The Impact of Hospitalists on the Cost and Quality of Inpatient Care in the United States: A Research Synthesis

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There is substantial disagreement regarding the impact of hospitalists on costs, quality, and satisfaction with inpatient care. The authors reviewed 21 evaluations of the use of hospitalists in U.S. hospitals. Most evaluations found that patients managed by hospitalists had lower total costs or charges than patients in comparison groups and that these savings were achieved primarily by reducing length of stay. Most evaluations found no statistically significant differences in quality of care or satisfaction. However, lack of random assignment limits the ability to draw causal inferences from many of the evaluations. All randomized studies were conducted in teaching hospitals, raising questions as to the generalizability of findings to nonteaching hospitals. Further research is needed to better identify the mechanisms by which hospitalists reduce length of stay and to ascertain which types of hospitalist programs are most effective and which patients are most likely to benefit.

Keywords: *hospitalists; physicians; inpatient care; evaluation; cost; quality*

The development of the hospitalist role is one of the most noteworthy innovations in the management of hospitalized patients in the United States. Under this new model, a primary care physician "hands off" a patient he or she admits to the hospital to a hospitalist physician who is responsible for the

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patient's care during the hospital stay. The use of hospitalists represents a dramatic break with tradition, because U.S. physicians have typically managed their patients in both outpatient and inpatient settings.

Hospitalist programs were initially established in markets with high rates of enrollment in health maintenance organizations (HMOs). The first hospitalist program was established in 1994 by the Park Nicollet Clinic, a large, multisite, multispecialty medical group located in the Minneapolis–St. Paul, Minnesota metropolitan area (Freese 1999, 350). Hospitals owned by Kaiser Permanente Northern California, one of the largest HMOs in the United States, began using hospitalists in 1995 (Craig et al. 1999, 356). Teaching hospitals in Boston, San Francisco, and other markets soon implemented similar initiatives under which faculty hospitalists led hospitalist teams that included residents and medical students (Brown et al. 1999; Wachter et al. 1998).

The use of hospitalists has spread rapidly in the ensuing years. Sixty-five percent of respondents to a national survey of internists conducted in 1999 reported that hospitalist services were available in their communities (Auerbach et al. 2000). More than 3,000 U.S. physicians belong to the National Association of Inpatient Physicians, an association of hospitalists (Wachter 2002, 689).

Physicians may serve as hospitalists on either a part-time or full-time basis. In some cases, primary care physicians in a medical group take turns managing one another's hospitalized patients. When physicians rotate into the hospitalist role, they remain in the hospital throughout the day to monitor patients' conditions, to adjust treatment plans, and to order diagnostic tests and specialty consultations as needed. In other cases, hospitals or medical groups hire physicians to provide inpatient care exclusively. This model represents an advance over the rotation model, because physicians in the hospitalist role spend more time in the hospital, which increases their expertise in managing inpatient care and communicating with office-based primary care physicians (Wachter 1998, 2002).

In the United States, the use of hospitalists is usually voluntary. Some HMOs require primary care physicians to use hospitalists, but most have chosen not to do so because many physicians object to such mandates (Wachter 2002). Most mandatory programs that exist today are in university-affiliated teaching hospitals in which faculty in certain departments have decided to use hospitalists to manage all of their admissions.

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In most hospitals, hospitalists typically manage only patients admitted to general medical wards. These are patients who are hospitalized for a medical condition, such as persons with acute myocardial infarction, angina, asthma, bronchiolitis, cancer, congestive heart failure, gastroenteritis, infection, pneumonia, or seizures. Hospitalists may also manage patients in critical care wards in which patients are not managed by intensivists (i.e., physicians specializing in critical care). Obstetric, psychiatric, and surgical patients are usually managed by physicians in those specialties.

Physicians sharply disagree as to the merits of hospitalists. Advocates assert that hospitalists improve efficiency because they can monitor patients more closely and respond more quickly to changes in their condition (Schroeder and Schapiro 1999; Sox 1999). Some advocates maintain that the use of hospitalists may improve productivity in outpatient care as well, because primary care physicians no longer need to leave the office to visit hospitalized patients (Wachter and Goldman 1996). In addition, advocates believe that quality of care may improve because hospitalists have more experience in managing inpatient care (Wachter and Goldman 1996).

Critics counter that hospitalists may compromise patient care and physician satisfaction. Some critics assert that the lack of continuity between inpatient and outpatient care may lead to the loss of valuable information about the patient's condition, prior medical history, values, and family and social circumstances (Schroeder and Schapiro 1999; Wachter 2002). Others are concerned that hospitalists may use medical technologies more aggressively (Schroeder and Schapiro 1998). Critics also maintain that patients may not feel comfortable having their hospital care managed by a physician with whom they do not have a prior relationship (Sox 1999). In addition, some critics argue that limiting primary care physicians to outpatient practice threatens their professional identify and denies them an important source of professional satisfaction (Brown 1998; Schroeder and Schapiro 1999; Sox 1999).

These differing views underscore the need to assess the empirical evidence regarding the efficacy of hospitalists. This review synthesizes 21 evaluations of the use of hospitalists in U.S. hospitals. We discuss major findings regarding the impact of hospitalists on resource use; quality of care; and patient, family, and provider satisfaction. We also critique the research designs of the evaluations and their implications for the internal and external validity of their findings.

The review is organized as follows. The Methods section describes the methods used to identify evaluations of hospitalist programs and to classify their findings. The Findings section critiques the research designs used in the evaluations and discusses their findings. The Discussion and Conclusion

section summarizes the findings from the review, as well as implications for practice and avenues for further research on hospitalists.

NEW CONTRIBUTION

Although several reviews of evaluations of hospitalist programs have been published previously (Michota 2000; Michota 2001; Wachter 2002; Wachter and Goldman 2002), these reviews were published prior to the publication of seven evaluations in article format in peer-reviewed journals. This review includes these seven recent evaluations of hospitalist programs as well as the relevant evaluations covered in previous reviews. The recent evaluations are important additions to the literature on hospitalists because they analyze hospitalist interventions for longer periods of time than previous evaluations, examine additional disease-specific measures of quality of care, and test new hypotheses regarding the mechanisms by which hospitalists affect patient outcomes. This review will also provide more explicit guidance to managers of hospitals, medical groups, and health plans considering implementation of hospitalist programs, because prior reviews have not systematically assessed the internal and external validity of the evaluations. Our findings may also be of interest to researchers studying innovation in hospital care.

