A systematic review of outcomes and quality measures in adult patients cared for by hospitalists vs nonhospitalists

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Texto completo:
A systematic review of English-language literature was undertaken to answer the question, “Are there differences in cost or quality of inpatient medical care provided to adults by hospitalists vs nonhospitalists?” A computerized search was performed, using hospitalist and either quality, outcome, or cost as search terms. References from relevant articles were searched by hand. A standard data-extraction tool was used, and articles were included on the basis of quality and relevance. The results that were included (N=33) show general agreement that hospitalist care leads to shorter length of stay and lower cost per stay. Three reports show improvement in outcomes for orthopedic surgery patients who receive hospitalist consultation or management. 3 reports show improvement in markers of quality of care for patients with pneumonia, and 2 reports show improvement in aspects of heart failure management. Further research should seek to determine why differences in care exist, whether these improvements might be generalized to other physicians, and whether hospitalists provide demonstrable benefit in other areas of care.


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In the United States, general medical inpatient care is provided by both hospitalists (who provide only inpatient care) and more traditional, nonhospitalist physicians (who provide both outpatient and inpatient care). Although the hospitalist model of care is established and accepted in Canada and the United Kingdom, the first hospitalist program in United States, the Park Nicollet program in Minneapolis, was not established until 1994. (1) A growing effort is being made to determine whether a difference in care exists between these 2 groups of physicians because a systematic difference would have implications for the cost and quality of care.

Reviews of hospitalist care were previously undertaken by Wachter and Goldman, (2) Wachter, (3) and most recently Coffman and Rundall. (4) Since the 2005 review by Coffman and Rundall, a number of reports on hospitalist care (including 20 articles cited in this review) have compared hospitalist and nonhospitalists in terms of cost, length of stay (LOS), and quality measures. The previous reviews generally concluded that hospitalist care leads to lower cost per admission and shorter LOS without altering patient satisfaction.

This review collects and synthesizes all available reports of trials that help answer the question, “Are there differences in cost or quality of inpatient medical care provided to adults by hospitalists vs nonhospitalists?” The review is undertaken now because of the number of new articles since the last review and because of the importance of identifying any modifiable differences between hospitalists and other physicians that might lead to systematic improvements in cost or quality of care.

MATERIALS AND METHODS
A systematic review of the English-language literature was undertaken to answer the question, “Are there differences in cost or quality of inpatient medical care provided to adults by hospitalists vs nonhospitalists?” Articles were included if they contained data on outcomes, quality measures, or cost of care delivery from randomized trials or observational studies of adult patients cared for by hospitalists vs nonhospitalists. Articles were excluded if they pertained to pediatric or critical care hospitalists rather than general medicine hospitalists. Articles were excluded if they compared factors in addition to type of attending physician (for example, articles comparing a service with residents or a discharge planner and a service without). Poor-quality articles were also excluded (for example, if they had no comparison group, used estimated numbers of outcomes for a control group, or did not report significance or P values).

Searches for relevant articles were conducted on the National Library of Medicine Gateway (http://gateway.nlm.nih.gov/gw/Cmd) and on the Cochrane Collaboration Web site (www.cochrane.org). Search terms included hospitalist and either quality, outcome, or cost. Articles were screened by title and then by abstract. In addition, on the National Library of Medicine Web site, the Related Articles search tool was used after relevant articles were retrieved. The selected articles were searched by hand for further research reports on the topic that might not have been located in the original searches. The search included articles published up to August 1, 2008.

The selected articles were evaluated for study quality according to the methods outlined by the Cochrane Handbook for Systematic Reviews of Interventions. (5) The methods included classification of articles on the basis of study type and scrutiny of articles for methodological flaws. A formal information tracking and evaluation tool was used for data extraction. A flowchart similar to that outlined by the QUOROM (Quality of Reporting of Meta-analyses) statement (6) was used to track the flow of reports through the evaluation process (Figure).

