

Prospective Evaluation of Clinical Criteria to Select Older Persons with Acute Medical Illness for Care in a Hypothetical Home Hospital

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OBJECTIVE: To evaluate criteria to select older persons who need hospitalization for common acute medical illnesses for care in a hypothetical home hospital.

DESIGN: Prospective record review.

SETTING AND PARTICIPANTS: Patients aged 65 and older admitted to the general medical service of a community-based university hospital.

MEASUREMENTS: We developed illness-specific selection criteria to identify older persons with certain acute medical conditions for treatment in a hypothetical home hospital. The selection criteria were reviewed prospectively against all community-dwelling older patients admitted to the general medical service of a community-based university hospital over a 4-month period. We determined eligibility for home hospital admission based on information available at the time of admission and then tracked the patient's hospital course.

RESULTS: One hundred fifty-seven admissions of 143 patients were reviewed. The selection criteria identified 33% of patients admitted to the acute hospital with one of the three target diagnoses as eligible for a home hospital model of care had it been available. Eligible patients experienced shorter lengths of stay (3.7 vs 5.4 days, $P = .012$), fewer mean number of procedures performed (0.98 vs 1.70, $P = .001$), fewer mean number of complications (0.17 vs 0.56, $P = .010$), and fewer events that could be handled only in the acute hospital setting ($P = .036$). In addition, in logistic regression analysis, three criteria for home hospital ineligibility, pulmonary congestion associated with ischemic chest pain (odds ratio 6.85, 95% CI 2.64, 17.81), the presence of an acute coexisting illness requiring hospitalization independent of the target conditions (odds ratio 2.66, 95% CI 1.11, 6.41), and significant pulmonary congestion after initial treatment (odds ratio 14.4, 95% CI 1.77, 117.41) were significantly associated with items difficult to accomplish at home.

CONCLUSIONS: Criteria can be delineated that identify older persons with acute medical illnesses who may be suitable for treatment in a home hospital. *J Am Geriatr Soc* 45:1066-1073, 1997.

There is increasing interest in community-based alternatives for the care of older adults. Programs such as the Long Term Care Channeling Demonstration Program,¹ Social Health Maintenance Organizations (SHMOs),² and the Program for All-inclusive Care for the Elderly (PACE),³ have targeted older persons with chronic illnesses and disabilities and have had as their goal the prevention or delay of nursing home admission and the prevention of hospitalization.

Treating older persons at home for acute medical illnesses in a home hospital model of care has received less attention and study.^{4,5} In this model, the critical elements of hospital care, physician and nursing care, medicines, and appropriate technologies, are brought home to the patient. Though few studies of home hospital care have been performed, there is evidence to suggest that the treatment of older persons experiencing acute illness might be as or more successful in the home because of a reduction of the risk of iatrogenic disease and the possibilities of improved outcomes from treatment in a familiar, comfortable setting.⁶ Home hospital was employed in the treatment of myocardial infarction in the prethrombolytic era.^{7,8} Recently, mainly home-based approaches were used to treat uncomplicated deep venous thrombosis.^{9,10} These studies benefited from examination of discrete, diagnostically crisp illnesses, which most physicians believe, a priori, require in-patient treatment and demonstrated that home treatment was comparable to usual hospital care.

Designing home hospital for older persons with acute medical illness or exacerbations of chronic medical illness has not been studied extensively. A home hospital program in Israel provided in-home, physician-supervised interdisciplinary medical care for patients who "required" hospitalization but who didn't require "constant supervision," and in a non-randomized design, demonstrated decreased acute hospital utilization and lower costs. In this study, the average length of stay was 46 days, and 12% of admissions lasted 90 days or longer.¹¹ This suggests that such general selection criteria didn't select patients appropriately for acute hospital

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treatment by American standards. Such studies highlight the critical issue of patient selection for home hospital. Patients cared for in home hospital must be neither so sick as to require an intensive care unit nor so well that healthcare providers use home hospital for patients who never really needed hospital care but benefit from increased home services. In the present study, we will outline our vision of a home hospital and describe the prospective evaluation of clinical criteria to select older patients with common acute medical conditions for care in such a model.

