Early Mobilization of Patients Hospitalized With Community-Acquired Pneumonia

Linda M. Mundy, Terry L. Leet, Kate Darst, Mark A. Schnitzler and William Claiborne Dunagan

Chest 2003;124;883-889
DOI: 10.1378/chest.124.3.883

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Linda M. Mundy, MD; Terry L. Leet, PhD; Kate Darst, RN; Mark A. Schnitzler, PhD; and Wm Claiborne Dunagan, MD

Study objective: **To determine if early mobilization (EM) of hospitalized adults with community-acquired pneumonia (CAP) reduces hospital length of stay.**
Design: **Group randomized trial.**
Setting: **Three Midwestern hospitals.**
Participants: **Four hundred fifty-eight patients with CAP admitted to 17 general medical units between November 1997 and April 1998.**
Intervention: **EM was defined as sitting out of bed or ambulating for at least 20 min during the first 24 h of hospitalization. Progressive mobilization occurred each subsequent day during hospitalization.**
Measurements and results: **Intervention (n = 227) and usual-care patients (n = 231) were similar in age, gender, disease severity, door-to-drug delivery time, and IV-to-po switchover time. Hospital length of stay for EM vs usual care was significantly less (mean, 5.8 vs 6.9 days; adjusted absolute difference, 1.1 days; 95% confidence interval, 0.0 to 2.2 days). There were no differences in adverse events or other secondary outcomes between treatment groups.**
Conclusions: **Like patients hospitalized with acute myocardial infarction and total knee replacements, EM of hospitalized patients with CAP reduces overall hospital length of stay and institutional resources without increasing the risk of adverse outcomes.**
(CHEST 2003; 124:883–889)

Key words: community-acquired pneumonia; improvement; mobilization

Abbreviations: CAP = community-acquired pneumonia; CI = confidence interval; EM = early mobilization; PORT = Patient Outcomes Research Trial; PSI = pneumonia severity index; SF-12 = Rand Health Status Questionnaire Short Form-12

Community-acquired pneumonia (CAP) is common and costly. There are more than four million cases of CAP per year in the United States, of which 15% require hospitalization.[1] In 1996, total costs for inpatient care were $4 billion.[2] Efforts to improve the efficiency for treating patients with CAP have focused predominantly on improved triage decisions,[3] identification of low-risk patients for outpatient care,[3] reduction in delivery time of antimicrobial agents,[4] earlier transition from IV to oral therapy,[5,6] and more judicious use of antimicrobial therapy.[7]

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Clinical practice guidelines for CAP were recently published by the Infectious Diseases Society of America[8] and the American Thoracic Society,[9] providing an evidence-based approach to the evaluation and management of immunocompetent hosts with CAP. Therapeutic recommendations beyond antimicrobial drug regimens proven to enhance health outcomes for patients with CAP may augment such guidelines.

Early mobilization (EM) of patients has been

*From the Division of Infectious Diseases (Drs. Mundy and Dunagan), Washington University School of Medicine; Department of Community Health (Drs. Mundy and Leet), Saint Louis University School of Public Health; Center for Healthcare Quality and Effectiveness (Ms. Darst), BJC Health System; and Health Administration Program (Dr. Schnitzler), Washington University School of Medicine, St. Louis, MO.
This project was funded by the Innovations for Healthcare Program of the Center for Healthcare Quality and Effectiveness, BJC Health System, St. Louis, MO.
Manuscript received September 10, 2002; revision accepted February 4, 2003.

Correspondence to: Linda M. Mundy, MD, Washington University School of Medicine, Division of Infectious Diseases, 660 South Euclid, Campus Box 8051, St. Louis, MO 63110; e-mail: lmundy@im.wustl.edu

shown to be a simple and effective therapeutic intervention that improves the health outcomes among patients with myocardial infarction and those undergoing total knee replacements.[10,11] Although the mechanism by which mobilization contributes to shortened length of stay is unknown, the rationale for EM of patients with CAP may be biologically plausible. In mobilization from horizontal to upright position, there may be improvement in aeration and/or blood flow redistribution with optimized drug delivery to the site of injury, reduced risk of aspiration, and maintenance of functional health status. Alternatively, perhaps EM simply convinces the patient and physician that the patient has clinically improved enough for discharge.