[FIGURE OMITTED]

RESULTS
Results of this systematic review of hospitalist care vs nonhospitalist care of general medical patients as they relate to cost, LOS, and other markers of quality is presented in Table 1. (7-27) In general, the results show that inpatient care by hospitalist physicians leads to decreased hospital cost and LOS. Exceptions to this conclusion include 3 reports showing no significant difference in most quality measures between hospitalists and nonhospitalists (28), (29), (29) and 2 reports showing generally better performance by either a family medicine service (8) or a cardiologist-directed service (30) than by hospitalist care. Three reports describe the need for fewer subspecialty consults by hospitalists than by non-hospitalists. (14), (31), (32) A few reports describe improved survival in patients cared for by hospitalists vs nonhospitalists. (7), (19), (20)

<table>
<thead>
<tr>
<th>Reference, location, y</th>
<th>Hospital type</th>
<th>Study type</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aubert et al, (7) San Francisco, CA, 2002</td>
<td>Community-based teaching hospital</td>
<td>Retrospective cohort, multivariate adjustment</td>
<td>HPS vs community physicians</td>
</tr>
<tr>
<td>Carak et al, (8) Charleston, SC, 2008</td>
<td>For-profit community hospital</td>
<td>Retrospective cohort</td>
<td>HPS vs family medicine teaching service vs own primary care physician</td>
</tr>
<tr>
<td>Davis et al, (9) Tupelo, MS, 2000</td>
<td>Rural community hospital</td>
<td>Retrospective cohort</td>
<td>HPS vs non-HP general internist care</td>
</tr>
<tr>
<td>Diamond et al, (10) Pittsburgh, PA, 1998</td>
<td>Urban community teaching hospital</td>
<td>Crossover study</td>
<td>HPS vs primary physician care</td>
</tr>
<tr>
<td>Everett et al, (11) Orlando, FL 2007</td>
<td>Urban community hospital</td>
<td>Retrospective cohort, multivariate adjustment</td>
<td>Private HPS vs non-HP general internists vs academic internist team care</td>
</tr>
<tr>
<td>Everett et al, (12) Orlando, FL, 2004</td>
<td>Urban community hospital</td>
<td>Retrospective cohort, multivariate adjustment</td>
<td>HPS vs non-HP general internist care</td>
</tr>
<tr>
<td>Gregory et al, (13) Boston, MA, 2003</td>
<td>Academic medical center</td>
<td>Crossover, comparison with historical controls</td>
<td>HPS vs non-HP care</td>
</tr>
<tr>
<td>Hackner et al, (14) Los Angeles, CA, 2001</td>
<td>Academic medical center</td>
<td>Retrospective cohort, multivariate analysis</td>
<td>HPS vs non-HP care</td>
</tr>
<tr>
<td>Hackner et al, (15) Anna Arbor, MI</td>
<td>Community teaching hospital</td>
<td>Retrospective cohort, multivariate</td>
<td>Private HPS vs academic MD community</td>
</tr>
</tbody>
</table>

TABLE 1. Reports of HP vs Non-HP Care of Adult Patients: Results Related to Cost, LOS, and Some Other Measures of Quality (a), (b)
2005

Halpert et al, (16) Boston, MA, 2000
"Crossover" cohort with historical controls and multivariate adjustment
"Inpatient physician" vs general internal medicine care

Kaboli et al, (17) Iowa City, IA, 2004
Prospective cohort, multivariate adjustment
HP vs non-HP care

Lindenauer et al, (18) Mostly small to mid-sized non-teaching hospitals, 2007
Retrospective cohort, multivariate adjustment
HP vs family medicine vs general internal medicine care

Meltzer et al, (19) Chicago, IL, 2002
Cohort with multivariate adjustment
HP vs non-HP care

Meltzer et al, (20) Chicago, IL, 2002
Academic medical center
Multivariate adjustment
HP vs non-HP care

"Pre and post" crossover, multivariate adjustment
HP vs non-HP care

Palmer et al, (22) Morgantown, WV, 2001
Academic center
Retrospective cohort
General internal medicine care by HP vs general internists vs subspecialists

Parekh et al, (23) Ann Arbor, MI 2004
Academic center
Retrospective cohort, multivariate adjustment
General medicine care by HP vs specialty physician

Parks et al, (24) not stated, 2004
Academic center
Retrospective cohort with multivariate adjustment
HP vs non-HP care