METHODS

The Hypothetical Intervention

In home hospital, a patient will be identified on the basis of specific clinical criteria at the time a decision has been made, either at a primary care site or in an emergency department, to admit him or her to the acute hospital. The eligible patient will be stabilized and transported home in the company of a nurse coordinator and will be met at home by the home hospital physician. The home hospital physician will make a full assessment and initiate appropriate diagnostic and therapeutic measures. The physician will make at least daily visits to the patient at home and be available 24 hours a day for urgent or emergent visits to the home. The patient will have direct nursing supervision for the initial portion of his or her stay in the home hospital, the duration depending on the level of illness acuity as judged by the physician. The nurse coordinator will supervise the case management and ensure that the team elements are in place. In addition to physician visits and nursing supervision, diagnostic studies such as electrocardiograms, radiography and ultrasound, durable medical equipment, intravenous fluids, intravenous antimicrobials and other medicines, and oxygen and other respiratory therapies would be provided at home. Diagnostic studies and therapeutics that could not be provided at home, such as computerized tomography, magnetic resonance imaging, and endoscopy, would be provided, as needed, with brief visits to the appropriate outpatient resource of the acute hospital. A home health agency will designate a cadre of nurses, aides, and other ancillary staff to work with the home hospital. Caremaps¹² and clinical outcomes evaluations will provide a pathway for care. The patient will be followed until stable for discharge, at which time his or her care supervision will revert to the patient's original primary care physician.

Selection of Target Conditions

Several general criteria guided the initial selection of conditions targeted for treatment in the home hospital: that they occur frequently and account for a significant portion of hospitalizations among older persons, that the diagnosis be relatively uncomplicated, and that the treatment be well defined. In addition, the treatment would be feasible, safe, and cost effective in the home setting.

To assure selection of conditions that account for a large percentage of hospitalizations, we reviewed data from the Maryland Hospital Discharge Survey (1994).¹³ Thirty-one diagnoses accounted for 68% of all admissions from home to medical wards for persons 65 years of age and older. From these, we selected six candidate diagnoses for further study based on clinical feasibility to treat at home and practicality of selecting home hospital treatment before hospital admission. These diagnoses were: congestive heart failure (CHF),

chronic obstructive airway disease (COAD), community-acquired pneumonia (CAP), fluid and electrolyte disorders, urinary tract infection, and cellulitis.

A review of 10 randomly selected hospital records of patients admitted with a primary diagnosis of fluid and electrolyte disorders revealed a markedly heterogeneous group of underlying disorders, which made home hospital treatment difficult to plan and implement. From the remaining diagnoses, CHF, COAD, and CAP were chosen for further investigation based on the factors noted above. In addition, because these three illnesses often present with dyspnea, they may be difficult to distinguish clinically from one another at the time of admission to hospital. They may also present simultaneously in older persons, and share certain treatment modalities. Therefore, we thought design and study of a home hospital would be facilitated by selecting these three target conditions. These three diagnoses accounted for 18.3% of primary discharge diagnoses for persons 65 years and older admitted from home to medical ward, non-intensive-care beds.

Criteria Development

We reviewed literature on the target conditions, with special attention to issues of diagnosis, criteria for inpatient treatment, and criteria for intensive care unit treatment, to help develop clinical criteria to identify patients suitable for home hospital. With the exception of literature on CAP¹⁴⁻¹⁶ and pulmonary edema¹⁷ there was little relevant literature except for consensus statements such as the American Thoracic Society guidelines on CAP¹⁸ and the Agency for Health Care Policy and Research,¹⁹ American College of Cardiology/American Heart Association,²⁰ and World Health Organization guidelines on CHF.²¹

