

# Effect of Hospitalist Attending Physicians on Trainee Educational Experiences: A Systematic Review

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**BACKGROUND:** Trainees receive much of their inpatient education from hospitalists.

**PURPOSE:** To characterize the effects of hospitalists on trainee education.

**DATA SOURCES:** MEDLINE, Database of Reviews of Effectiveness (DARE), National Health Service (NHS) Economic Evaluation Database (EED), Health Technology Assessment (HTA), and the Cochrane Collaboration Database (last searched October 2008) databases using the term "hospitalist", and meeting abstracts from the Society of Hospital Medicine (SHM) (2002-2007), Society of General Internal Medicine (SGIM) (2001-2007), and Pediatric Academic Societies (PAS) (2000-2007).

**STUDY SELECTION:** Original English language research studies meeting all of the following: involvement of hospitalists; comparison to nonhospitalist attendings; evaluation of trainee knowledge, skills, or attitudes. 711 articles were reviewed, 32 retrieved, and 6 included; 7,062 meeting abstracts were reviewed, 9 retrieved, and 2 included.

**DATA EXTRACTION:** Two authors reviewed articles to determine study eligibility. Three authors independently reviewed included articles to abstract data elements and classify study quality.

**DATA SYNTHESIS:** Seven studies were quasirandomized one was a noncontemporaneous comparison. All citations only measured trainee attitudes. In all studies comparing hospitalists to nonhospitalists, trainees were more satisfied with hospitalists overall, and with other aspects of their teaching, but ratings were high for both groups. One of 2 studies that distinguished nonhospitalist general internists from specialists showed that trainees preferred hospitalists, but the other did not demonstrate a hospitalist advantage over general internists.

**CONCLUSIONS:** Trainees are more satisfied with inpatient education from hospitalists. Whether the increased satisfaction translates to improved learning is unclear. *Journal of Hospital Medicine* 2009;4:490-498. © 2009 Society of Hospital Medicine.

**KEYWORDS:** clinical clerkship/methods, hospitalist, hospital teaching, internship methods, program evaluation, residency/methods.

Wachter and Goldman<sup>1</sup> described the hospitalist model for inpatient care more than a decade ago. The Society of Hospital Medicine (SHM) defines hospitalists as "physicians whose primary professional focus is the general medical care of hospitalized patients. Their activities include patient care, teaching, research, and leadership related to hospital medicine."<sup>2</sup> This care delivery model has enjoyed exponential growth, with approximately 20,000 hospitalists in the United States, and an estimated 30,000 by the end of the decade.<sup>3-5</sup> Currently, 29% of hospitals, including 55% with at least 200 beds, employ hospitalists to coordinate inpatient care.<sup>6</sup> Data suggests that hospitalists promote cost containment and decrease length of stay without negatively affecting rates of death, readmission, or patient satisfaction.<sup>7-15</sup>

In academic settings, hospitalists also provide a substantial amount of teaching to trainees,<sup>16-18</sup> and the hospitalist model represents a fundamental change in inpatient educa-

tion delivery. Traditional ward attendings typically consisted of a heterogeneous group of subspecialists, laboratory-based clinician scientists, and general internists, many of whom attended and taught relatively infrequently. By virtue of focusing purely on inpatient care, hospitalists are more intimately involved with inpatient care systems, as well as teaching challenges (and opportunities) in the inpatient setting. The theoretical educational benefits of hospitalists include greater availability, more expertise in hospital medicine, and more emphasis on cost-effective care.<sup>7,18,19</sup> Concerns that trainees would have diminished autonomy and less exposure to subspecialist care have not been borne out.<sup>16,20,21</sup>

The purpose of this study was to examine the role of hospitalists on inpatient trainee education. We systematically reviewed the literature to determine the impact of hospitalists compared to nonhospitalist attendings on medical students' and residents' education.

## MATERIALS AND METHODS

### Data Sources

We searched the MEDLINE, Database of Reviews of Effectiveness (DARE), National Health Service (NHS) Economic Evaluation Database (EED), Health Technology Assessment (HTA), and Cochrane Collaboration databases for citations using the term “hospitalist” through November 2007, and updated the literature search through October 1, 2008. Additionally, we manually searched the bibliographies of relevant retrieved articles and national meeting abstracts from the SHM (2002-2007), Society of General Internal Medicine (SGIM) (2001-2007), and Pediatric Academic Societies (PAS) (2000-2007). The authors of included meeting abstracts were contacted for additional information.