Academic center
Retrospective cohort
HP vs non-HP care

Tingle & Lambert, (26) Garland, TX, 2001
Community hospital with family medicine residency
Retrospective cohort
HP vs family medicine teaching service

"Alternate day controlled trial, service vs multivariable traditional service care
HP vs non-HP care

Reference, location, y
Methodological problems
Reported results

Auberbach et al, (7) San Francisco, CA, 2002
Single site, only 5 hospitalists
LOS and costs no different in first year, in second year, LOS 0.61 d shorter for HPs than non-HPs (P = .002) and cost per stay $822 less for HPs (P = .002); risk of death lower for HP patients in hospital (0.71, (P = .03) and at 30 d and 60 d

Lower LOS for family medicine teaching service (4.0 d vs 4.7 d for HPs vs 5.4 d for primary care; P < .001); readmission not significantly different; fixed and variable costs less for family medicine teaching service; fixed costs $1719 for family medicine teaching service vs $2072 for HPs vs $2656 for primary care service (P = .005); variable costs $2318 for family medicine teaching service vs $2689 for HPs vs $2656 for primary care physicians (P = .006)

Davis et al, (9) Tupelo, MS, 2000
Single site, only 2 HPs studied
Hospitalist mean LOS 4.1 d vs 5.5 d for general internists (P = .001); hospitalist cost per stay $4098 vs $4658 ($P = .001); HPs tended to use fewer resources (P = .001)

Diamond et al, (10) Pittsburgh, PA, 1998
Single site, historical controls
Lower median LOS for HPs (5.01 d vs 6.81 d; P < .001); median cost of stay less for HPs ($3552 vs $4139; P < .001); HPs had lower 14-d readmission rate (7.9% vs 17.2%; P < .001) and lower 30-d readmission rate (4.6% vs 9.9%; P < .001)

Everett et al, (11) Academic OneFile - Documento - A systematic review of outcome...
non-HPs (3.7 d vs 4.3 d; P < .001) cost lower for HPs than non-HPs ($4402.50 vs $4761.30; P < .001); mortality equivalent for HPs and generalists; academic HPs had LOS of 2.6 d and cost of $3333.80 (both less than for nonacademic HPs and generalists; P < .001); odds of readmission 0.79 for HPs vs academic HPs and 0.78 for academic HPs vs generalists.

Everett et al, Single site
(12) Orlando, FL, 2004
16.1% lower LOS and 8.3% lower cost per stay for HPs vs non-HPs (reported as "significant" but no P value stated)

Gregory et al, Single facility, historical controls
(13) Boston, MA, 2003
LOS 2.19 for HPs vs 3.48 d for non-HPs (P < .001); cost per admission less for HPs ($1775 vs $2332 for non-HPs; P < .001); cost per day of admission more for HPs ($811 vs $679 for non-HPs; P < .001); increased throughput was thought to increase hospital profitability with HPs.

Hackner et al, Single facility
(14) Los Angeles, Ca, 2001
Medican LOS 3 d for academic HPs vs 4 d for nonacademic generalists (P<.001); median cost less for HPs ($4092 vs $4853 for nonacademic generalists; P<.001); subspecialty consults less for academic HPs (16.6% vs 37.6% for nonacademic generalists; P<.001); change most notable for patients older than 65 years; no significant difference in mortality or 30-d readmission rate

Hackner et al, Single facility
(15) Anna Arbor, MI 2005
20% reduction in LOS for academic HPs (P <.001) and 8% reduction for private HPs (P = .099) vs community physicians; total costs 10% less for academic generalists (P<.001); 6% less for private HPs (P=.02) vs community physicians; difference in costs and 30-d mortality was significant.