METHODS

Three major techniques were used to obtain evaluations. Bibliographic searches were conducted using the National Library of Medicine's PubMed database and the ProQuest/ABI Inform database. Title, Abstract, and Major Subject Heading searches were conducted using the terms *hospitalist* and *hospital* and physician. References cited in evaluations and literature reviews retrieved through the bibliographic searches were examined to identify additional evaluations. In addition, the Cochrane Collaborative's database of critical reviews of medical literature was searched to determine whether the Collaborative had published a synthesis of evaluations of hospitalist programs.

Four criteria were used to identify eligible evaluations. Evaluations were deemed eligible for inclusion in the study if they (1) were published in a peer-reviewed journal in article form, (2) examined patients hospitalized in the United States, (3) assessed the use of hospitalists on general medical wards, and (4) used experimental designs or quasi-experimental designs with multivariate analysis to control for potential differences between the intervention and comparison groups that might affect the results (e.g., disease severity, age, sex, ethnicity, insurance type). Limiting the synthesis to evaluations published in article form eliminated a few evaluations cited in prior reviews for

which only abstracts were published in peer-reviewed journals. We restricted eligibility to evaluations of hospitalist programs in the United States to control for the economic, political, and social contexts within which inpatient care is provided. Eligibility was limited to evaluations that assessed the use of hospitalists on general medical wards to reduce potential differences in disease severity that might confound comparisons across studies. This criterion excluded one evaluation that examined the use of hospitalists in pediatric critical care units (Tenner, Dibrell, and Taylor 2003). Limiting eligibility for quasi-experimental evaluations to evaluations that used multivariate methods to control for potential confounders led us to exclude two evaluations cited in prior reviews of the literature (Freese 1999; Seid, Quinn, and Kurtin 1997) and one recent evaluation (Gregory, Baigelman, and Wilson 2003).

Applying these eligibility criteria yielded 21 eligible evaluations. Sources of funding were not reported for most evaluations. Among evaluations that reported funding sources, the funders included hospitals participating in the evaluations, government agencies, philanthropic organizations, and universities.

The evaluations were coded by the authors with regard to important aspects of their research designs, settings, comparisons, and findings. Aspects of research design classified included the strength of the overall research design (e.g., randomized trial, quasi-experimental), sample size, duration of study, type of control or comparison group used, and measures used to assess outcomes. To determine whether findings varied with the type of hospitalist program, evaluations were coded to indicate whether the hospitalist program was voluntary or mandatory, and whether hospitalist teams encompassed residents and medical students as well as physicians. Comparison groups were coded to indicate whether hospitalists were being compared to community-based primary care physicians or to teams of faculty physicians, residents, and medical students. Evaluations were also coded to indicate the characteristics of the hospitals and patient populations studied.

FINDINGS

CRITIQUE OF RESEARCH DESIGNS

Table 1 lists the 21 evaluations and describes their overall research designs, sample sizes, types of control or comparison group, and duration of the interventions. Specific aspects of the research designs and other characteristics of the evaluations are discussed below. Although the designs of these evaluations have many strengths, they also have some important limitations that

TABLE 1 Research Designs of Evaluations Included in the Review

Evaluation	*Research Design*	*Type of Control or Comparison Group*	*Total Sample Size*	*Intervention Group Size*	*Control/ Comparison Group Size*	*Length of Intervention*
1. Auerbach et al. (2002)	Quasi-experimental	Concurrent	5,308	1,615	3,693	2 years
2. Bellet and Whitaker (2000)	Quasi-experimental	Historical	1,440	813	627	1 year
3. Craig et al. (1999)	Quasi-experimental	Historical	Not reported	Not reported	Not reported	1.5 years
4. Davis et al. (2000)	Quasi-experimental	Concurrent	2,124	443	1,681	1 year
5. Diamond, Goldberg, and Janosky (1998)	Quasi-experimental	Historical	3,299	1,620	1,679	1 year
6. Hackner et al. (2001)	Quasi-experimental	Concurrent	1,637	477	1,160	1 year
7. Halpert et al. (2000)	Quasi-experimental	Historical	6,784	2,265	4,519	1 year
8. Kearns et al. (2001)	Randomized	Concurrent	4,456	2,245	2,211	1 year
9. Landrigan et al. (2002)	Quasi-experimental	Concurrent and historical	17,873	3,625	14,248	21 months
10. Lindenauer et al. (2002)	Quasi-experimental	Concurrent	326	137	189	1 year
11. Meltzer et al. (2002)	Randomized	Concurrent	6,511	1,613	4,898	2 years
12. Molinari and Short (2001)	Quasi-experimental	Concurrent and historical	1,319	903	416	9 months
13. Ogershok et al. (2001)	Quasi-experimental	Historical	2,177	1,099	1,078	1 year
14. Palmer et al. (2001)	Randomized	Concurrent	2,464	829	761 generalist controls; 874 specialist controls	1 year

15. Reddy et al. (2001)	Randomized	Concurrent and historical	277	73	78 concurrent controls; 126 historical controls	1 year
16. Rifkin et al. (2002)	Quasi-experimental	Concurrent	455	185	270	1 year
17. Smith, Westfall, and Nicholas (2002)	Quasi-experimental	Concurrent	97	21 pulmonologist intervention; 53 family physician intervention	23	1 year
18. Stein et al. (1998)	Quasi-experimental	Concurrent	237	114	48 office-based & residents comparison; 75 office-based comparison	1 year
19. Tingle and Lambert (2001)	Quasi-experimental	Concurrent	529	355	174	15 months
20. Wachter et al. (1998)	Randomized	Concurrent and historical	4,897	806	817 concurrent controls; 3,274 historical controls	1 year
21. Wells, Dahl, and Wilson (2001)	Quasi-experimental	Concurrent	181	91	90	9 months

affect the internal and external validity of their findings. We also find that some outcomes are measured less frequently than others, which limits the strength of the evidence regarding the effects of hospitalists on these outcomes.

Strength of research design. For each of the evaluations, we assessed the strength of the research design by categorizing the design into one of four groups. The first group consisted of evaluations that randomized subjects. These evaluations had the strongest research designs, because randomization assures that the intervention and control groups are equivalent at baseline with respect to characteristics other than the intervention, which enhances ability to draw causal inferences (Campbell and Stanley 1963). Randomization was typically implemented by alternating assignment of patients to the intervention group (i.e., the group managed by hospitalist physicians) and the control group based on physicians' call schedules. Blinding of the physicians participating in these studies was not feasible given the operationalization of the intervention.