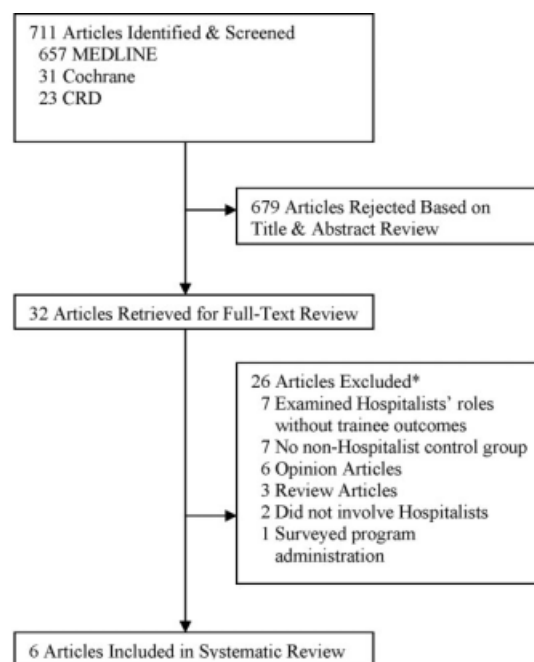
### Data Selection

We included English-language studies that reported the effects of hospitalist attending physicians on the knowledge, skills, or attitudes of medical students or residents in an inpatient setting, and compared these outcomes to a comparison group of trainees taught by nonhospitalist attending physicians. We excluded opinion articles, review articles, descriptions of curricula, surveys of program leaders, and evaluations of teaching without trainee assessments.

### Data Extraction

We developed a standardized data extraction form based on the Best Evidence Medical Education (BEME) Collaboration protocol.<sup>22</sup> The following information was extracted from each article: study design and measurement scale; attending and trainee information; study setting; response rate, if available; outcomes measuring attending physician’s teaching ability; and outcomes assessing trainees’ attitudes, knowledge, and skills. Open-ended items solicited overall impression, concerns, new insights, and avenues for research not already captured in the data extraction form. A meta-analysis was not performed due to varying measures for teacher assessments.

One investigator (P.N.) performed the literature search and a second investigator (K.E.H.) reviewed and confirmed the appropriateness of the articles retained and excluded based on review of the titles and abstracts. Next, 3 investigators (P.N., K.E.H., S.R.) confirmed that all the included articles met inclusion criteria. All 3 independently abstracted each article and coded the strength of findings and methodological quality based on: (1) response rate; (2) number of trainees and attendings; (3) control for additional education interventions; (4) explicit indication of random allocation of trainees to attendings; and (5) presence of a contemporaneous comparison group of nonhospitalist attendings. The level of behavioral impact by the 4-level Kirkpatrick hierarchy was also recorded for each study to assess the strength of the intervention.<sup>23</sup> The strength of data was rated for each study on a scale of 1 to 5, with 1 = no clear conclusions can be drawn; 2 = results ambiguous,



\*Some articles excluded for multiple reasons.

FIGURE 1. Search and selection of included articles.

but appears to be a trend; 3 = conclusions can probably be based on results; 4 = results are clear and very likely to be true; and 5 = results are unequivocal. Disagreements about search criteria, data extraction, and classification of study results were resolved by consensus.

## RESULTS

### Search Results

The database searches yielded 711 articles (Figure 1). Based on review of titles and abstracts, 32 articles were retrieved for full-text review. During full-text review, we eliminated 26 studies because they had no nonhospitalist control group,<sup>7,16,18,24-27</sup> were opinion or review articles,<sup>19,21,28-34</sup> examined hospitalists’ roles without trainee outcomes,<sup>17,35-40</sup> surveyed program administration,<sup>41</sup> or did not involve hospitalists.<sup>42,43</sup> Ultimately, 6 citations published between 2002 and 2007 met all inclusion criteria (Table 1).<sup>44-49</sup> The updated literature search through October 1, 2008 did not yield any additional relevant studies.