Halpert et al, Single facility
(16) Boston, MA, 2000
LOS decreased by 0.3 d (P = .008) and cost decreased by $462 per admission (P = .001) for inpatient physician vs general internal medicine care; decreased charges thought secondary to decreased LOS; mortality rate and 30-d readmission not significantly different

Kaboli et al, Only 3 hospitalist physicians, single site, nonrandom assignment
(17) Iowa City, IA, 2004
LOS shorter for HPs (5.5 d vs 6.5 for non-M; P = .009), adjusted cost per admission 10% less for HPs vs non-HPs (P = .004); similar mortality and 30-d readmission rates

Lindemauer et al, Observational
(18) 45 US hospitals 2007
HPs had shorter LOS than general internists by 0.4 (P = .001) and lower cost per stay by $268 (P = .02); HPs had shorter LOS than family practitioners by 0.4 d (P < .001), and lower cost per stay of $125 was not significant (P = .33); death rates and readmission rates were not significantly different.

Meltzer et al, Single hospital
(19) Chicago, IL, 2001
No difference in LOS or cost between HPs and non-HPs in year 1; in year 2, LOS 0.5 d less for HPs (P < .01) and cost per stay $740 less for HPs (P < .01); on first year of program, no difference in mortality; by second year, lower 30-d mortality for HPs (4.2% vs 6% for non-HPs; P = .04)

Meltzer et al, Single hospital
(20) Chicago, IL, 2002
By Second year of study, LOS 0.49 d shorter for HPs than non-HPs (P = .01), cost per stay $792 lower for HPs (P = .01); adjusted relative risk of death 0.65 for HPs vs non-HPs (P = .03); LOS, cost, and mortality all seemed over the time the
Hospitalist care was also reported to improve several measures of care for specific services or conditions, including orthopedic surgery, pneumonia, and congestive heart failure. Interestingly, improvement was not seen for patients with human immunodeficiency virus or low-risk chest pain (Table 2 (28-39)).
TABLE 2. Condition-Specific Reports of HP vs non-HP Care of Adult Patients: Results Related to Quality-of-Care Measures (a)

<table>
<thead>
<tr>
<th>Reference, location, y</th>
<th>Hospital type</th>
<th>Study type</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedic surgery (b)</td>
<td>Batsis et al, (33) Rochester, MN, 2007</td>
<td>Academic tertiary care hospital</td>
<td>Retrospective cohort with multivariate adjustment HP vs non-HP care management of hip fracture patients</td>
</tr>
<tr>
<td></td>
<td>Huddleston et al, (34) Rochester, MN, 2004</td>
<td>Teaching hospital (primarily surgical)</td>
<td>Randomized, controlled Comanagement by HP vs standard orthopedic care with medical consultation</td>
</tr>
<tr>
<td></td>
<td>Roy et al, (36) Jacksonville, FL, 2006</td>
<td>Community-based academic medical center</td>
<td>Retrospective cohort Consultation by HP vs non-HP in hip fracture surgery patients</td>
</tr>
<tr>
<td>Pneumonia (b)</td>
<td>Rifkin et al, (37) Waterbury, CT, 2007</td>
<td>Community teaching hospital</td>
<td>Retrospective cohort HP vs non-HP care</td>
</tr>
<tr>
<td></td>
<td>Scheurer et al, (38) South Carolina, 2005</td>
<td>Hospitals statewide</td>
<td>Retrospective cohort from statewide database HP vs non-HP care</td>
</tr>
<tr>
<td>Congestive heart failure (b)</td>
<td>Lindenauer et al, (39) Springfield, MA, 2002</td>
<td>Community teaching hospital</td>
<td>Retrospective cohort, multivariate adjustment HP vs non-HP care</td>
</tr>
<tr>
<td></td>
<td>Roytman et al, (32) Honolulu, HI, 2008</td>
<td>Community-based teaching hospital</td>
<td>Retrospective cohort HP vs non-HP care</td>
</tr>
<tr>
<td></td>
<td>Vasilevskis et al, (28) multicenter, 2008</td>
<td>6 academic hospitals</td>
<td>Retrospective Academic HP vs academic non-HP care</td>
</tr>
</tbody>
</table>
| HIV (b)                | HIV (b)                             | 417 Articles identified by electronic search of the NLM Gateway and Cochrane Collaboration Web sites
|                        | 45 Identified for further evaluation after title and abstract review, use of the Related Articles search tool on NLM Gateway, and hand-searching of relevant articles' references
|                        | 12 Rejected 8 Methodological issues (use of estimated rather than observed comparison values or no reporting of P values) 4 Other exclusion criteria not obvious from abstract
|                        | 33 Selected for inclusion in the review