For the most part, the randomization procedures were successful. Four of the evaluations that randomized patients found no statistically significant differences (at $p < .05$) between the intervention and control groups with respect to patients' demographic characteristics, diagnoses, comorbidities, or insurance type (Kearns et al. 2001; Meltzer et al. 2002; Reddy et al. 2001; Wachter et al. 1998). One evaluation (Palmer et al. 2001) found no statistically significant differences in patient demographics or case mix but did find that the comparison group treated by specialist physicians had fewer patients enrolled in managed care plans ($p < .01$) and more Medicaid patients ($p < .03$).

In many cases, the design of the hospitalist intervention precluded randomization. At some of the hospitals studied, primary care physicians were required to use hospitalists to manage all patients or patients enrolled in a particular HMO. In other cases, physicians chose whether or not to use hospitalists to manage their patients. While such implementation schemes are quite common, they complicate evaluation. Bias may be introduced if the patients of physicians who choose to use hospitalists differ systematically from those of physicians who do not or if patients enrolled in particular HMOs differ systematically from other patients.

The other three groups consisted of evaluations with quasi-experimental designs that used multivariate methods to control for potential confounders. The second strongest group was composed of quasi-experimental evaluations that used concurrent comparison groups and had sample sizes larger than 1,000. The use of concurrent comparison groups permits one to rule out secular trends as an alternate explanation. In addition, the use of large samples increases the

likelihood that the samples are representative of the population to which one seeks to generalize the results and provides greater statistical power to detect differences between the intervention and comparison groups (Gujarati 1995). The third group consists of evaluations that used quasi-experimental designs and concurrent comparison groups but had sample sizes less than 1,000.

The fourth and weakest group encompasses evaluations that used quasi-experimental designs and historical comparison groups. One cannot rule out the possibility that differences found by these evaluations may be due to secular trends rather than hospitalists (Showstack, Katz, and Weber 1999, 380). Controlling for secular trends is particularly important with regard to the impact of hospitalists on length of stay, because the evaluations were completed in the mid- to late 1990s, a time period during which length of stay declined in hospitals throughout the United States.

Only 5 of the 21 evaluations randomly assigned patients to the intervention or control group (Kearns et al. 2001; Meltzer et al. 2002; Palmer et al. 2001; Reddy et al. 2001; Wachter et al. 1998). Five evaluations used quasi-experimental designs and had concurrent comparison groups and sample sizes larger than 1,000 (Auerbach et al. 2002; Davis, et al. 2000; Hackner et al. 2001; Landrigan et al. 2002; Molinari and Short 2001). Six evaluations used quasi-experimental designs and had concurrent comparison groups and sample sizes less than 1,000 (Lindenauer et al. 2002; Rifkin et al. 2002; Smith, Westfall, and Nicholas 2002; Stein et al. 1998; Tingle and Lambert 2001; Wells, Dahl, and Wilson 2001). Five evaluations were quasi-experimental studies that used historical comparison groups (Bellet and Whitaker 2000; Craig et al. 1999; Diamond, Goldberg, and Janosky 1998; Halpert et al. 2000; Ogershok et al. 2001).

Duration of the intervention. The length of time that an intervention is studied is another important characteristic of evaluations. Sixteen of the 21 evaluations collected data on hospitalist physicians for 1 year or less (see Table 1). The longest intervention period was 2 years (Auerbach et al. 2002; Meltzer et al. 2002). Short intervention periods may lead to inaccurate conclusions regarding the impact of hospitalists in the long term. Both of the evaluations that examined hospitalist interventions for 2 years (Auerbach et al. 2002; Meltzer et al. 2002) found statistically significant differences between the intervention and comparison groups in Year 2 but not in Year 1. A study that examined a hospitalist intervention for 21 months found that hospitalists' patients initially had lower costs but that their costs increased over time, albeit at a lower rate than costs for patients in the comparison group (Landrigan et al. 2002).

Characteristics of study settings and populations. We assessed the external validity of the evaluations by examining characteristics of the studies that affect ability to generalize to the population of hospital patients in the United States.

TABLE 2 Characteristics of Study Settings and Populations

Characteristics of Study Setting or Population	*Number of Studies* (N = 21)
Patient care units	
Adult	17 studies[1, 3-8, 10-12, 14-20]
Pediatric	4 studies[2, 9, 13, 21]
Diagnoses	
Multiple diagnoses	16 studies[1-9, 11-14, 19-21]
Single diagnosis	5 studies[10, 15-18]
Patient eligibility for intervention group	
All patients	15 studies[1-2, 4-5, 8, 10-11, 13-16, 18-21]
Patients enrolled in a particular health plan	6 studies[3, 6-7, 9, 12, 17]
Hospital type	
Teaching hospital	16 studies[1-2, 5-11, 13-15, 17-20]
Community hospital	5 studies[3-4, 12, 16, 21]

Note: The numbers in superscript correspond to the numbering of the studies in Table 1 (e.g., [1] refers to Auerbach et al. 2002, [2] refers to Bellet and Whitaker 2000).

This assessment is summarized in Table 2. Seventeen evaluations examined outcomes for adult patients, and 4 evaluations examined outcomes for children. Sixteen evaluations examined outcomes for patients with multiple diseases and conditions. Five evaluations focused on specific diseases or conditions: 4 on pneumonia and 1 on heart failure (Lindenauer et al. 2002; Reddy et al. 2001; Rifkin et al. 2002; Smith, Westfall, and Nicholas, 2002; Stein et al. 1998). Six evaluations examined patients who had a particular type of health insurance. Three evaluations examined commercial HMO enrollees (Craig et al. 1999; Halpert et al. 2000; Molinari and Short 2001), and 1 evaluated Medicaid recipients (Hackner et al. 2001). In 2 cases (Landrigan et al. 2002; Smith, Westfall, and Nicholas 2002), the intervention group was composed of enrollees of a HMO that mandated the use of hospitalists, and the comparison group consisted of patients who had other types of health insurance.