Examination of meeting abstracts yielded a total of 7,062 abstracts (Figure 2), of which 9 abstracts were retrieved for full-text review. Two abstracts met inclusion criteria (Table 1).<sup>50,51</sup> Excluded meeting abstracts included published studies that were already abstracted as manuscripts,<sup>52,53</sup> had no nonhospitalist control group,<sup>54,55</sup> did not involve hospitalists,<sup>56</sup> surveyed program administrators,<sup>57</sup> or examined hospitalists’ roles without trainee outcomes.<sup>58</sup> Our communications with abstract authors did not yield any relevant additional information.

**TABLE 1. Summary of Studies**

Location, year <sup>reference</sup>	Learners (n)	Number of Attendings	Attending Ward Responsibilities (weeks per year)	Attending Experience (mean years postgraduation)	Attending Gender (% female)	Survey Response Rate (%)	Data Strength <sup>‡</sup>
University of Chicago, 2002 <sup>44</sup>	PGY-unspecified (86)	2-4 hospitalists; unknown nonhospitalists	12-24 hospitalists; 4-8 nonhospitalists			58	2
Children's Hospital, Boston, 2002 <sup>45</sup>	PGY-1, PGY-3 (unknown)	8 hospitalists; 75 nonhospitalists	12-16 hospitalists; 2-4 nonhospitalists			63	2
Oregon Health & Sciences, 2004 <sup>46</sup>	MS3 (138)	6 hospitalists; 11 nonhospitalists	22.8 hospitalists; 6.4 nonhospitalists	4.2 hospitalists; 10.9 nonhospitalists	2/6 (33%) hospitalists; 4/11 (36%) nonhospitalists	72	3
University of California, San Francisco, 2004 <sup>47</sup>	MS3-4, PGY1-3 (917)	17 hospitalists; 39 general internists; 13 subspecialists	12 hospitalists; 3.24 nonhospitalists		6/17 (35%) hospitalists; 17/52 (33%) nonhospitalists	91	4
Grady Memorial, 2004 <sup>48</sup>	MS3-4, PGY1-3 (unknown)	12 hospitalists; 27 general internists; 51 subspecialists	24 hospitalists; 6 nonhospitalists	6.1 hospitalists; 9.7 general internists; 21.6 subspecialists	6/12 (50%) hospitalists; 16/51 (31%) nonhospitalists	81	3
Penn State Children's Hospital, 2007 <sup>49</sup>	MS3 (67)	2 hospitalists; 8 nonhospitalists	2 MDs covered 32 hospitalists; 8 MDs covered 28 nonhospitalists		1/2 (50%) hospitalists; 2/8 (25%) nonhospitalists	100	3
Multiple sites, 2005 <sup>50*,†</sup>	MS3 (294)					54	2
California Pacific Medical Center, 2006 <sup>51*</sup>	PGY-unspecified (unknown)						1

\* Meeting abstracts.

<sup>†</sup> Brigham & Women's Hospital, University of California San Francisco, University of Chicago, University of Washington, University of Illinois, University of New Mexico.

<sup>‡</sup> Data strength: 1 (no clear conclusions can be drawn), 2 (results ambiguous, but appears to be a trend), 3 (conclusions can probably be based on results), 4 (results are clear and very likely to be true), 5 (results are unequivocal).