FIGURE. Flow of information through the systematic review process. NLM = National Library of Medicine.
<table>
<thead>
<tr>
<th>Reference, location, y</th>
<th>Methodological problems</th>
<th>Reported results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedic surgery (b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batsis et al, (33) Rochester, MN, 2007</td>
<td>Single site</td>
<td>No difference in survival 1 y after hip surgery between HP and non-HP care patients: 70.5% (95% CI, 64.8-76.7) vs 70.6% (95% CI, 64.9-76.8); P = .36</td>
</tr>
<tr>
<td>Huddleston et al, (34) Rochester, NY, 2004</td>
<td>Single site, nonblinded</td>
<td>More HP patients discharged without complications (61.6% vs 49.8% for non-HPs; P = .01); costs not different between groups; adjusted LOS shorter for HPs (5.1 d vs 5.6 d for non-HPs; P&lt;.001)</td>
</tr>
<tr>
<td>Phy et al, (35) Rochester, MN, 2005</td>
<td>Single institution, historical controls</td>
<td>Mean time to surgery less with HP comanagement (25 h vs 38 h without HP involvement; P&lt;.001); time from surgery to discharge less with HP involvement (7 d vs 9 d; P = .94); LOS less with HP involvement (8.4 d vs 10.6 d; P&lt;.001); no significant difference in mortality or readmission</td>
</tr>
<tr>
<td>Roy et al, (36) Jacksonville, FL, 2006</td>
<td>Single site, 118 patients--perhaps too few to show a significant difference for LOS and cost</td>
<td>For hip fracture patients, time to surgery less than 24 h in 32% of patients with consultations by HPs and 11% of patients with consultations by non-HPs (P = .004); time to consultation 3 h by HP and 19.9 h by non-HP (P=.001); LOS 5 d for HP patients and 6 d for non-HP patients (P=.06); cost per stay $11,043 for HP patients and $12,820 for non-HP patients (P = .08)</td>
</tr>
</tbody>
</table>

| Pneumonia (b) |                         |                   |
| Rifkin et al, (37) Waterbury, CT, 2007 | Single site | HPs more likely than non-HPs to give pneumococcal vaccine or document the reason for not doing so (88.2% vs 65.6%, P = .001); HPs more likely to give appropriate DVT prophylaxis (96.9% vs 61.9%; P=001); LOS not significantly different between HPs and non-HPs |
| Rifkin et al, (31) New Hyde Park, NY, 2002 | Single center | Adjusted cost per stay $3907 for HPs vs $4501 for primary care physicians (P = .01); adjusted LOS 5.6 d for HPs vs 6.6 d for primary care physicians (P = .001); use of infectious disease consultants more likely by primary care physicians than by HPs (5% vs 2%; P = .05); no significant difference in hospital mortality or readmission rate |

| Congestive heart failure (b) |                         |                   |
| Scheurer et al, (38) South Carolina, 2005 | Observational | For pneumonia patients with moderate illness, LOS was 4.9 d with HP care vs 5.2 d with non-HP care (P = .04); adjusted LOS 5.6 d for HP care vs 6.6 d for primary care physicians (P = .001); mean charges for major illness were $29,950 with HP care vs $23,259 with non-HP care (P = .031); mean charges for extreme illness were $522,045 with HP care vs $56,867 with non-HP care (P = .002) |
| Lindemauer et al, (39) Springfield, MA, 2002 | Single institution | Ejection fraction was appropriately documented for more patients by HPs than by non-HPs (94% vs 87%; P = .041); LOS shorter for HPs than non-HPs (P = .05); |
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mortality and readmission at 30 d were no different

Royzman et al, (32) Honolulu, HI, 2008
Observational, single site
Compared with non-HP care, HP care was associated with increased use of ACE inhibitors or ARBs (86% vs 73%; P = .001), decreased use of multiple consultants (8% vs 16%; P = .03), decreased cost (P = .001), and decreased LOS (P = .001); readmissions were similar

Vasilevskis et al, (28) multicenter, 2008
Observational
No difference between HPs and non-HPs in measurement of ejection fraction, use of ACE inhibitors, use of p-blockers, LOS, mortality, or cost; HP patients had higher odds of keeping follow-up appointments (OR = 1.83; 95% CI, 1.44-2.31)

CONCLUSION
Systematic reviews may be hampered by difficulties related to publication bias, in which articles are more likely to be published if they show positive findings. This limits the reports as a group to be able to draw conclusions about the overall effect of hospitalists on outcomes. In particular, the results of systematic reviews are only as strong as the studies included in them. In this review, the studies included are heterogeneous, making a meta-analysis inappropriate.