Sixteen of the evaluations were conducted in teaching hospitals, and 5 of the evaluations were conducted in community hospitals. As a consequence, findings from most of these evaluations are more likely to generalize to teaching hospitals than to other hospitals. This limitation is important because only approximately 8 percent of U.S. community hospitals belong to the Council of Teaching Hospitals (American Hospital Association 2004; Association of American Medical Colleges 2004). Results from evaluations of hospitalist interventions in teaching hospitals may not generalize to nonteaching hospitals because standard practices for managing inpatient care differ markedly in teaching and nonteaching hospitals. In nonteaching hospitals, primary care

TABLE 3 Intervention and Control/Comparison Groups by Teaching Status

Control Group or Comparison Group	*Intervention Group*	
	Academic Ward Team Led by Hospitalist Faculty	*Nonacademic Hospitalists*
Academic ward team led by nonhospitalist faculty	10 studies[2, 7-8, 11, 13-15, 17-18, 20]	3 studies[9, 17, 19]
Nonacademic physicians	4 studies[1, 5-6, 18]	5 studies[3-4, 12, 16, 21]

Note: The numbers in superscript correspond to the numbering of the studies in Table 1 (e.g., [1] refers to Auerbach et al. 2002, [2] refers to Bellet and Whitaker 2000). The numbers in the table exceed the number of studies because one study (Smith, Westfall, and Nicholas 2002) examined two types of intervention groups (academic and nonacademic) and because one study (Stein et al. 1998) had two comparison groups (academic and nonacademic). One study (Lindenauer et al. 2002) is excluded from this table because the authors combined data from patients of both academic and nonacademic physicians into a single intervention group and a single comparison group.

physicians have traditionally managed patients on their own, conferring directly with specialists and nurses as needed, whereas in teaching hospitals, faculty physicians have supervised the delivery of care by residents and medical students. Given residents' and medical students' lack of experience, one might expect that hospitalists would have greater impact in teaching hospitals than in nonteaching hospitals because faculty supervision would increase. On the other hand, residents and medical students are available to monitor patients and adjust treatment plans throughout the day, which may reduce the impact of hospitalists in teaching hospitals relative to nonteaching hospitals.

Table 3 illustrates the implications of teaching status for the generalizability of evaluation results. Most of the evaluations were conducted in teaching hospitals, which limits their generalizability to the types of hospitals in which the majority of U.S. hospital patients are treated. Only 5 of the 21 evaluations compared patients who obtained care from nonacademic hospitalists with patients who obtained care from nonacademic primary care physicians. Ten evaluations compared patients treated by academic ward teams led by hospitalist faculty with patients treated by academic ward teams led by nonhospitalist faculty. Four studies compared patients of academic ward teams led by hospitalists with patients of nonacademic physicians. Three studies compared patients of nonacademic hospitalists with patients of academic ward teams led by nonhospitalist faculty.[1]

The evaluations also differed with respect to the nature of the hospitalist intervention. As noted previously, only five evaluations randomly assigned patients to the intervention and control groups (Kearns et al. 2001; Meltzer

et al. 2002; Palmer et al. 2001; Reddy et al. 2001; Wachter et al. 1998). Seven evaluations involved mandatory hospitalist programs instituted by HMOs or academic departments (Diamond, Goldberg, and Janosky 1998; Hackner et al. 2001; Halpert et al. 2000; Landrigan et al. 2002; Molinari and Short 2001; Ogershok et al. 2001). Six evaluations examined voluntary hospitalist programs (Auerbach et al. 2002; Bellet and Whitaker 2000; Davis et al. 2000; Lindenauer et al. 2002; Rifkin et al. 2002; Stein et al. 1998; Wells, Dahl, and Wilson 2001). One evaluation encompassed both a mandatory and a voluntary hospitalist model (Smith, Westfall, and Nicholas 2002). In the only evaluation to encompass multiple hospitals, the nature of the hospitalist intervention varied across hospitals (Craig et al. 1999). One evaluation presented insufficient information to determine whether the hospitalist program was voluntary or mandatory (Tingle and Lambert 2001).

Outcome measures. Tables 4, 5, and 6 display the measures used to evaluate the impact of hospitalists on resource use, quality of care, and satisfaction. All 21 evaluations examined at least one measure of resource use. Twenty-one evaluations compared length of stay, and 20 compared total hospital costs or charges. Ten evaluations compared costs or charges for specific ancillary services, such as hematology, pharmacy, radiology, and respiratory therapy, and 5 evaluations compared the number of ancillary services used. Six evaluations compared the use of specialty consultants. Three evaluations compared use of intensive care units.

There are important limitations to the measures of costs used in most of the evaluations. Some evaluations use data on hospital charges rather than hospital costs. Charges often do not reflect the actual cost of care, because hospitals may negotiate different prices with different insurers. In addition, most evaluations do not include data on physician fees, presumably because they are not captured in hospital administrative databases. The absence of these data prevents evaluators from estimating the total costs of care (Showstack, Katz, and Weber 1999, 379). The lack of data on physician fees may lead to inaccurate inferences about the impact of hospitalists on costs because patients treated by hospitalists may incur higher expenses for physician services.

Twenty of the 21 evaluations assessed at least one measure of quality of care. Nineteen evaluations examined rates of hospital readmission at intervals of 7, 10, 14, or 30 days. Seventeen evaluations compared rates of in-hospital mortality. Other outcomes assessed include postdischarge mortality rate (4 evaluations), self- or parent-reported health status following hospitalization (3 evaluations), disease-specific measures of clinical processes (3 evaluations), and rate of emergency department visits postdischarge (3 evaluations).

(text continues on p. 394)

TABLE 4 Studies with Favorable Findings Regarding Resource Use by Hospitalists by Strength of Research Design

Measure	*Number of Studies Measuring Outcome* (n = 21)	*Randomized Designs* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size > 1,000* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size ≤ 1,000* (n = 6)	*Quasi-Experimental Designs with Historical Comparison Group* (n = 5)
Lower total costs or charges	20	3 of 5 studies	4 of 4 studies	3 of 6 studies[a]	4 of 5 studies[b]
Shorter length of stay	21	3 of 5 studies	5 of 5 studies	4 of 6 studies[a]	3 of 5 studies
Lower costs or charges for ancillary services	10	0 of 2 studies	1 of 2 studies	1 of 3 studies	3 of 3 studies
Lower rate of specialty consultation	6	0 of 1 study	1 of 2 studies	1 of 1 study	0 of 2 studies
Less use of ancillary services	5	1 of 2 studies	1 of 1 study	0 of 1 study	1 of 1 study
Fewer transfers to intensive care unit	3	0 of 1 study	0 of 1 study	0 of 1 study	No studies

Note: This table displays the number of studies by category that found that patients treated by hospitalists used fewer resources than patients of the control or comparison group. Only two studies found that hospitalists' patients used more resources than patients in the control or comparison group. These studies are referenced in the table and discussed below.

a. Smith, Westfall, and Nicholas (2002) found that patients of pulmonologist hospitalists had higher total costs than patients in the comparison group and that patients of both pulmonologist and family physician hospitalists had longer lengths of stay.

b. Craig et al. (1999) found that patients treated by hospitalists had higher total costs.