Since the effectiveness of EM has not been measured for patients with CAP, we conducted a group randomized trial to determine whether EM of patients with CAP during the first day of hospitalization and progressive mobilization each subsequent day safely shortens length of stay, along with assessment to ensure no increase in adverse events from this intervention.

Materials and Methods

Protocol

The study population included patients with CAP admitted to three hospitals in St. Louis, MO from November 17, 1997, through April 30, 1998. Inclusion criteria were ≥ 18 years old, new infiltrate on chest radiograph (compared with old radiographs if available), and either one major criteria (cough, sputum production, or temperature > 37.8°C) or two minor criteria (pleuritic chest pain, dyspnea, altered mental status, pulmonary consolidation on examination, or leukocyte count > 12,000/μL).[12,13] Exclusion criteria included hospitalization within the prior 2 weeks, diagnosis of large-volume aspiration pneumonia,[13] admission to an ICU or nonstudy floor, or transfer to an ICU within 7 days of admission. The study was approved at site 1 by the Human Studies Committee, Washington University Medical Center, and the institutional review boards at site 2 and site 3.

The three hospitals participating in the study were part of the BJC Health System, an integrated health-care system for residents primarily from eastern Missouri and southern Illinois. Site 1 was Barnes-Jewish Hospital, an urban, tertiary referral hospital licensed for 1,287 beds and the principal teaching hospital for Washington University School of Medicine. Patients, house staff, and physicians were randomly assigned to medical firms. Site 2 was Christian Hospital Northeast, a community hospital licensed for 475 beds that serves a suburban population, including several large nursing homes. Site 3 was Missouri Baptist Medical Center, a community hospital licensed for 494 beds that serves a suburban population.

The study intervention was EM of hospitalized patients with CAP. As part of the study protocol, EM was defined as movement out of bed with change from horizontal to upright position for at least 20 min during the first 24 h of hospitalization, with progressive movement each subsequent day during hospitalization. Patient movement to an upright position in bed for meals or to a commode for toileting was not considered adequate for EM. A group randomized trial was used to control confounding bias by randomly allocating medical units with patients with CAP to the intervention and usual-care groups. Implementing a randomized controlled trial for this patient population would have been very difficult. If the unit of randomization had been the patient instead of the medical unit, a nurse caring for two patients with CAP on a given unit, or in the same room on a given day, may have been asked to encourage EM for one patient and not the other. Hence, a group randomized trial is the preferred study design when allocation of identifiable groups is required.[14] As this was a research protocol, this intervention was not part of a specific written clinical pathway, and EM was categorized as a dichotomous variable. If a patient on an intervention unit was prescribed bed rest, the nurse caring for the patient called the ordering physician for permission to advance the patient's activity level to "out of bed as tolerated." All nurses in the intervention units received a 30-min training session regarding the study protocol from the head nurse. The script for the intervention unit nurses when interacting with patients with CAP was "Even though you have just been admitted with pneumonia, I would like to help you get out of bed today. We think this may improve your recovery."