Economic analysis suggests that hospitalists increased profitability by moving patients more quickly ("higher throughput") through hospital systems that had beds in short supply. (13)

Several theories have been offered to explain the apparent differences between hospitalist and nonhospitalist outcomes. According to one theory, hospitalists are able to respond more rapidly to inpatient medical problems. (2) (This has been called disease-specific physician experience. (20))

Hospitalist programs appear to mature with time, perhaps because of adjustment by hospitalists or increased experience. Several studies have shown that hospitalist programs did not have an effect (or had lesser effect) on cost or LOS during their first year but did have notable effect during their second year. (7), (19), (20)

Hospitalist programs appear to mature with time, perhaps because of adjustment by hospitalists or increased experience. Several studies have shown that hospitalist programs did not have an effect (or had lesser effect) on cost or LOS during their first year but did have notable effect during their second year. (7), (19), (20)

Several theories have been offered to explain the apparent differences between hospitalist and nonhospitalist outcomes. According to one theory, hospitalists are able to respond more rapidly to inpatient medical problems. (2) (This has been called disease-specific physician experience. (20))

Several recent reports have shown that the higher daily cost per patient of hospitalists is compensated for by the more rapid discharge of patients from the hospital. One study examined the possibility that the reported decreases in costs by hospitalists are due to incomplete evaluation of patients in the hospital. In other words, the costs of any tests not completed in the hospital would be passed on to outpatient clinics after hospitalization, making hospitalists only appear more efficient. The investigators concluded that this was not the case in their study. (22) Economic analysis suggests that hospitalists increased profitability by moving patients more quickly ("higher throughput") through hospital systems that had beds in short supply. (13)

Many of the research reports referenced in this review are observational studies with associated nonrandom allocation, and several of the prospective studies also had nonrandom assignment. Nonrandom assignment of patients can allow bias to occur and can also allow unequal levels of a confounding factor in different study groups, even if such bias and inequity are not readily apparent. For example, with nonrandom assignment, we might expect a larger number of acuity II patients with pneumoias to be admitted by critical care physicians than by hospitalists and a larger number to be admitted by hospitalists than by a family medicine service, making comparisons about cost, survival, and LOS difficult. In this review, several studies had fewer than 5 hospitalists in the study group, and many studies were done at a single institution. Both of these factors may result in bias related to personal characteristics of a few physicians or to regional differences in practice. Among the articles in this review, reporting of results is nonuniform, with some articles reporting means, others medians, and some only ratios. The reports as a group are heterogeneous, making a meta-analysis inappropriate.

Systematic reviews may be hampered by difficulties related to publication bias, in which articles are more likely to be published if they show positive findings. This limitation is not confined to this review but is a potential problem for any review. I am unaware of any unpublished data on the topic of this review. Whether to include unpublished data should be an important consideration in conducting a systematic review. Investigators need to remember, however, that bias against negative results is not the only reason why a manuscript may be unpublished; a manuscript may have any of a number of inadequacies that disqualify it from consideration for publication.

CONCLUSION
Despite limitations in the quality of available reports, common themes emerge from this review of hospitalist care. In general, hospitalist care appears to result in lower cost per admission, largely because of shorter LOS, although use of fewer consultants has been observed by some investigators as well. A few reports show differences in other measures of quality, such as mortality, readmission rate, and performance in specific populations, such as patients with pneumonia, those with congestive heart failure, and those undergoing orthopedic surgery.
Further studies should investigate whether benefits shown for hospitalist care might be generalized to other physicians. These studies should also examine whether differences between hospitalists and nonhospitalists exist in other areas of care, with the intent again being to define the reason for any differences so that any improvements in care can be generalized to other physicians.