**Study Settings, Designs, and Outcomes**

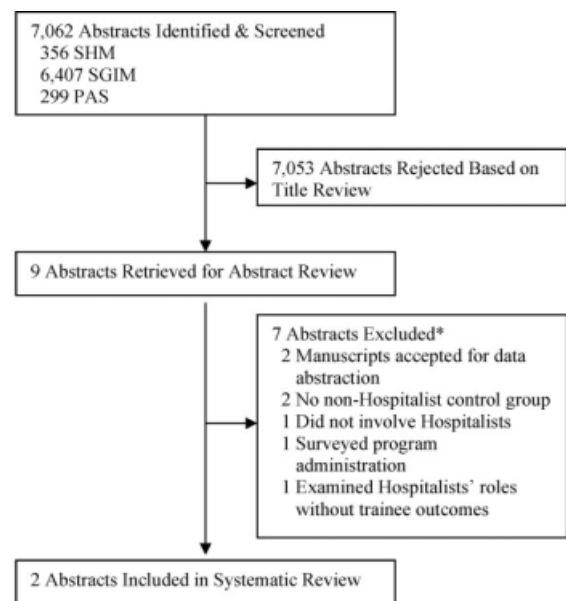
Six of 8 included studies occurred in an internal medicine inpatient setting: 4 in university hospitals,<sup>44,46,47,50</sup> 1 in a public safety-net hospital,<sup>48</sup> and 1 in a community teaching hospital.<sup>51</sup> The remaining 2 studied the inpatient pediatric wards in university hospitals.<sup>45,49</sup>

In 7 of 8 included studies, trainees were assigned to work with hospitalists or nonhospitalists according to the study site's standard method for allocating trainees to rotations; trainees were not allowed to choose their supervising attending. We considered these studies to be quasirandomized. The other study compared nonhospitalist attending evaluations the year prior to implementing hospitalists to hospitalist attending evaluations the year afterward.<sup>45</sup>

Studies measured trainee attitudes through routinely administered evaluations,<sup>46,47,49,51</sup> dedicated surveys,<sup>44,48,50</sup> or both.<sup>45</sup> One also qualitatively coded trainees' written responses to determine themes.<sup>48</sup>

**Characteristics of Learners**

Studies assessed only residents,<sup>44,45,51</sup> only third-year medical students,<sup>46,49,50</sup> or residents and third-year and fourth-



\*Some meeting abstracts excluded for multiple reasons.

**FIGURE 2.** Search and selection of included meeting abstracts.

**TABLE 2. Trainee Ratings of Attending Teaching**

	Number of Studies Evaluated	Hospitalists Better	Nonhospitalists Better	No Difference
Overall rating of attending	8	44-46, 47*, 48-51	—	47 <sup>†</sup>
Teaching effectiveness	5	44, 48-50	—	46
Feedback delivery	4	45, 47*, 48	47 <sup>†</sup>	46
Involvement of trainees in patient care decisions	3	45, 48	—	44
Quality of ward rounds	2	44, 49	—	—
Effectiveness as a role model	2	45, 48	—	—
Communication of rotation goals	1	46	—	—
Emphasizes evidence-based care	1	48	—	—
Emphasizes cost-effective care	1	47	—	—
Availability	2	45	—	48
Perceived knowledge	3	45, 48	—	47
Bedside teaching	1	—	45	—
Apparent interest in psychosocial aspects of care	1	47*	47 <sup>†</sup>	—

NOTE: Studies that achieved statistical significant in demonstrating increased trainee satisfaction for each domain are listed in each attending group's column.

\* Hospitalists compared to subspecialists.

<sup>†</sup> Hospitalists compared to general internists.

year medical students.<sup>47,48</sup> The amount of time trainees spent with each attending physician ranged from 2 to 4 weeks. One-half of the studies reported the number of trainees responding to surveys in each attending group. Two studies had an equivalent number of trainees respond for each attending group,<sup>47,49</sup> while the other 2 had approximately twice as many trainees working with hospitalists respond.<sup>46,50</sup> No studies reported other characteristics of trainees assigned to the different attending groups.

### Characteristics of Attendings

Hospitalists were described as attending between 12 and 32 weeks per year while nonhospitalists worked 2 to 12 weeks, except in 1 study where nonhospitalists worked 28 weeks (Table 1).<sup>49</sup> Two studies separated nonhospitalists into general internists and subspecialists<sup>47,48</sup> but only 1 contrasted the weeks on service for the 2 groups of nonhospitalists.<sup>48</sup> On average, hospitalists tended to be younger and have less experience than nonhospitalist attendings (Table 1). In those reporting attending gender, there was no significant difference between the 2 attending groups.