Illness-specific eligibility criteria were developed to identify patients who were felt by their primary care or emergency department physician to require inpatient treatment, but who could be treated at home when the appropriate supervision and services, as described above, were provided. The eligibility criteria specifically targeted patients who could not be treated on an ambulatory basis: patients with significant comorbid illnesses and those who required oxygen therapy, intravenous fluids, or antibiotics. Exclusion criteria to identify patients who required acute hospital care and for whom home hospital would be inappropriate were delineated. Criteria were reviewed by internal medicine, geriatric, pulmonary, cardiology, and infectious disease consultants. To assess basic soundness, each set of criteria was applied retrospectively to 25 randomly selected case records of patients aged 65 and older admitted from the community to the Johns Hopkins Bayview Medical Center (JHBMC). For each target condition, the criteria identified approximately 30% of patients as eligible for home hospital care.

Prospective Evaluation of Protocols

To evaluate these protocols further, they were reviewed prospectively against all patients, aged 65 and older, admitted from the community with one of the target conditions to the general medical (nonintensive-care) services of JHBMC from January 1 to April 30, 1995.

Subjects with the target diagnoses were identified from the hospital admission logs on a daily basis. The admitting diagnosis listed on the hospital admission log was often a symptom rather than a diagnosis. The following symptoms

listed as diagnoses or reasons for admission prompted review of a patient's record: dyspnea, fever, sepsis, cough, failure to thrive, chest pain, or hypoxemia. In addition, admission logs were reviewed, and charge nurses on the medical wards were queried on weekdays to identify patients with the target conditions. Subjects were included in the study if they were aged 65 or older, admitted from the community, and one of the target conditions was identifiable to the emergency room physician, admitting house officer, or admitting physician from an outpatient site, in the cases of patients admitted directly to hospital.

Once identified, investigators (B. L. or M. H.) reviewed data from the initial patient emergency department or clinic evaluation, and with only that initial information, eligibility for care in a hypothetical home hospital was determined based on the specific selection criteria. No change in eligibility status was permitted or made based on the subsequent course of the patient's illness.

Data Collection

Data were abstracted from the record using a standardized instrument for demographics, details of emergency department or primary care site treatment, comorbid conditions, social situation, medication use, symptoms and signs of illness, and laboratories. The patient's hospital course was then tracked on a daily basis for the development of the following complications: death, transfer to intensive or cardiac care unit, intubation, myocardial infarction, nosocomial infections, diarrhea, delirium, use of physical or chemical restraints, falls, and fracture. Utilization of hospital resources were tracked. In addition, all progress notes were reviewed, and a list of all physician orders was compiled to facilitate assessment of situations encountered and procedures performed that would have been difficult or impossible to accomplish in the home setting. A critical complication was defined as death, transfer to intensive care setting, intubation, or myocardial infarction. An emergency clinical situation was defined as one that required physician evaluation within 30 minutes such as the development of shortness of breath, hypotension, tachycardia, or other acute change in status. Emergency consultation was defined as consultation required on a same day basis and was also included as an emergency clinical situation. A difficult item was defined as cardiac telemetry, an urgent or difficult procedure to do in the home, and difficult medicines such as intravenous heparin or intravenous nitroglycerin. An urgent or difficult procedure included such radiological studies as computerized tomography, magnetic resonance imaging, echocardiogram or ultrasound, tube feeding required on a same day basis, exercise stress test, ventilation perfusion scan, Holter monitor, endoscopic procedure, thoracentesis, paracentesis, induced sputum, and same day transfusion. The fact that a procedure was carried out on a same day basis usually did not reflect clinical urgency as often as it reflected the urgent need of the housestaff to move patients through the hospital system. Nonetheless, all were scored as urgent or difficult procedures.

Concordance and Data Abstraction Validity Check

No formal study of data concordance between record abstractors was performed. However, all records were reexamined by one investigator (J.W.B.) after the patient was discharged from hospital. This review uncovered no informa-

tion that dictated adjustment of initial assessment of eligibility status.