The thoughtful editorial comments of Kirsten Ward, PhD, Non-communicable Disease Branch, London School of Hygiene and Tropical Medicine, are appreciated.

REFERENCES


TABLE 1. Continued a,b

<table>
<thead>
<tr>
<th>Reference, location, y</th>
<th>Hospital type</th>
<th>Study type</th>
<th>Comparison</th>
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<th>Reported results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meltani &amp; Scott, 2001 Washington state, 2001</td>
<td>Regional medical center</td>
<td>“Pre and post” controlled, multivariate adjustment</td>
<td>HP vs non-HP care</td>
<td>Historical controls, 5 hospitalists studied</td>
<td>From a managed care standpoint, HPs more likely than non-HPs to have few medically unnecessary days (1.54; P&lt;0.001) and to meet “optimal recovery guidelines” (OR, 1.74; P&lt;0.001)</td>
</tr>
<tr>
<td>Palmer et al., Moogestowns, WV, 2001</td>
<td>Academic center</td>
<td>Retrospective cohort</td>
<td>General internal medicine care by HP vs internist vs specialist</td>
<td>Single institution</td>
<td>No difference observed between study groups of patients in whom further evaluation was thought necessary at hospital discharge and those for whom testing was scheduled on an outpatient basis after hospital stay</td>
</tr>
<tr>
<td>Park et al., Ann Arbor, MI, 2004</td>
<td>Academic center</td>
<td>Retrospective cohort, multivariate adjustment</td>
<td>General medicine care by HP vs specialty physician</td>
<td>Single site</td>
<td>For general medical patients, HPs LOS 4.31 d vs rheumatologists 4.97 d (P=0.02) and endocrinologists 4.79 d (P=0.03); HPs cost per stay $5707 vs endocrinologists $8376 (P=0.01); readmission and mortality not significantly different</td>
</tr>
<tr>
<td>Riffkin et al., not stated, 2004</td>
<td>Academic center</td>
<td>Retrospective cohort</td>
<td>HP vs non-HP care</td>
<td>Single institution</td>
<td>Adjusted OR for having above average LOS 0.6 for HPs vs non-HPs (P=0.11)</td>
</tr>
<tr>
<td>Southern et al., Bronx, NY, 2007</td>
<td>Academic center</td>
<td>Retrospective cohort with multivariate adjustment</td>
<td>HP vs non-HP care</td>
<td>Only 5 HPs, single institution</td>
<td>Mean LOS less for academic HPs than for non-HPs: 5.01 vs 5.87 d; P&lt;0.02; readmission in LOS greatest for patients requiring close clinical monitoring and complex discharge planning; no difference in in-hospital mortality, 30-d mortality, or readmission</td>
</tr>
<tr>
<td>Tingle &amp; Lambert, Garland, TX, 2001</td>
<td>Community hospital with family medicine residency</td>
<td>Retrospective cohort</td>
<td>HP vs family medicine teaching service care</td>
<td>Single site, powered to detect difference in LOS of half a day and $1000 cost</td>
<td>No statistically significant difference between HP service and family practice teaching service in cost, LOS, or mortality</td>
</tr>
</tbody>
</table>

| Wachter et al., San Francisco, CA, 1990 | Community hospital | “Alternate day controlled” trial, multivariate adjustment | Managed care (HP) vs traditional service care | Randomized assignment, single site | Mean LOS 4.3 d for managed care service vs 4.9 d for traditional service (P=0.01); average cost $7807 for managed care service vs $7777 for traditional service (P=0.05); mortality and readmission rates similar; most cost reduction suggested to result from decreased LOS |

a HP = hospitalist; LOS = length of stay; OR = odds ratio.

b The patient groups studied are general medical service patients unless otherwise stated.