Trained case managers abstracted demographic and clinical variables from medical records. Abstracted variables included the participant's age, gender, hospital admission source, comorbidities, physical examination, and laboratory test results to measure the Patient Outcomes Research Trial (PORT) pneumonia prediction rule for mortality.[3] Administration and timing of antimicrobial therapy were recorded. Door-to-drug delivery time was defined as the elapsed time from initial sign-in to the emergency department or admitting office to receipt of the first dose of antimicrobial therapy. IV-to-po therapy switchover time was defined as the elapsed time from first IV to first oral therapy. Participants were interviewed by a trained interviewer between hospital day 2 and day 4. There were two interviewers for the 5-month study period who were trained by a health behaviorist with expertise in survey implementation who then observed the first 10 interviews by each interviewer. Interviewer A worked at sites 1 and 3, while interviewer B worked at site 2. The interviewers assessed functional health status using the Rand Health Status Questionnaire Short Form-12 (SF-12)[15] and pneumonia-specific symptom scale[16] at 30 days prior to symptom development (baseline) and pneumonia nadir. The SF-12 provided physical and mental component summary scores for comparison with the pneumonia-specific symptom scale, which focused on the percentages of patients with CAP reporting sputum production, cough, dyspnea, pleuritic chest pain, and fatigue. The primary outcome (hospital length of stay) and secondary outcomes (mortality rate, number of chest radiographs, emergency department visits, and re-admissions at 30 days and 90 days after hospital admission) were confirmed from the BJC Health System medical informatics database and national databases containing vital status information (Choice Point; Vienna, VA). Charge data were obtained from the BJC Health System medical billing system for hospital care and all re-admissions within 90 days at each site. Charge data were adjusted for costs using site-specific conversion ratios. A subset evaluation of cost distributions was performed at site 1, with resource allocations grouped into costs for laboratory, pharmacy, radiology, respiratory, emergency, and total care.

A pilot study was conducted from July 7, 1996, through March 31, 1997, at site 1 to assess several potential quality improvement indicators for care given to patients with CAP.[17] Process indicators that were assessed were time from emergency department triage to hospital discharge, physician orders, time to receipt of first antibiotic, location of first antibiotic delivery (emergency department vs medical unit), EM, oxygen utilization and weaning

times, preantibiotic expectorated sputum procurement, and social worker interventions. The pilot study data revealed a trend in reduction in hospital length of stay (5.2 days vs 6.3 days, $p = 0.20$) for patients with CAP randomized to the medical unit promoting EM ($n = 36$) vs two units providing usual care ($n = 91$). Based on the pilot data obtained at site 1, a minimum sample size of 360 patients (180 patients in each study arm) was estimated to detect a 1-day reduction in hospital length of stay for patients with CAP undergoing EM. Recruitment was therefore targeted for 442 patients to allow for an estimated 20% loss to follow-up.

Since medical units at the three hospitals were the unit of assignment for the study intervention, a mixed-model analysis of variance was used.[14,18] Comparisons were made for mean hospital length of stay and log odds of secondary outcomes (mortality, follow-up emergency department visits, chest radiographs, and re-admissions) for patients in the intervention and usual-care groups by intention to treat. The mixed model included fixed main effect (intervention, predicted risk of pneumonia severity,[3] door-to-drug delivery time[17,19]), and random main effect (medical unit) terms. Intervention/covariate interaction terms were considered in the model to assess for possible effect modification. The precision of the estimated difference in hospital length of stay for the two treatment groups was determined using 95% confidence intervals (CIs). All analyses were conducted using the MIXED procedure and GLIMMIX macro in SAS for Windows, version 6.12 (SAS Institute; Cary, NC).

Assignment

As a group randomized trial, specific medical units at each hospital were assigned to the intervention or usual-care group. Before assignment, we assessed all units that were assigned patients with CAP at each hospital during the 18-month period prior to the study to determine CAP volume per unit. Using International Classification of Diseases, Ninth Revision, Clinical Modification diagnostic codes to identify patients with CAP, we found no differences in age, gender or hospital length of stay for patients admitted to the medical units within each site (data not shown). At site 1, the medical firm that was randomized originally to the intervention group in the pilot study was maintained as an intervention unit for this study. In addition, one of the three remaining medical firms and one of three nonfirm units were randomly selected as intervention units. At site 2, one of two larger medical units among seven units with patients with CAP was randomly selected as an intervention unit. At site 3, one of three medical units was randomly assigned to the intervention group. The remaining medical units that provided care for patients with CAP at each hospital were assigned to the usual-care group. In total, there were 5 medical units and 12 medical units assigned to the intervention and usual-care groups, respectively.