### Methodological Quality

Because all of the included studies only evaluated trainee attitudes, they were all coded as Level 1 by the Kirkpatrick hierarchy for “covering learners’ views on the learning experience, its organization, presentation, content, teaching methods, and aspects of the instructional organization, materials, quality of instruction.”<sup>23</sup>

The methodological quality of the studies varied. Seven studies used a contemporaneous control group, and 1<sup>45</sup>

employed a noncontemporaneous comparison of hospitalists to nonhospitalists. Seven included studies reported the trainee response rate, which varied widely (from 54% to 100%) (Table 1). None of the studies reported whether any other educational interventions that could have biased study results were implemented during the study period. Of the 6 published studies, the strength of the data for 5 studies was rated as a 2 or 3 and for 1 the strength was rated a 4 (Table 1).

### Trainee Evaluations Comparing Hospitalists to All Nonhospitalists

The most commonly evaluated attending measures included trainees’ overall satisfaction with attendings (n = 8 studies),<sup>44-51</sup> trainees’ ratings of teaching effectiveness (n = 5 studies),<sup>44,46,47,49,50</sup> attending effectiveness of feedback delivery (n = 4 studies),<sup>45-48</sup> trainees’ perceptions of attending knowledge (n = 3 studies),<sup>45,47,48</sup> and attending involvement of trainees in patient care decisions (n = 3 studies) (Table 2).<sup>44,45,47</sup> Several other outcomes were reported in 2 or fewer studies (Table 3). All studies reported nonnormally distributed evaluation ratings, with trainee ratings of all attending groups skewed toward high ratings.

Of the 8 studies comparing hospitalists to all nonhospitalists, trainees were statistically significantly more satisfied with hospitalists in all but 1 (Table 3).<sup>44-51</sup> Hospitalists’ overall teaching effectiveness was rated significantly higher in 4 studies,<sup>44,47,49,50</sup> but 1 did not demonstrate a difference.<sup>46</sup> Hospitalists were also rated higher at feedback delivery compared to all nonhospitalists, with 2 studies<sup>45,47</sup> and 1 abstract reporting hospitalists’ superiority. One other study showed increased satisfaction with hospitalists’ feedback only compared to

