscript: Southern, Hallipern, and Arnsten. Critical
revision of the manuscript for important intellectual con-
tent: Southern, Bellin, and Arnsten. Statistical analysis:
Southern and Hallipern. Obtained funding: Arnsten. Ad-
ministrative, technical, and material support: Berger and
Arnsten. Study supervision: Bellin and Arnsten.

Financial Disclosure: None reported.

Funding/Support: This study was supported by the In-
stitute for Medical Effectiveness Research, a joint project
of the Albert Einstein College of Medicine and the North
Shore–Long Island Jewish Health System, and the Cli-
cal Investigation Core of the Center for AIDS Research
at the Albert Einstein College of Medicine and Monte-
fiore Medical Center (National Institutes of Health grant
P30 AI51519).

Previous Presentation: Portions of this paper were pre-
SENTed at the 29th Annual Meeting of the Society for
General Internal Medicine; April 28, 2006; Los Angeles,
California.

Additional Contributions: Lori Ashton, BS, provided pro-
gramming support.

REFERENCES

1. Pham HH, Devers KJ, Kuo S, Benenson R. Health care market trends and the evo-

2. Wachter RM, Goldman L. The hospitalist movement 5 years later. JAMA. 2002;

3. Wachter RM, Katz P, Showstack J, Bindman AB, Goldman L. Reorganizing an
academic medical service: impact on cost, quality, patient satisfaction, and

4. Diamond HS, Goldberg E, Janosky JE. The effect of full-time faculty hospitalists
129(3):197-203.

5. Craig DE, Hartka L, Lisosky WH, Caplan WM, Litsky P, Smilhey J. Implementa-
tion of a hospitalist system in a large health maintenance organization: the Kaiser

6. Freenoe RB. The Park Nicollet experience in establishing a hospitalist system. Ann

7. Halfpert AP, Pearson SD, LeWine HE, McKeen SC. The impact of an inpatient phy-
6(5):549-555.


9. Rifkin WD, Conner D, Silver A, Eichhorn A. Comparison of processes and out-
comes of pneumonia care between hospitalists and community-based primary care

pitalists on cost, outcomes, and patient satisfaction in a rural health system. Am

11. Auerbach AD, Wachter RM, Katz P, Showstack J, Baron RB, Goldman L. Imple-
mentation of a voluntary hospitalist service at a community teaching hospital: im-
proved clinical efficiency and patient outcomes. Ann Intern Med. 2002;137
(11):859-865.

of a hospitalist service: efficient care for the aging population? Chest. 2001;

with nurse discharge planner on patient care in an academic teaching hospital.

costs and outcomes on an academic general medicine service: results of a trial of

15. Bellet PS, Whitaker RC. Evaluation of a pediatric hospitalist service: impact on

nance organization hospitalist system in academic pediatrics. Pediatrics. 2002;
110(4):720-728.

17. Stein MD, Hanson S, Tammaro D, Hanna L, Most AS. Economic effects of com-


18. Rifkin WD, Holmboe E, Scherer H, Sierra H. Comparison of hospitalists and non-
hospitalists in inpatient length of stay adjusting for patient and physician

19. Lindenuker PK, Chehabedidine R, Pekow P, Fitzgerald J, Benjamin EM. Quality of
care for patients hospitalized with heart failure: assessing the impact of hospitalists.

on mortality and length of stay following radical cystectomy. J Urol. 2006;176

21. Wannamethee SG, Shaper AG, Lennon L, Whincup PH. Height loss in older men:
associations with total mortality and incidence of cardiovascular disease. Arch

tionship among alcohol consumption, mortality, and cardiac events: the Health,
Aging, and Body Composition Study. Arch Intern Med. 2006;166(14):1490-
1497.


Healthcare Research and Quality; 2003.

25. US Department of Health and Human Services, Agency for Healthcare Research


27. Cots F, Elvira D, Castells X, Saer M. Relevance of outlier cases in case mix sys-
tems and evaluation of trimming methods. Health Care Manag Sci. 2003;6
(1):27-35.