Patients with CAP were admitted to the medical units at each hospital based on bed availability. Nurse managers for the units comprising the intervention group were responsible for emphasizing the role of EM for patients with CAP to the nursing staff, who in turn were responsible for encouraging patients with CAP to attempt EM. Nurse managers and staffs for the units representing the usual-care group were not informed of the intervention, and staffs on the intervention units were asked not to discuss the study intervention with other health professionals or hospital personnel.

Masking

Patients with CAP assigned to both groups consented to 90-day follow-up posthospital admission. Patients with CAP assigned to the intervention group were told that EM might improve their chances for quicker recuperation, but were not further informed about the nature of the study. Although nurses in the intervention group were encouraged to promote EM of patients with CAP on their units, some nurse-patient interactions may have prevented EM from occurring. Compliance with EM recommendations was recorded. Physicians and other nonnursing staff members who interacted with patients with CAP were not informed of the study. The interviewers were not informed of the randomization status of the units or patients.

Results

Patients

Four hundred fifty-eight of 711 patients (64%) hospitalized with CAP were included in the study. Patient exclusions were hospitalization within 2 weeks of the current hospital admission ($n = 190$), diagnosis with large-volume aspiration pneumonia ($n = 31$), admission or transfer to an ICU ($n = 17$), or assignment to a nonstudy hospital unit ($n = 15$). Of the 458 patients enrolled, 428 patients (93%) met the major criteria and 30 patients (7%) met the minor criteria for definitive or presumptive CAP. Two hundred twenty-seven patients were assigned to the intervention group, and 231 patients were assigned to the usual-care group. Patients in the two treatment groups were similar in age, gender, disease severity, and host immune status (Table 1). Notably, 25% of patients were < 50 years of age, 25% were > 80 years of age, and approximately 25% had serum albumin levels below 3.5 g/dL. These patient characteristics, along with door-to-drug delivery time, did not differ for the two treatment groups.

Three hundred seventy patients received their first antimicrobial dosage within 8 h, with a mean length of stay of 5.9 days for the intervention group and 6.9 days for the usual-care group (adjusted absolute difference, 1.0 days; 95% CI, -0.2 to 2.2). Sixty-two patients received their first dose of antimicrobial therapy after 8 h, with mean length of stay of 5.7 days and 6.9 days for the intervention and usual-care groups, respectively. The remaining 26 patients received an antimicrobial agent prior to admission to hospital.

Interviews for prepneumonia and baseline functional health status using the SF-12 questionnaire and pneumonia-specific questionnaire were successfully completed in 273 of 458 patients (60%). An equal percentage of patients with CAP in each study group completed the baseline interview. There were no differences by gender or mean length of stay; however, those who completed the interview were younger (mean, 62.8 years vs 69.0 years; $p < .01$). As expected, the differences in prepneumonia and baseline average scores were much greater for the phys-

Table 1—*Subject Demographic and Clinical Characteristics

Characteristics	Usual Care (n = 231)	Intervention (n = 227)	p Value
Hospital			
Site 1	89 (39)	99 (44)	0.44
Site 2	92 (40)	78 (34)	
Site 3	50 (22)	50 (22)	
Female gender	129 (56)	127 (56)	0.98
Age, yr			
17–49	54 (23)	56 (25)	0.81
50–69	54 (23)	59 (26)	
70–79	60 (26)	51 (22)	
80–103	63 (27)	61 (27)	
PSI			
I, II, III (low)	33 (14)	38 (17)	0.21
	43 (19)	52 (23)	
	47 (20)	39 (17)	
IV (moderate)	65 (28)	71 (31)	
V (high)	43 (19)	27 (12)	
Immune status			
Immunocompetent	177 (77)	175 (77)	0.99
Immunosuppressed, no HIV	32 (14)	31 (14)	
HIV	8 (3)	7 (3)	
Unknown	14 (6)	14 (6)	
Hypoalbuminemia, albumin < 3.5 mg/dL	68 (29)	57 (25)	0.30
Antimicrobial therapy			
Door-to-IV drug time, h†	4.4 (0.72; 0–89)	5.6 (0.82; 0–57)	0.25
IV-to-po drug switch, d‡	2.5 (0.34; 0–41)	2.1 (0.40; 0–18)	0.49
po drug-to-discharge, d‡	4.8 (0.57; 0–29)	3.8 (0.80; 0–20)	0.33

*Data are presented as No. (%) or mean (SE; range).
†Adjusted for disease severity and medical unit.
‡Adjusted for disease severity, door-to-drug delivery time, and medical unit.

ical component summary score than the mental component summary score using the SF-12 questionnaire.