**TABLE 3. Results of Studies Evaluating Hospitalists vs. Nonhospitalists**

Reference Citation, Location, Year	Study Design	Major Findings	Data Strength
Chung et al., <sup>44</sup> University of Chicago, 2002	Retrospective, quasirandomized with contemporaneous controls	% of Internal Medicine house staff "very satisfied" with Internal Medicine attendings (5-point scale, 5 = very satisfied): End of month: hospitalist 58%, nonhospitalist 39%; end of year: hospitalists 76%, nonhospitalists 48%. Compared to residents who did not work with hospitalists, residents with experience with hospitalists had fewer concerns about loss of autonomy (8% vs. 41%, $P = 0.02$ ), and no difference in concerns about exposure to different faculty (41% vs. 60%, $P = 0.08$ )	2
Landrigan et al., <sup>45</sup> Children's Hospital, Boston, 2002	Retrospective, single group with historical control	Overall satisfaction with inpatient experience (4-point scale, 4 = extremely satisfied): interns, 3.5 with hospitalists, 3.2 with nonhospitalists. PGY3, 3.5 with hospitalists, 3.5 with nonhospitalists. Rating of teaching effectiveness (5-point scale, 5 = excellent): hospitalists 4.7, nonhospitalists 4.4. PGY3s reported less ability to make decisions independently, less ability to supervise with hospitalist attendings, but differences did not meet statistical significance ( $P = 0.07$ ).	2
Hunter et al., <sup>46</sup> Oregon Health & Sciences, 2004	Retrospective, quasirandomized with contemporaneous controls	MS3 combined overall rating of attending during Internal Medicine clerkship (9-point scale, 9 = outstanding): hospitalists 8.56, nonhospitalists 8.22. Combined rating was a composite of 7 parameters (communication of rotation goals, establishing learning climate, use of educational time, teaching style, evaluation and feedback, contribution to growth and development, and effectiveness as clinical teacher).	3
Hauer et al., <sup>47</sup> University of California, San Francisco, 2004	Retrospective, quasirandomized with contemporaneous controls	Internal medicine house staff, MS4 and MS3 overall satisfaction with Internal Medicine attending (9-point scale, 9 = excellent): hospitalists 8.3 (SD 0.9), nonhospitalist general internists 7.9 (SD 1.3), subspecialists 8.1 (SD 1.7); $P = 0.01$ for comparison of hospitalists vs. nonhospitalist generalists, $P = 0.20$ for comparison of hospitalists vs. subspecialists. Attending teaching effectiveness (5-point scale, 5 = excellent): hospitalists 4.8 (SD 0.6), general internists 4.5 (SD 0.8), specialists 4.5 (SD 1.1); $P < 0.001$ for comparison of hospitalists vs. nonhospitalist generalists, $P = 0.03$ for comparison of hospitalists vs. subspecialists. Attending knowledge (9-point scale): hospitalists 8.2 (SD 1.1), nonhospitalists 7.9 (SD 1.2), subspecialists 8.1 (SD 1.5); $P < 0.01$ for comparison of hospitalists vs. nonhospitalist generalists, $P = 0.10$ for comparison of hospitalists vs. subspecialists. Attending valuation of trainee opinions (9-point scale): hospitalists 8.3 (SD 0.9), nonhospitalist generalists 8.2 (SD 1.3), subspecialists 8.1 (SD 1.7); $P = 0.20$ for comparison of hospitalists vs. nonhospitalist generalists; $P = 0.60$ for comparison of hospitalist vs. subspecialists. Provision of feedback (9-point scale): hospitalists 7.9 (SD 1.6), nonhospitalist generalists 7.2 (SD 2.3), subspecialists 7.0 (SD 2.5); $P < 0.01$ for comparison of hospitalists vs. nonhospitalist generalists, $P = 0.01$ for comparison of hospitalists vs. subspecialists.	4
Kripalani et al., <sup>48</sup> Grady Memorial, 2004	Retrospective, quasirandomized with contemporaneous controls	Internal medicine house staff, MS4 and MS3 satisfaction with Internal Medicine attending teaching effectiveness (25-item McGill Clinical Tutor Evaluation, maximum score 150): hospitalists 134.5 (95% CI, 130.2-138.8), general internists 135.0 (95% CI, 131.2-138.8), specialists 126.3 (95% CI, 120.4-132.1).	3
Geskey and Kees-Fols, <sup>49</sup> Penn State Children's Hospital, 2007	Retrospective, quasirandomized with contemporaneous controls	MS3 overall satisfaction with Pediatric attending teaching (4-point scale, 4 = excellent), hospitalists 3.9, nonhospitalists 3.0. MS3s rated hospitalists higher than nonhospitalists in all 4 attending characteristics measured: teaching effectiveness, effectiveness as a pediatrician, student advocacy effectiveness, and overall.	3
Arora et al., <sup>50</sup> Multiple sites, 2005* <sup>†</sup>	Retrospective, quasirandomized with contemporaneous controls	MS3 overall satisfaction with Internal Medicine clerkship (5-point scale, 5 = very satisfied): hospitalists 4.5, nonhospitalists 4.3. Trends toward greater emphasis on education ( $P = 0.07$ ) and higher quality attending rounds ( $P = 0.07$ ) with hospitalists. Effects of hospitalists on resident perceptions of autonomy not reported.	2
Chintharajah and Aronowitz, <sup>51</sup> California Pacific Medical Center, 2006*	Retrospective, with contemporaneous controls. Method of assignment to attending type not stated.	Internal Medicine house staff ratings of Internal Medicine attendings: Using a 9-point scale in 1998-2002, then 5-point scale in 2003-2005. Hospitalists were rated higher than nonhospitalists in all areas assessed in 1998-2002, but were rated higher in only 3 areas in 2003-2005 (accessibility, feedback, and teaching procedures). Data not shown.	1

\*Meeting abstracts.

<sup>†</sup>Brigham & Womens Hospitals University of California-San Francisco, University of Chicago, University of Washington, University of Illinois, University of New Mexico.

NOTE: Shows the individual study results for outcomes measured in 3 or more studies.