Statistical Analysis

Patient characteristics and complications and procedures experienced were compared based on assignment as eligible or ineligible for home hospital. The chi-square statistic was used to determine statistically significant differences. Three outcomes during hospitalization (critical complication, emergency clinical situation, and difficult item) were compared based on the patient's assignment as ineligible or eligible for home hospital. Factors that were associated significantly with these outcomes in bivariate analyses were entered into logistic regression models to determine their independent effect on the outcome. Odds ratios and 95% confidence intervals were computed. Logistic regression models were also used to determine the extent to which major ineligibility criteria for home hospital predicted adverse outcomes. Four of the most frequent reasons for ineligibility (pulmonary congestion > 1/2 lung fields after initial treatment, hypoxemia, acute coexisting illness requiring hospital admission independent of the target condition, and pulmonary congestion associated with ischemic chest pain) were entered into separate regressions on the three outcomes. Another common reason for ineligibility, frequent nebulized bronchodilator use, was not modeled in these regressions because it was included as an ineligibility criterion for reasons related to the logistics of home hospital implementation. Odds ratios and 95% confidence intervals were computed. Mean values for length of stay and mean number of complications and procedures were compared using two-tailed *t* tests.

RESULTS

Between January 1 and April 30, 1995, there were 1102 admissions of community-dwelling persons aged 65 and older to the general medical service of JHBMC. Of these, 143 patients were admitted 157 times with one of the three target conditions as the principal reason for admission. These 157 admissions comprise the study population. Ninety-six percent of the subjects were admitted to hospital through the emergency department, and 3.8% were admitted directly to hospital from an ambulatory primary care site. The average age of study subjects was 74.9 years. Ninety-two percent of subjects were white and 8% were black. Thirty percent of all subjects lived alone, 65% lived with family, and 4% lived with non-family caregivers. Table 1 presents data on commonly occurring comorbid conditions in the study population. There were no significant differences between subjects eligible or ineligible for home hospital by demographics or comorbid conditions.

Table 2 presents eligibility rates for the hypothetical home hospital by diagnosis. The selection criteria identified 52 cases (33%) as eligible and 105 cases (67%) as ineligible for a home hospital model of care, had it been available.

Table 3 lists the leading reasons for home hospital ineligibility and Figure 1 details length of stay data.

A clinical complication occurred in 21% of all patients, 27% of patients ineligible and 10% of patients eligible for the hypothetical home hospital. The mean number of complications for ineligible patients was 0.56 and for eligible patients, 0.17. This difference was significant at $P = .01$. Table 4 presents data on clinical complications among the study population. With regard to specific types of complications,

Table 1. Commonly Occurring Comorbid Conditions at Admission, by Eligibility Status for Home Hospital

Condition	Total (%) n = 157	Ineligible (%) n = 105	Eligible (%) n = 52	P Value
Hypertension	79 (50.3)	50 (47.6)	29 (55.8)	0.336
COAD	79 (50.3)	56 (53.9)	23 (29.1)	0.257
CHF	63 (40.1)	44 (41.9)	19 (36.5)	0.519
Coronary artery disease	49 (31.2)	31 (29.5)	18 (34.6)	0.517
Diabetes mellitus	41 (26.1)	28 (26.7)	13 (25.0)	0.823
Myocardial infarction	31 (19.8)	20 (19.1)	11 (21.2)	0.755
Cerebrovascular accident	22 (14.0)	16 (15.2)	6 (11.5)	0.530
Hospitalized within year for any reason	43 (27.4)	31 (29.5)	12 (23.1)	0.394

Table 2. Eligibility Status for Home Hospital, by Target Diagnosis

Status	Total (%)	CAP (%)	COAD (%)	CHF (%)
Ineligible	105 (66.9)	27 (54.0)	34 (72.3)	44 (73.3)
Eligible	52 (33.1)	23 (46.0)	13 (27.7)	16 (26.7)
Total	157	50	47	60

Table 3. Leading Reasons for Ineligibility for Home Hospital, by Target Diagnosis*

Reasons for Ineligibility	CAP 27	COAD 34	CHF 44
Hypoxemia†	19	12	19
Acute coexisting illness requiring admission independent of target condition	9	11	18
Nebulized bronchodilators more frequent than q 2 h		20	
Pulmonary congestion > 1/2 lung fields after initial treatment			18
Pulmonary congestion associated with ischemic chest pain			13

* Subjects could be ineligible for more than one reason.