Effect of Intervention

Patients with CAP with lower prediction scores for mortality were more likely to achieve EM (Table 2), and patients in the intervention group were more adherent with EM than patients receiving usual care (73% vs 61%, p = .02). Overall, patients in the intervention group spent 1 day less in the hospital than patients who received usual care (mean, 5.8 days vs 6.9 days; adjusted absolute difference, 1.1 days; 95% CI, 0.0 to 2.2 days). Using the PORT pneumonia prediction rule,[12] low-risk category III patients in the intervention group were discharged 2.6 days earlier than those receiving usual care (mean, 4.9 days vs 7.4 days; adjusted absolute difference, 2.6 days; 95% CI, 0.2 to 5.0 days). Patients in both groups had similar door-to-drug delivery time (mean, 4.4 h vs 5.6 h; adjusted absolute difference, 1.2 h; 95% CI, 3.4 to 0.9 h) and IV-to-po switchover

Table 2—*Length of Stay by PSI

		Usual Care					Intervention					Hospital Length of Stay	
PSI Category		No.	Mean	SE	Range	Compliance, %	No.	Mean	SE	Range	Compliance, %	Diff	95% CI
I, II, III	low	33	5.6	0.78	1–29	67	38	4.6	0.76	2–19	76	1.1	− 1.1 to 3.2
		43	5.1	0.51	1–15	67	52	5.0	0.51	2–19	87	0.0	− 1.4 to 1.5
		47	7.4	0.81	2–43	57	39	4.9	0.89	2–11	72	2.6	0.2 to 5.0
IV	moderate	65	8.2	0.69	2–31	66	71	6.9	0.70	0–18	70	1.3	− 0.7 to 3.2
V	high	43	7.3	0.76	1–25	41	27	7.4	0.74	2–20	48	0.1	− 2.6 to 2.4
Total		231	6.9	0.36	1–43	61	227	5.8	0.43	0–20	73	1.1	0.0 to 2.2

*Compliance = percentage of patients undergoing early mobilization; Diff = difference in hospital length of stay between treatment groups, adjusted for disease severity, door-to-drug delivery time, and medical unit.

time (mean, 2.5 days vs 2.1 days; adjusted absolute difference, 0.4 days; 95% CI, 0.7 to 1.4). Despite no differences in the door-to-drug delivery time and IV-to-po switchover time, patients assigned to the intervention group were discharged 1 day earlier than those in the usual-care group (mean, 3.8 days vs 4.8 days; adjusted absolute difference, 1.0 day; 95% CI, 1.0 to 2.9 days).

Secondary Outcomes Analysis

Overall, 14 of 458 patients (3.1%) died while hospitalized (Table 3). The in-hospital mortality rate was low for hospitalized patients with CAP and may reflect the exclusion of patients admitted or transferred to ICUs, per the study design. Nevertheless, based on the PORT pneumonia prediction rule for mortality, inpatient mortality rates did increase with heightened mortality risk, ranging from 0 to 2% for low-risk patients, to 3 to 5% for moderate-risk patients, and 11 to 12% for high-risk patients with CAP, with no differences between the two study groups. The mortality rates and numbers of follow-up chest radiographs, emergency department visits, and re-admissions were not significantly different for the two treatment groups at 30 days or 90 days after hospital admission.

The adjusted mean hospital charges were $10,159 per patient for intervention care vs $12,868 per patient for usual care ($p = 0.05$). Using site-specific cost-to-charge conversions, the cost savings of the intervention provided an estimated cost savings of $1,000 per patient. In assessment of patient re-admissions at 90 days, there were 2.6 re-admissions per 1,000 patient-days at a charge of $5,573 per patient in the intervention group, compared to 2.9 re-admissions per 1,000 patient-days at a charge of $4,767 per patient in the group receiving usual care ($p = 0.77$).