<table>
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<tr>
<th>Reference, location, y</th>
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<tr>
<td><strong>Orthopedic surgery</strong></td>
<td>Baxia et al., Rochester, MN, 2007</td>
<td>Academic tertiary care hospital</td>
<td>Retrospective cohort with multivariate adjustment</td>
<td>HP vs non-HP care (20.5% vs 25.0% vs 30.0%)</td>
<td>No difference in survival rate after hip fracture between HP and non-HP care patients: 70.5% (95% CI, 64.8-76.7%) vs 70.6% (95% CI, 64.9-78.9%); P=0.36</td>
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<td>Huddleston et al., Rochester, MN, 2004</td>
<td>Teaching hospital (primarily surgical)</td>
<td>Retrospective cohort</td>
<td>HP vs standard orthopedic care with medical consultation</td>
<td>Single site, nonrandomized</td>
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<tr>
<td>Physician et al., Rochester, MN, 2005</td>
<td>Academic center</td>
<td>Crossover</td>
<td>HP vs standard orthopedic care with medical consultation</td>
<td>Single institution, historical controls</td>
<td>Mean time to surgery less with HP reimbursement (25 vs 38 hours; P&lt;0.001); time from surgery to discharge less with HP reimbursement (7.9 vs 10.4; P&lt;0.05); LOS less with HP reimbursement (8.7 vs 10.6; P&lt;0.001); no significant difference in mortality or readmission</td>
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<tr>
<td>Roy et al., Jacksonville, FL, 2006</td>
<td>Community-based academic medical center</td>
<td>Retrospective cohort</td>
<td>Consultation by HP vs non-HP in hip fracture surgery patients</td>
<td>Single site, 118 patients — too few to show a significant difference for LOS and cost</td>
<td>For hip fracture patients, time to surgery less than 24 hours in 23% of patients with consultations by HPs and 11% of patients with consultations by non-HPs (P=0.04); time to consultation 3 h by HP and 5.9 h by non-HP (P&lt;0.001); LOS 5.0 d for HP patients and 6.0 d for non-HP patients (P=0.06); cost per stay $11,043 for HP patients and $12,820 for non-HP patients (P=0.08)</td>
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<tr>
<td><strong>Pneumonia</strong></td>
<td>Rikkin et al., Waterbury, CT, 2007</td>
<td>Community teaching hospital</td>
<td>Retrospective cohort</td>
<td>HP vs non-HP care</td>
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<td>Rikkin et al., New Hyde Park, NY, 2002</td>
<td>Community hospital</td>
<td>Retrospective cohort with multivariate adjustment</td>
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<td><strong>Congestive heart failure</strong></td>
<td>Lindenauer et al., Springfield, MA, 2002</td>
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<tr>
<td>Royman et al., Honolulu, HI, 2002</td>
<td>Community-based teaching hospital</td>
<td>Retrospective cohort</td>
<td>HP vs non-HP care</td>
<td>Observational, single site</td>
<td>Compared with non-HP care, HP care was associated with increased use of ACE inhibitors or ARBs (86% vs 72%; P=0.03), decreased use of multiple medications (8% vs 16%; P=0.03), decreased costs (P&lt;0.001), and decreased LOS (P=0.002); readmissions were similar</td>
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<tr>
<td>Vasilevski et al., multicenter, 2008</td>
<td>6 academic hospitals</td>
<td>Academic HP vs academic non-HP care</td>
<td>Observational</td>
<td>Retro-spective</td>
<td>No difference between HPs and non-HPs in measurement of ejection fraction, use of ACE inhibitors, use of β-blockers, LOS, mortality, or cost; HP patients had higher odds of keeping follow-up appointments (OR=1.83; 95% CI, 1.44-2.39)</td>
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<tr>
<td><strong>HIV</strong></td>
<td>Schneider et al., multicenter, 2008</td>
<td>8 academic hospitals</td>
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<td><strong>Chest pain</strong></td>
<td>Sonkiew et al., New York, NY, 2008</td>
<td>Academic medical centers</td>
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<td>Observational, single site</td>
</tr>
</tbody>
</table>

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4. ACE = angiotensin-converting enzyme; ARB = angiotensin II receptor blocker; CI = confidence interval; DVT = deep vein thrombosis; HIV = human immunodeficiency virus; HP = hospitalist; LOS = length of stay; OR = odds ratio.

5. Items are presented by condition or service type because they were thus reported in the medical literature.