† Partial pressure of arterial oxygen < 60 mm Hg or oxygen saturation < 90% while breathing room air after initial treatment.

there were no statistically significant differences between the two groups of subjects. Of interest, one patient eligible for home hospital was a woman admitted with COAD. She was treated with a benzodiazepine, became obtunded, then required intubation and transfer to the intensive-care unit where she died, thus accounting for three of the four most severe complications in the home hospital eligible group.

Table 5 presents data on the occurrence of clinical situations and procedures that would be difficult or impossible to do at home, by eligibility status. Patients eligible for home hospital were less likely to experience a difficult item ($P = .004$), less likely to experience an urgent or difficult procedure ($P = .036$), and were less likely to have had cardiac telemetry monitoring ordered for them by their physicians ($P = .003$). Differences with regard to other procedures did not reach

statistical significance. The mean number of clinical situations and difficult items was 1.06 for ineligible patients compared with 0.52 for home hospital eligible patients. This difference was significant at $P < .001$.

Table 6 lists the odds ratios for having one of three significant adverse outcomes (critical complication, emergency clinical situation, or difficult item) given a specific reason for ineligibility for home hospital care, controlling for the other most frequent reasons. The presence of pulmonary congestion associated with ischemic chest pain was associated significantly with each of these adverse outcomes. The presence of an acute coexisting illness that required hospital admission independent of the target diagnosis was associated with a critical complication and a difficult item. The presence of significant pulmonary congestion after initial treatment was associated with a difficult item.

In addition, we examined the association of patient clinical factors with the occurrence of adverse outcomes to determine if we should alter the eligibility criteria. Logistic regressions were modeled for these outcome variables: critical complication, emergency clinical situation, and difficult item. These analyses yielded few, barely significant factors, with broad confidence intervals and little clinical relevance as eligibility criteria.

It is often difficult to distinguish between CAP, CHF, and COAD in the acutely ill older person presenting with dyspnea. Forty-seven of the 157 admissions (30%) had more than one of the three target diagnoses listed as the admission diagnosis by the emergency room physician and/or the admitting house officer. Compared with patients admitted with only one of the three target diagnoses ($n = 110$), these patients were more likely to: complain of dyspnea on exertion ($P = .033$), have a prior history of CHF or COAD ($P = .045$), have equivocal chest radiograph findings ($P = .012$), demonstrate ambiguous physical examination findings ($P = .005$), and receive therapies for more than one of the target conditions ($P < .001$). However, there was no difference between the two groups with regard to eligibility for home hospital treatment, length of stay, complications suffered during their hospital stay, number of procedures experienced, or number of situations experienced that could only be handled in the hospital.

DISCUSSION

In this paper we outline a specific home hospital model that would provide nursing supervision, physician visits and coverage, ancillary therapies, and advanced diagnostic and