In a subset analysis of cost comparisons available at site 1, total costs per patient were $5,507 for intervention care vs $6,594 per patient for usual care. The breakdown of costs for intervention vs usual care were as follows: laboratory costs, $1,036 vs $1,211; pharmacy costs, $745 vs $888; radiology costs, $405 vs $457; respiratory costs, $198 vs $290; and emergency costs $308 vs $255, respectively.

Table 3—*Secondary Outcomes

Secondary Outcomes	Usual Care (n = 231)	Intervention (n = 227)
All-cause mortality		
During hospitalization†		
PSI I	0/33 (0)	0/38 (0)
PSI II	0/43 (0)	0/52 (0)
PSI III	1/47 (2.1)	0/39 (0)
PSI IV	3/65 (4.6)	2/71 (2.8)
PSI V	5/43 (11.6)	3/27 (11.1)
Total	9/231 (3.9)	5/227 (2.2)
Within 90 d‡		
PSI I	0/33 (0)	0/38 (0)
PSI II	0/43 (0)	0/52 (0)
PSI III	1/47 (2.1)	2/39 (5.1)
PSI IV	8/65 (12.3)	10/71 (14.1)
PSI V	11/43 (25.6)	10/27 (37.0)
Total	20/231 (8.7)	22/227 (9.7)
Hospital re-admissions§		
Within 30 d		
0	199 (90)	203 (91)
1	21 (9)	18 (8)
≥ 2	2 (1)	1 (< 1)
Within 90 d		
0	177 (80)	181 (82)
1	35 (16)	34 (15)
≥ 2	10 (5)	7 (3)
Emergency department visits§		
Within 30 d		
0	192 (86)	203 (91)
1	27 (12)	19 (9)
≥ 2	3 (1)	0 (0)
Within 90 d		
0	167 (75)	175 (79)
1	42 (19)	34 (15)
≥ 2	13 (6)	13 (6)
Chest radiographs§		
Within 30 d		
0	188 (85)	191 (86)
1	32 (14)	28 (13)
≥ 2	2 (1)	3 (1)
Within 90 d		
0	161 (73)	162 (73)
1	45 (20)	41 (18)
≥ 2	16 (7)	19 (9)

*Data are presented as No./total (%) or No. (%).
†Based on information from health system medical informatics database for 458 patients.
‡Based on information from national mortality databases within 90 days after hospital admission for 458 patients.
§Based on information from health system medical informatics database for 444 patients alive at discharge.

Discussion

Our data suggest that EM of patients with CAP with movement out of bed for at least 20 min during the first 24 h of hospitalization and progressive daily mobilization can reduce hospital length of stay without increasing risk of adverse outcomes. Although this intervention has been shown to be effective for other disease entities,[10,11] EM is not recommended in CAP care nor is it a therapeutic component of current CAP guideline recommendations.[20,21] We did not observe a dose-response relationship with increasing disease severity, as measured by the pneumonia severity index (PSI).[3] A plausible explanation is that the effect of the intervention was different

among the patients in PSI categories. Notably, the intervention appeared to have the most effect among low-risk, category III patients, which represents the most severe of the three low-risk categories. For less ill patients, a more powerful intervention may be required to show major differences in outcomes, as patients were likely to recuperate regardless of the treatment. For the more severely ill patients, especially category V, they were perhaps either too ill to be easily mobilized or the intervention too modest to produce the desired impact.

Alternatively, the reduction in hospital length of stay for patients undergoing EM may have occurred from an enhanced nursing focus on patients with CAP in the intervention group, with improvements in several unmeasured processes of institutional resources that together contributed to earlier discharge. However, IV-to-po switch therapy occurred similarly for patients in the intervention and usual-care groups. Since physicians were blinded to the study purpose and intervention, yet responsible for determining the timing of therapeutic switchover, the shorter hospital length of stay for the intervention patients may be solely due to EM.