TABLE 5 Studies with Favorable Findings Regarding Quality of Care Provided by Hospitalists by Strength of Research Design

Measure	*Number of Studies Measuring Outcome* (n = 21)	*Randomized Designs* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size > 1,000* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size ≤ 1,000* (n = 6)	*Quasi-Experimental Designs with Historical Comparison Group* (n = 5)
Lower readmission rate	19	0 of 5 studies	0 of 4 studies	0 of 5 studies	2 of 5 studies[a]
Lower in-hospital mortality rate	17	1 of 5 studies	1 of 4 studies[b]	0 of 5 studies	0 of 3 studies
Lower postdischarge mortality rate	4	1 of 3 studies	1 of 1 study	No studies	No studies
Better self- or parent-reported health status posthospitalization	3	0 of 2 studies	No studies	0 of 1 study[c]	No studies
Better performance on disease-specific measures of clinical processes	3	No studies	No studies	2 of 3 studies[d]	No studies
Lower postdischarge emergency department visit rate	3	0 of 1 study	No studies	0 of 2 studies	No studies

Note: This table displays the number of studies by category that found patients treated by hospitalists received a higher quality of care than patients in the control or comparison group. Only four studies found that hospitalists provided worse quality of care. These studies are referenced in the table and discussed below.

a. Bellet and Whitaker (2000) found that patients treated by hospitalists had a higher rate of readmission within 10 days of discharge.

b. Davis et al. (2000) found that hospitalists' patients who had pneumonia without comorbidities had a higher in-hospital mortality rate.

c. Wells, Dahl, and Wilson (2001) found that parents of children treated by hospitalists had more concerns about allergies and eating habits.

d. Rifkin et al. (2002) found that patients treated by hospitalists were more likely to have at least one unstable clinical parameter at discharge, most often systolic blood pressure lower than 100 mm.

TABLE 6 Studies with Favorable Findings Regarding Patient or Parent Satisfaction with Care Provided by Hospitalists by Strength of Research Design

Measure	*Number of Studies Measuring Outcome* (n = 21)	*Randomized Designs* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size > 1,000* (n = 5)	*Quasi-Experimental Designs with Concurrent Comparison Group and Sample Size ≤ 1,000* (n = 6)	*Quasi-Experimental Designs with Historical Comparison Group* (n = 5)
Higher satisfaction among patients or families	7	0 of 3 studies	1 of 2 studies	1 of 1 study	0 of 1 study
Higher satisfaction among physicians, residents, and/or medical students	5	1 of 3 studies	No studies	No studies	1 of 2 studies

Note: No studies found that patients, families, physicians, residents, or medical students were less satisfied with hospitalists.

The use of measures of readmission and in-hospital mortality is understandable, because data for these variables can be obtained from hospital records. However, large sample sizes are often required to detect differences between intervention and control/comparison groups because these are dichotomous measures of rare events. In contrast, continuous data on costs or charges and length of stay are usually available for all patients. Thus, evaluations that have sufficient power to uncover differences in resource use may not have sufficient power to discern differences in these measures of quality of care (Andrew Auerbach, M.D., personal communication, April 11, 2003).

The strength of the evidence regarding hospitalists' impact on satisfaction is limited because few evaluations examined satisfaction. Seven evaluations compared patients' or parents' (in the case of pediatric patients) satisfaction with care delivered by hospitalists and nonhospitalists. Five evaluations examined the satisfaction of physicians, residents, and/or medical students. Satisfaction was typically measured using Likert-type scale instruments.

Data sources. Most evaluations obtained data on resource use and quality-of-care indicators from hospital administrative databases. Four evaluations obtained additional administrative data on mortality from state vital statistics and Social Security databases (Auerbach et al. 2002; Kearns et al. 2001; Meltzer et al. 2002; Wachter et al. 1998). Chart reviews were conducted for four evaluations because the authors believed this method provided more accurate information regarding length of stay, use of resources, and clinical outcomes (Lindenauer et al. 2002; Rifkin et al. 2002; Smith, Westfall, and Nicholas 2002; Wells, Dahl, and Wilson 2001). Data on patient or parent satisfaction were obtained from written surveys administered to patients or parents during hospitalization and from telephone surveys administered posthospitalization. Faculty, resident, and medical student satisfaction were assessed through written surveys.

FINDINGS FROM EVALUATIONS

In this section, we summarize the findings of the 21 evaluations. We emphasize findings from the five evaluations that randomized subjects. All differences reported were statistically significant at $p = .05$. In general, the evaluations indicate that hospitalists reduce resource use but do not affect quality of care or patient, family, or provider satisfaction.

Resource use outcomes. Findings regarding resource use are displayed in Table 4. Three of the five evaluations that randomized patients and 11 of the 15 quasi-experimental evaluations found that patients treated by hospitalists had lower hospital costs or charges than patients in the control or comparison

group (Auerbach et al. 2002; Bellet and Whitaker 2000; Davis et al. 2000; Diamond, Goldberg, and Janosky 1998; Hackner et al. 2001; Halpert et al. 2000; Landrigan et al. 2002; Meltzer et al. 2002; Ogershok et al. 2001; Palmer et al. 2001; Rifkin et al. 2002; Stein et al. 1998; Wachter et al. 1998; Wells, Dahl, and Wilson 2001). Ten of the evaluations that found that hospitalists' patients had lower costs or charges—3 with randomized designs and 7 with quasi-experimental designs—contained sufficient data to estimate mean differences in costs or charges. We calculated the weighted mean using sample size as the weight to give greater weight to evaluations with large samples. The differences in costs or charges ranged from 5 percent to 44 percent, with a weighted mean of 14 percent. Evaluations with randomized designs reported smaller effects on average than quasi-experimental evaluations, suggesting that a portion of the reduction in resource use reported in the quasi-experimental evaluations may be due to unmeasured differences between the intervention and comparison groups. Four evaluations found no difference in total hospital costs or charges (Kearns et al. 2001; Lindenauer et al. 2002; Reddy et al. 2001; Tingle and Lambert 2001). Two evaluations found that patients who received care from hospitalists had higher total costs than patients who received care from community-based primary care physicians (Craig et al. 1999; Smith, Westfall, and Nicholas 2002).