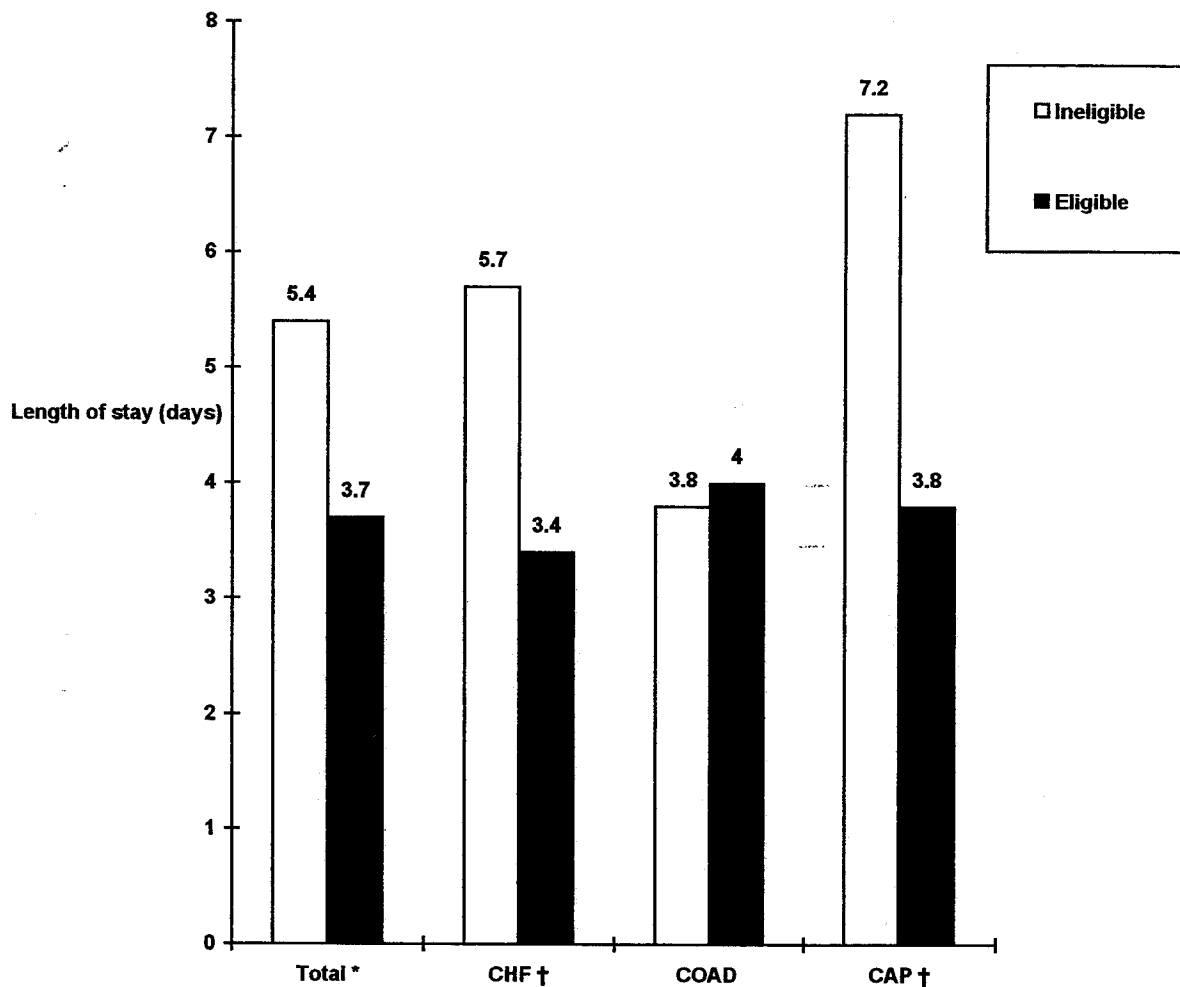


Figure 1. Mean length of stay by eligibility criteria. Between group comparison of mean hospital length of stay based on a two-sample *t* test: **P* = .012, †*P* < .001.

Table 4. Frequent Complications, by Eligibility Status for Home Hospital

Complication	Total (%) n = 157	Ineligible (%) n = 105	Eligible (%) n = 52	<i>P</i> Value
Critical complications				
Death	7 (4.5)	5 (4.8)	2 (3.9)*	0.794
Transfer to intensive care	8 (5.1)	7 (6.7)	1 (1.9)*	0.203
Intubation	3 (1.9)	2 (1.9)	1 (1.9)*	0.994
Myocardial infarction	3 (1.9)	3 (2.9)	none	0.218
Other complications				
Infection	19 (12.1)	15 (14.3)	4 (7.7)	0.393
Diarrhea	9 (5.7)	7 (6.7)	2 (3.9)	0.474
Delirium	5 (3.2)	5 (4.8)	none	0.110
Psychotropic medication	5 (3.2)	3 (2.9)	2 (3.9)	0.740
Physical restraints	4 (2.6)	4 (3.8)	none	0.154