Abbreviations: CI, confidence interval; MS, medical student; PGC, postgraduate year; SD, standard deviation.

subspecialists.<sup>48</sup> Hospitalists were perceived as being more knowledgeable and allowing greater trainee involvement in patient care decisions, in 2 of 3 studies addressing each of these questions. In order to evaluate preconceived notions, 1 study demonstrated that residents who never worked with hospitalists were significantly more concerned about hospitalists negatively impacting their clinical autonomy than residents who had worked with hospitalists at least once.<sup>44</sup>

Hospitalists were rated as more available in 1 study<sup>45</sup> with a trend toward more availability in another.<sup>47</sup> Trainee satisfaction was higher with hospitalists on other measures including quality of ward rounds,<sup>44,49</sup> effectiveness as a role model,<sup>45,48</sup> communication of rotations' goals,<sup>46</sup> emphasis on evidence-based medicine,<sup>48</sup> and emphasis on cost-effective care.<sup>47</sup> In 1 study, trainees were significantly more satisfied with the bedside teaching of nonhospitalists.<sup>45</sup> In another, trainees felt that, compared to hospitalists, general internists seemed to be more interested in the psychosocial aspects of patients' care.<sup>48</sup>

### Trainee Evaluations Comparing Hospitalists to Outpatient Generalists and Subspecialists

Of the studies that examined whether the type of nonhospitalist (general internist vs. subspecialist) impacted trainee ratings, 1 showed that trainees were equally satisfied with hospitalists and general internists but that general internists were rated higher than hospitalists for feedback delivery.<sup>48</sup> Hospitalists were rated significantly higher than subspecialists overall and for feedback delivery.<sup>48</sup> The other study that subclassified nonhospitalists into general internists and subspecialists showed that hospitalists were more highly rated than both general internists and subspecialists overall and for teaching effectiveness and feedback delivery.<sup>47</sup>

## DISCUSSION

This systematic review of the literature describing hospitalists as educators shows that trainees are generally more satisfied with hospitalists than nonhospitalists on their inpatient rotations. Hospitalists were rated more highly than traditional ward attendings overall, and for teaching effectiveness<sup>44,47,49,50</sup> and feedback delivery.<sup>45,47</sup> Limited data (3 studies each) indicates that trainees perceive hospitalists as being at least as knowledgeable as traditional attendings, and encouraging similar levels of trainee involvement in patient care decisions. Trainees may be more satisfied with hospitalists than with general internists or subspecialists, although some comparisons have shown that general internists may be preferred. No studies have evaluated the impact of hospitalists on trainee outcomes beyond satisfaction, such as knowledge acquisition, rotation grades, or clinical performance.

Our review suggests that, with increased time spent on the wards, hospitalists exhibit attributes consistent with specialization in inpatient care.<sup>1,14</sup> Hospitalists were noted to emphasize cost-effectiveness<sup>47</sup> and evidence-based medicine<sup>48</sup> and to conduct higher-quality ward rounds.<sup>44,49</sup> Hos-

pitalists are uniquely qualified to teach about inpatient goals and processes such as decreasing length of stay in the hospital and cost-effective care.<sup>1,3,7,12,15</sup> Trainees see hospitalists as role models,<sup>45,47</sup> and the site-defined nature of hospital medicine promotes trainees' access to hospitalist attendings. Such accessibility has been described as an independent attribute of excellent physician role models,<sup>59,60,62</sup> Our findings from our methodologically rigorous systematic review of the literature extend the conclusions of a narrative review of the literature on hospitalists as educators that also identified favorable ratings of hospitalists, with some unresolved concerns about resident autonomy and the role of subspecialist teachers in hospitalist systems.<sup>63</sup>

Diminished trainee autonomy was an early concern about hospitalists in academic medical centers.<sup>16,20,21</sup> In the earliest study we identified that assessed autonomy, trainees perceived similar amounts of autonomy with hospitalists compared to nonhospitalists.<sup>44</sup> Interestingly, house staff in more experienced hospitalist models even described experiencing increased involvement in patient care when supervised by hospitalist attendings in both the pediatric and internal medicine settings.<sup>45,47</sup> Hospitalists might also generate more clinical diversity for house staff by reducing length of stay and thereby enhancing opportunities for learning with newly admitted patients.<sup>13,14,64</sup>