A third explanation of effect is a biologically plausible mechanism that may have altered ongoing pulmonary pathophysiology and provided a causal effect for EM reducing hospital length of stay in this patient population. In mobilizing hospitalized patients with CAP from bed, there may be improvement in aeration and/or blood flow redistribution with optimized drug delivery to the site of injury, reduced risk of aspiration, and maintenance of functional health status. In this study, we did not assess the causal effect for EM vs a perception of clinical improvement by the patients and/or physicians that may have contributed to earlier discharge. If the study can be repeated in other hospitalized CAP patient populations, the addition of a clinical stability measure, as reported by Halm et al,[22] may help clarify the association of the intervention and outcome.

This intervention study is strengthened from utilization of several metrics now refined for clinical investigations of therapeutic CAP care and functional health status. In utilizing the PORT pneumonia prediction rule,[3] we noted a decreased length of stay and institutional resources (data not shown) among patients with CAP with lower mortality risk. In addition, this metric enhanced our ability to detect higher compliance with EM among patients with lower PSI scores. Finally, the cost data from our group randomized trial provide a framework from which cost-effectiveness analysis of CAP can be designed and evaluated.

We recognize several limitations of this study. First, we selected a group randomized trial rather than a randomized controlled trial to control for confounding bias and to increase compliance with the intervention for patients assigned to medical units randomly allocated to the intervention or usual-care group. Although this experimental study design is more commonly used to evaluate public health interventions in community trials, it can be used for medical research when allocation of identifiable groups is required.[14] Second, there could have been contamination of the medical units representing the usual-care group. Nurses at each site did not rotate between units and no *per diem* nurses were used during the study, but any contamination would have underestimated the significant effect of the intervention seen in our findings. Third, EM was recorded as a dichotomous variable, and we were unable to assess different degrees of mobilization for correlation with outcomes. Fourth, data procurement for most of the secondary outcomes was limited to follow-up within our integrated health-care system. Although our findings may have underestimated these secondary outcomes, we do not believe this would have occurred differentially for the two treatment groups. Among the patients who were contacted by telephone at 90-day follow-up, those who were rehospitalized returned to the original site of CAP care. Fifth, we did not collect data on the number of ongoing diagnostic evaluations, despite clinical improvements compatible with discharge. Although such evaluations have been associated with delayed discharge,[23] it is unlikely that these evaluations occurred disproportionately among assigned groups. Our charge data for site 1 suggest that the costs associated with additional length of stay correlate with a distribution of added laboratory, pharmacy, radiology, and respiratory care costs. Lastly, we did not attempt to identify the etiologic agents attributable to the episode of CAP. To account for this, we retrospectively obtained International Classification of Diseases, Ninth Revision, Clinical Modification diagnostic codes for the patients in our study population. Notably, a pneumonia-specific etiology was coded in 16% of cases, and the rates were similar for both treatment groups.

In summary, we conclude that EM of this hospitalized population with CAP was associated with reduced hospital length of stay and fewer institutional resources without increasing adverse events or posthospitalization resource utilization. Nonetheless, our findings have not, to the best of our knowledge, been replicated by other investigators. Before incorporation of our results into existing therapeutic CAP guidelines and application to other disease entities that focus on improving health outcomes, additional clinical investigations need to be conducted.

ACKNOWLEDGMENT: We thank the patients, families, nurses, and administrators at Barnes-Jewish Hospital, Christian Hospital Northeast and Missouri Baptist Medical Center for their participation and support. We thank Vicki Ferris, Neice Green, Naomi Hampton, JoAnn Johnson, Krista Kuhn, Barb Quick, Cindy Spies and Lynn Williams for data collection; Debbie Geiselman, Judy Musick, and Connie Sinn for data management; Jennie Dulac for administrative support; and Jordana Stewart for manuscript preparation.

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Linda M. Mundy, Terry L. Leet, Kate Darst, Mark A. Schnitzler and William Claiborne Dunagan

Chest 2003;124;883-889
DOI: 10.1378/chest.124.3.883