* A single patient with COAD was treated with a benzodiazepine, became obtunded, was transferred to the intensive care unit, intubated, and later died. Her experience accounted for three of the four most significant complications suffered in the home hospital eligible group.

therapeutic capabilities, including intravenous fluids and antibiotics. When physicians have been queried about patients with CAP they admitted to hospital, in regard to types of services that would allow for treatment outside the acute hospital, these are the types of service they identify.²² In

addition, most such patients prefer to be treated at home, but few are given the option.²³ Home hospital may be appropriate in these situations.

This prospective study demonstrates that clinical criteria can be delineated that identify older persons with significant

Table 5. Clinical Situations and Procedures That Would Be Difficult or Impossible to Do At Home, by Eligibility Status for Home Hospital

Procedures	Total (%) n = 157	Ineligible (%) n = 105	Eligible (%) n = 52	P Value
Emergency clinical situation*	21 (13.4)	16 (15.2)	5 (9.6)	0.330
Emergency consultation	6 (3.8)	6 (5.7)	none	0.079
Any difficult item†	83 (52.9)	64 (61.0)	19 (36.5)	0.004
Urgent/difficult procedure‡	54 (34.4)	42 (40.0)	12 (23.1)	0.036
Cardiac telemetry	49 (31.2)	41 (39.1)	8 (15.4)	0.003
Difficult medicine§	14 (8.9)	12 (11.4)	2 (3.9)	0.118

* Emergency clinical situations: chest pain, shortness of breath, hypotension, acute change in status requiring physician evaluation within 30 minutes, or emergency consultation.

† Individual patients who experienced more than one difficult item were counted only once.

‡ Urgent/difficult procedures: computerized tomography, magnetic resonance imaging, echocardiogram and other ultrasound procedures, tube feeding, exercise stress test, ventilation-perfusion scan, Holter monitor, endoscopic procedure, thoracentesis, paracentesis, induced sputum, or same day transfusion.

§ Difficult medicines: intravenous heparin or intravenous nitroglycerin.

Table 6. Odds Ratios (OR) of Adverse Outcomes for Common Reasons for Ineligibility for Home Hospital, Adjusted for Other Variables in the Model

Reason for Ineligibility	(n)	Critical Complication* (n = 21)		Emergency Clinical Situation† (n = 21)		Difficult Item‡ (n = 83)	
		Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Pulmonary congestion >1/2 lung fields after initial treatment	18	1.63	0.35-7.69	0.88	0.21-3.60	14.4	1.77-117.41
Hypoxemia§	50	0.29	0.06-1.52	1.10	0.40-2.98	0.72	0.33-1.60
Acute coexisting illness	38	4.73	1.32-16.99	1.60	0.57-4.47	2.66	1.11-6.41
Pulmonary congestion associated with ischemic chest pain	13	4.74	1.30-17.33	3.64	1.37-9.72	6.85	2.64-17.81

* Critical complications: death, transfer to intensive care, intubation, myocardial infarction.

† Emergency clinical situation: chest pain, shortness of breath, hypotension, acute change in status requiring physician evaluation within 30 minutes or emergency consultation.

‡ Difficult item: urgent or difficult procedure (computerized tomography, magnetic resonance imaging, echocardiogram and other ultrasound procedures, tube feeding, exercise stress test, ventilation-perfusion scan, holter monitor, endoscopic procedure, thoracentesis, paracentesis, induced sputum, or same day transfusion), cardiac telemetry, or difficult medicine.

§ Partial pressure of arterial oxygen <60 mm Hg or oxygen saturation <90% while breathing room air after initial treatment.

comorbidities, hospitalized with CAP, CHF, and COAD, who, we believe, could be treated in a home hospital. Specifically, these patients experience shorter lengths of stay and experience fewer complications and events that can be handled only in the acute hospital.