Reductions in resource use may be achieved by increasing throughput (e.g., reducing length of stay) or by decreasing service intensity (e.g., using fewer ancillary services and specialty consultations). Findings from these evaluations indicate that hospitalists reduce resource use primarily by increasing throughput. Three of the five evaluations with randomized designs and 12 of the 16 quasi-experimental evaluations found that patients treated by hospitalists had shorter lengths of stay (Auerbach et al. 2002; Bellet and Whitaker 2000; Davis et al. 2000; Diamond, Goldberg, and Janosky 1998; Hackner et al. 2001; Halpert et al. 2000; Landrigan et al. 2002; Lindenauer et al. 2002; Meltzer et al. 2002; Molinari and Short 2001; Palmer et al. 2001; Rifkin et al. 2002; Stein et al. 1998; Wachter et al. 1998; Wells, Dahl, and Wilson 2001). Eleven of the evaluations that found that hospitalists' patients had shorter length of stay—3 with randomized designs and 8 with quasi-experimental designs—reported sufficient data to estimate mean differences in length of stay for the intervention and comparison groups. The difference in length of stay ranged from 7 percent to 33 percent, with a weighted mean of 12 percent. Evaluations with randomized designs typically reported smaller effects. Five evaluations found no statistically significant difference in length of stay (Craig et al. 1999; Kearns et al. 2001; Ogershok et al. 2001; Reddy et al. 2001; Tingle and Lambert 2001). One evaluation found that patients who obtained care from hospitalists had longer lengths of stay than patients whose care was provided by community-based physicians (Smith, Westfall, and Nicholas 2002).

In contrast to the largely positive findings regarding length of stay, most evaluations suggest that hospitalists do not reduce costs or charges for ancillary services. Ten evaluations examined costs or charges for ancillary services. Neither of the 2 evaluations that randomized patients found statistically significant differences in costs or charges for ancillary services (Kearns et al. 2001; Reddy et al. 2001), and only 2 of the 5 quasi-experimental evaluations that used concurrent comparison groups found that hospitalists' patients had lower costs or charges for ancillary services (Hackner et al. 2001; Wells, Dahl, and Wilson 2001). All three quasi-experimental studies that used historical controls found that hospitalists' patients had lower costs or charges for ancillary services (Bellet and Whitaker 2000; Diamond, Goldberg, and Janosky 1998; Ogershok et al. 2001), but these differences may have been due to secular trends in costs and charges for ancillary services. Similarly, only 3 of the 5 evaluations that measured use of ancillary services found that hospitalists' patients used fewer of these services (Davis et al. 2000; Ogershok et al. 2001; Palmer et al. 2001).

Less evidence is available regarding the use of specialty consultations and intensive care units. Only five evaluations assessed specialty consultations, and only three examined transfers to intensive care units. None of the evaluations that randomized patients found statistically significant differences in these measures.

What might explain why two of the five evaluations with experimental designs did not find statistically significant differences in resource use? In one case (Reddy et al. 2001), the lack of difference in costs/charges or length of stay may be due to simultaneous implementation of a clinical practice guideline for treatment of pneumonia. Use of the guideline may have reduced differences in the manner in which hospitalist and nonhospitalist physicians managed patients with pneumonia. In fact, the purpose of the evaluation was to assess whether practice guidelines are a viable alternative to hospitalists. The results suggest that for common diagnoses, implementation of clinical guidelines may achieve results similar to those of hospitalists with less disruption of existing care management practices.

The reasons why Kearns and colleagues (2001) did not detect differences in resource use are less clear. The authors suggest that differences between their findings and those of Wachter and colleagues (1998) may be due to differences in the characteristics of the physicians who managed patients in the control groups. In Kearns and colleagues' (2001) study, the control group consisted of patients of full-time clinical faculty, whereas in Wachter and colleagues' study (1998), the control group was composed of patients of faculty who were primarily engaged in research. Kearns and colleagues (2001) may not have found that hospitalists reduced resource use, because the clinical faculty who man-

aged patients in the control group may have been more interested in patient care and more attuned to cost-effectiveness concerns than the research faculty studied by Wachter and colleagues (1998).

Other possible explanations concern differences in access to discharge planning services, differences in physician age, and differences in the length of the intervention period. Kearns and colleagues' (2001) design eliminates an alternate explanation for Palmer and colleagues' (2001) findings. In the latter evaluation, the hospitalist ward team included a nurse discharge planner, but the traditional ward teams that provided care to patients in the comparison groups did not. The authors' findings that patients in the intervention group had lower costs and shorter length of stay may have been due to the use of nurse discharge planners rather than to the use of hospitalists. Kearns and colleagues (2001) could rule out this explanation because patients in their intervention and control groups had similar access to discharge planning services.

Kearns and colleagues' (2001) results may also reflect the lack of age differences between the physicians who managed patients in the intervention and control groups. The differences detected by Meltzer and colleagues (2002), Palmer and colleagues (2001), and Wachter and colleagues (1998) may have been due to age differences between physicians managing patients in the intervention and control groups. In those three studies, the hospitalists were younger than the physicians who managed patients in the control groups. Having come of age in an era of cost containment, younger physicians may practice in a more cost-effective manner than their older colleagues regardless of whether they function as hospitalists. Kearns and colleagues (2001) may not have detected differences in resource use because the physicians who furnished care to the intervention and control groups were more similar in age.

However, one should not necessarily infer that Kearns and colleagues' (2001) findings are more accurate because they eliminated several potential confounders. Their finding that hospitalists do not affect resource use may be due to the duration of the intervention period. Kearns and colleagues (2001) only studied the hospitalist intervention for 1 year. Meltzer and colleagues' (2002) findings suggest that the full impact of hospitalists may not be apparent during the 1st year of the intervention. Their 2-year study found no statistically significant differences in total costs and length of stay during the 1st year but did find statistically significant differences during the 2nd year. This explanation seems especially plausible in cases such as Kearns and colleagues (2001), because the lack of differences in age and commitment to patient care may have resulted in fewer differences in practice patterns at baseline.