The studies that did not demonstrate increased satisfaction with hospitalists may be instructive as well. One negative study<sup>46</sup> reported results from a program that instituted the hospitalist model in response to declining trainee satisfaction. With an emphasis on improving the educational experience, nonhospitalist physicians who were already rated highly as teachers were also selected to attend on the wards. Nonetheless, trainees still were more satisfied with hospitalists overall. One study showed that hospitalists were rated more highly than subspecialists when delivering feedback but less so than general internists.<sup>47</sup> The authors suggest that their general internists may have been at a more optimum demographic by being a few more years out of training; such correlations of age and rank to evaluations have not been previously described.<sup>60,61</sup>

The disadvantages of hospitalists in trainee education identified by this systematic review include the quality of bedside teaching in one study<sup>45</sup> and interest in psychosocial aspects of care in another<sup>48</sup> compared to general internists. The decline in satisfaction with bedside teaching is a concern but the comparison was noncontemporaneous and the authors explained that the team size increased and resulted in an overall decrease in time at the bedside.<sup>45</sup> The concern that decreased patient length of stays may translate to less time spent with patients and less bedside teaching is not new.<sup>18</sup> Although hospitalists have shown particular educational advantages, the balance of clinical efficiency and education remains challenging. Trainees' perception that hospitalists were less interested in the psychosocial aspects of

care compared to general internists<sup>48</sup> was also anticipated when inpatient attending models began to shift, because hospitalization may now be viewed by trainees as discontinuous from a patient's outpatient care and social situation.<sup>18</sup> Nevertheless, hospitalists have been able to achieve such quality measures as decreased length of stay without decreasing patient satisfaction.<sup>10,12</sup>

Our study has several limitations. First, all attendings were rated highly in all studies. These high ratings are commonly seen with educational evaluations,<sup>65</sup> and this phenomenon creates a "ceiling effect" that limits variability within the group. Nevertheless, trainees rated hospitalists significantly higher than nonhospitalists overall in all of the included studies. The impact of these small but significant differences on trainees' learning and future clinical performance is unknown. Additionally, the distinction between hospitalists and nonhospitalists was not universal. Initially, it was proposed that academic hospitalists work as hospitalists 3 to 6 months each year.<sup>1</sup> This definition is sustained through almost all included studies that reported attending time on the wards, with hospitalists working 3 to 7 months and nonhospitalists working less than 3 months, but observed variability does not permit a universal hospitalist definition. It is possible that publication bias influenced our findings toward positive ratings of hospitalists; we reviewed and included meeting abstracts to minimize this bias. We did not review family medicine meeting abstracts.

The included studies had some methodologic strengths, including quasirandom assignment of trainees and use of a contemporaneous control group in almost all studies. However, the overall methodologic strength was fair given limitations in response rates and reporting of cointerventions; we thus considered most studies to represent trends rather than definitive results. Finally, all of the studies meeting our inclusion criteria to date only evaluated trainees' attitudes and beliefs. Because knowledge and skills were not objectively assessed, it is unclear how increased trainee satisfaction translates to knowledge and skill acquisition on the wards. However, Miller's pyramid and its proposed modification, the Cambridge model, suggest that targeting attitudes precedes knowledge acquisition,<sup>66</sup> and our study suggests the need for a research agenda examining the impact of hospitalists on trainees' future performance. Griffith et al.<sup>67</sup> demonstrated an association between increased satisfaction with teaching and medical students' performance on clerkship examinations and the U.S. Medical Licensing Examination (USMLE) Step 2.

Overall, trainees were more satisfied with hospitalists' teaching and feedback delivery. Our literature search shows that, although there are a limited number of studies of varying level of quality that cannot be compared using meta-analytic techniques, the currently available data suggests that hospitalists lead to improved learner satisfaction. More studies to delineate the differences between hospitalists and nonhospitalist general internists are needed. Con-

tinued exploration of the effects of attending age and rank on trainee learning may help determine whether this effect is reproducible, and what facets of attendings' teaching actually impact trainees' knowledge, skill acquisition, and behaviors. Since all studies only evaluated attitudes, studies analyzing knowledge and skills are required to more fully understand the educational outcomes of the hospitalist model.

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