Findings regarding hospitalists' impact on resource use were generally consistent regardless of whether patients in the intervention or control/comparison group obtained care from academic or nonacademic physicians,

with the exception of evaluations that compared nonacademic hospitalists to traditional academic ward teams. These evaluations were less likely to detect statistically significant differences in resource use, perhaps because the differences between the intervention and customary care may be more difficult to isolate. Non-academic hospitalists and traditional academic ward teams are similar in that physicians in both groups are in the hospital all day. Although the residents on traditional academic ward teams are less experienced than nonacademic hospitalists, they may have been able to monitor patients as closely as nonacademic hospitalists and act as quickly to obtain diagnostic and therapeutic services. In contrast, evaluations that compare hospitalist-led ward teams with traditional ward teams can better isolate the effects of hospitalists from the effects of residents, because residents are part of the patient care teams for both the intervention and control groups.

The results of five evaluations that compare patients of nonacademic hospitalists with patients of office-based physicians (Craig et al. 1999; Davis et al. 2000; Molinari and Short 2001; Rifkin et al. 2002; Wells, Dahl, and Wilson 2001) should also be interpreted with caution because their research designs are relatively weak. None of these evaluations randomize patients, and only two had concurrent comparison groups and large sample sizes. Moreover, the generalizability of the results is limited because patients in the hospitals studied may not be representative of patients hospitalized in community hospitals. With one exception, the evaluations examined hospitals in urban areas. The one rural hospital studied (Davis et al. 2000) was unusually large and probably treated patients with a wider range of diseases and levels of severity than a typical rural hospital. One evaluation (Craig et al. 1999) examined patients in hospitals that provided services exclusively to members of a large, group model HMO who may have differed systematically from the universe of hospitalized patients.

Findings regarding resource use were consistent for evaluations involving mandatory and voluntary hospitalist interventions and for those that examined adult and pediatric patients. Some evaluations found that the impact of hospitalists on resource use varied with patient age, disease, and disease severity (Bellet and Whitaker 2000; Davis et al. 2000; Diamond, Goldberg, and Janosky 1998; Hackner et al. 2001; Wells, Dahl, and Wilson 2001). However, conclusions regarding variation in the impact of hospitalists on patients with different characteristics are tenuous because subgroup analyses were not consistent across the evaluations.

Quality of care. Hospitalists appear to have less impact on quality of care than on resource use. As Table 5 illustrates, none of the five evaluations with

randomized designs detected statistically significant differences in readmission rates, and only one of the five found that hospitalists' patients had a lower in-hospital mortality rate (Palmer et al. 2001). Most quasi-experimental evaluations also failed to detect differences in these indicators. Only two of the quasi-experimental studies found that patients treated by hospitalists had lower readmission rates (Bellet and Whitaker 2000; Diamond, Goldberg, and Janosky 1998), and only one found that patients treated by hospitalists had lower in-hospital mortality (Auerbach et al. 2002).

Evidence regarding other indicators of quality of care is less persuasive because they were assessed in only a small number of evaluations. Two of the four evaluations that examined postdischarge mortality rates found that hospitalists' patients had lower rates (Auerbach et al. 2002; Meltzer et al. 2002). None of the three evaluations that measured self or parent-reported health status following hospitalization found statistically significant differences, nor did any of the three evaluations that measured postdischarge emergency room use. Two of the three evaluations that examined disease-specific measures of clinical processes found statistically significant differences that favored hospitalists. Lindenauer and colleagues' (2002) found that patients with heart failure who received their care from hospitalists were more likely to have had left ventricular ejection fraction tests, which provide physicians with important information about patients' conditions. Rifkin and colleagues (2002) found that hospitalists switched patients with pneumonia from intravenous to oral antibiotics more promptly once the patient's condition warranted switching, which facilitated more rapid discharge. However, the results of these evaluations may reflect unobserved differences between patients in the intervention and comparison groups because patients were not randomized.

A few of the evaluations found differences in quality of care that were not favorable to hospitalists. Bellet and Whitaker (2000) reported that patients treated by hospitalists had a higher rate of readmission within 10 days of discharge. Davis and colleagues (2000) found that hospitalists' patients who had pneumonia without comorbidities had a higher in-hospital mortality rate but found no differences for patients with other diagnoses. In Rifkin and colleagues' (2002) evaluation, patients treated by hospitalists were more likely to have one unstable clinical indicator at discharge, most often low blood pressure. Finally, Wells, Dahl, and Wilson (2001) found that parents of children treated by hospitalists had more concerns about allergies and eating habits. However, none of these evaluations randomized patients, so it is possible that the differences observed reflect unmeasured differences in patient characteristics rather than differences in the quality of care provided by hospitalist and nonhospitalist physicians.

Satisfaction outcomes. The evidence regarding the impact of hospitalists on satisfaction is more tenuous than the evidence of their impact on resource use and quality of care because only seven evaluations examined patient or family satisfaction, and only five examined provider satisfaction. None of the four evaluations of patient satisfaction found statistically significant differences in satisfaction with inpatient care (see Table 6). Two of the three evaluations that assessed parents' satisfaction with care provided to their children found that parents were more satisfied with some aspects of care provided by hospitalist physicians (Landrigan et al. 2002; Wells, Dahl, and Wilson 2001)). The third evaluation found no statistically significant difference in parents' satisfaction.

With regard to provider satisfaction, two of the four evaluations that assessed the satisfaction of residents and medical students found that they rated their educational experiences on ward teams led by hospitalist faculty more highly than their experiences on ward teams lead by nonhospitalist faculty (Halpert et al. 2000; Kearns et al. 2001). The two evaluations that assessed physician satisfaction found no statistically significant differences in satisfaction with a hospitalist ward team and a traditional ward team (Ogershok et al. 2001; Wachter et al. 1998). No evaluations assessed the satisfaction of office-based physicians.

DISCUSSION AND CONCLUSION

SUMMARY OF FINDINGS

These evaluations constitute an important first stage of research on hospitalist programs. However, they have some important methodological limitations. Few evaluations randomly assigned patients to intervention and control groups. Despite the use of multivariate methods to control for potential confounders, the results of quasi-experiments may reflect unobserved differences between the treatment and control groups. In addition, little is known about the long-term impact of hospitalists because most evaluations analyzed data on hospitalists' performance for 1 year or less. Finally, conclusions about the effects of hospitalists on resource use are limited by the lack of data on physician fees.

Despite these important limitations, the findings from the 21 evaluations of hospitalist programs suggest that using hospitalists can reduce the cost of inpatient care. Savings are achieved primarily by increasing throughput rather than by reducing intensity of service. These savings do not appear to be at the expense of quality or satisfaction. Most evaluations found that hospi-

talists' patients had clinical outcomes that were as good as, or better than, those of patients in the comparison group. Evaluations that addressed satisfaction found that patients and parents were at least as satisfied with care furnished by hospitalists and that residents and medical students were at least as satisfied with training provided by hospitalist and nonhospitalist faculty. Findings were generally consistent across patient populations and diagnoses. Evaluations of teaching and nonteaching hospitals yielded similar findings, although weaker research designs reduce the strength of inferences that can be drawn from evaluations of nonteaching hospitals.

For the most part, findings from evaluations that used randomized designs were similar to findings from evaluations that used quasi-experimental designs. However, two of the evaluations that randomized patients did not find statistically significant differences in resource use between the intervention and control groups. The favorable findings of three of the evaluations that used randomized designs may be due to differences between the intervention and control group other than the use of hospitalists, such as differences in access to discharge planning, physician age, and physician interest and experience in patient care. On the other hand, it seems equally plausible that the lack of statistically significant findings in the other two evaluations with randomized designs may reflect the presence of a confounding intervention or the short duration of the study.

IMPLICATIONS FOR PRACTITIONERS

The complexities of hospital reimbursement make it difficult to assess the implications of these evaluations for managers of hospitals and medical groups. The impact of hospitalists on a hospital's financial performance varies with the forms of payment the hospital receives (Gregory, Baigelman, and Wilson 2003). Hospitals that are paid primarily on a capitated or prospective basis (e.g., Medicare Prospective Payment System) probably would benefit from using hospitalists because such hospitals maximize revenue by reducing length of stay. On the other hand, hospitalists probably would not improve the financial performance of hospitals that are paid primarily on a per diem or fee-for-service basis because reducing length of stay would reduce their revenue. Similarly, hospitalists may yield greater financial benefits for medical groups that are capitated for hospital care than for medical groups that are paid primarily on a fee-for-service basis. The benefits of hospitalists may also vary with occupancy rates, bed capacity, average length of stay, and demand for inpatient care (Gregory, Baigelman, and Wilson 2003).

AGENDA FOR FURTHER RESEARCH

Further study is needed to determine whether a quality-of-care case can be made for hospitalists that would transcend the ambiguous business case. To date, most evaluations of hospitalists have not found statistically significant differences in the quality of care provided to patients who receive care from hospitalists and patients in comparison groups. As noted previously, the lack of difference in quality of care may reflect the outcome measures analyzed. Most evaluations of hospitalist programs assessed relatively rare events such as in-hospital mortality and hospital readmission. The samples analyzed may not be large enough to detect differences in the rates at which rare events occur. These measures are also imprecise indicators of the quality of care patients receive. Researchers are likely to gain greater insights from assessments of disease-specific indicators of quality of care, such as those analyzed by Lindenauer and colleagues (2002) and Rifkin and colleagues (2002).

Additional opportunities for further research include comparison of different hospitalist models and comparison of hospitalists to other strategies for controlling costs or improving quality. To date, only one evaluation (Smith, Westfall, and Nicholas 2002) has compared two different hospitalist models. This evaluation compared two hospitalist models—one using nonfaculty pulmonologists and one using family physician faculty and residents—with one another and to community-based primary care physicians. The evaluation found that the family physician hospitalists had lower total costs than the pulmonologist hospitalists. However, small sample size and lack of randomization render these conclusions tenuous. Other useful comparisons would include comparison of rotation and dedicated hospitalist models, as well as comparison of faculty-led hospitalist teams and nonfaculty hospitalists in the same specialty. Evaluators might also follow Reddy and colleagues' lead (2001) and compare hospitalist interventions with less costly interventions such as the use of clinical practice guidelines or nonphysician case managers.

Further research could also shed light on the reasons why hospitalists practice more efficiently. Only two evaluations systematically assessed a theory of action (Meltzer et al. 2002; Wachter et al. 1998). Both evaluations tested the theory that hospitalists practice more efficiently because they have more experience providing inpatient care. Wachter and colleagues (1998) found that hospital costs and length of stay did not vary with the number of years a physician attended in the hospital or the number of months a physician attended per year. In contrast, Meltzer and colleagues (2002) reported that outcomes varied with physicians' cumulative experience in providing inpatient care to patients with particular diseases or conditions. Their evaluation found that hospitalist faculty had significantly more experience with treatment of particular dis-

eases and conditions than nonhospitalist faculty. When the experience variable was included in multivariate analyses, the independent effect of hospitalist status disappeared, suggesting that disease-specific experience is a mechanism by which hospitalists improve cost-effectiveness.

Testing additional theories of action would enhance understanding of the mechanisms by which hospitals enhance the efficiency and quality of inpatient care. Evaluators have suggested other possible theories of action but have not tested them. Some have hypothesized that hospitalists are more efficient because they can monitor patients more frequently and adjust treatment plans more promptly in response to changes in patients' conditions. Hospitalists may also develop closer relationships with hospital staff and a better understanding of formal and informal hospital procedures (Andrew Auerbach, M.D., personal communication, April 11, 2003; and Jonathan Showstack, Ph.D., personal communication, March 20, 2003). In addition, some have speculated that hospitalists have a different style of practice from nonhospitalist physicians because they are younger. The mean age of respondents to a 1999 survey of physicians belonging to the National Association of Inpatient Physicians was 40.2 years, and approximately 60 percent had completed residency after 1989 (Hoff et al. 2001). Younger physicians may be more attuned to cost-effectiveness and may have more up-to-date knowledge regarding diagnostic and treatment options.

In summary, hospitalists are an important innovation in the delivery of inpatient care. They appear to reduce costs without compromising quality or satisfaction. Further research would assist health plans, hospitals, and medical groups in determining which types of hospitalist interventions are most effective and which patients are most likely to benefit from this innovation. Additional research would also enhance knowledge of the characteristics of hospitalists that enable them to reduce resource use. Researchers should use the strongest feasible research designs to maximize their ability to draw causal inferences regarding the impact of hospitalists. In addition, more studies of nonteaching hospitalists are needed to improve the generalizability of findings to the settings in which most persons in the United States are hospitalized.

NOTE

1. The number of evaluations described in this paragraph exceeds the total number of evaluations analyzed because one evaluation (Smith, Westfall, and Nicholas 2002) had two types of intervention groups, and one evaluation (Stein et al. 1998) had two types of comparison groups. A third evaluation (Lindenauer et al. 2002) could not be classified using this typology because the authors combined data from patients of academic and nonacademic physicians.

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