Clinical eligibility criteria were established from literature review and clinical considerations. Criteria were feasible to implement with basic information obtained in the initial medical encounter. Three of the most common exclusion criteria, the presence of pulmonary congestion associated with ischemic chest pain, the presence of an acute coexisting illness requiring hospitalization other than the target condition, and the presence of significant pulmonary congestion after initial treatment, were associated with adverse clinical events or difficult items to accomplish at home. Such associations lend credence to the eligibility criteria. The most common reason for home hospital ineligibility, hypoxemia, was not associated with adverse outcomes. In prior studies of CAP, hypoxemia has been associated with adverse outcomes and is significantly associated with the physician's decision to admit patients to hospital. In the current study, there were probably too few patients in the CAP group to detect this

effect. Also, management of severely hypoxemic patients likely requires more resources than home hospital can reasonably provide. For these reasons, we will continue to include hypoxemia as an ineligibility criterion.

There are several caveats to our work. First, although all subjects were admitted to hospital, the criteria did not set a strict lower limit of what constituted a "required admission" for the target diagnoses. Such thresholds are only beginning to be defined for medical illness. In the recent CAP Patient Outcomes Research Trials (PORT), Fine et al. delineate a clinical prediction rule that defines five risk classes (I-V) for patients with CAP and suggest that patients in class III likely deserve at least brief inpatient observation and treatment and those in class IV and V traditional inpatient care. Of the 24 patients with CAP in our study who were eligible for home hospital, 20 (83%) were class III or higher and 10 (42%) were class IV or V. These data suggest that in accepting older frail patients with acute illness we are, in fact, targeting persons who deserve inpatient care and the implementation of home hospital will not result in adding services and costs to the care of patients who could and should be treated as outpatients. Also, it is clear from the PORT studies and

clinical experience that clinical judgment is what usually drives individual admission decisions.²² This may be more relevant to the admission decision for older persons with coexisting illness for whom "clinical judgement must always supersede the (clinical prediction) rule."²⁴ In a study of physician practice style and hospitalization for chronic medical conditions, Komaronay et al.²⁵ found that there is a discretionary component in the hospitalization decision for patients with acute exacerbations of chronic medical conditions, and to avoid such a hospitalization, other options for care such must exist. Home hospital may be such an option.

Second, some exclusionary criteria, which rendered a significant number of patients ineligible for home hospital, were formulated for reasons related to projected logistical difficulties in admitting a patient to home hospital. For example, patients who were treated with nebulized bronchodilator therapy more frequently than every 2 hours after initial treatment were excluded because we were uncertain that it would be possible to deploy home hospital resources in sufficient time to meet the immediate medical needs of the patient on admission to home hospital. In the future, it may be possible to simplify and redefine such selection criteria for home hospital as more experience is acquired and the care model and its capabilities mature.

Third, the criteria do not eliminate the risk of selecting patients for home hospital who will not experience adverse clinical events. It is likely impossible to devise criteria to select such patients without severely and unnecessarily limiting enrollment in a home hospital because such events may not be preventable in any setting. Importantly, we believe that many adverse events that occur in the acute hospital and to which older patients are especially susceptible, such as functional decline, would not occur in a home hospital.²⁶ Although a different population, it is worth noting that patients in the CAP PORT study at low risk of complications who were treated as outpatients had better functional outcomes compared with those treated as inpatients.²⁷

Last, selection criteria were validated on a relatively small population of mostly white patients admitted chiefly from the emergency department. The criteria will require testing in other geriatric populations and settings.

Despite these limitations, we believe this study is the first to attempt to set out criteria to select older persons experiencing acute illnesses for acute home hospital care. A safety and feasibility trial of home hospital using these selection criteria is currently under way.

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APPENDIX

ELIGIBILITY CRITERIA FOR HOME HOSPITAL

Inclusion Criteria

- Patient with one of the target conditions (CAP, CHF, or COAD) and felt to require hospital admission for target condition by primary care physician or emergency department physician. In case of community acquired pneumonia, infiltrate must be present on chest radiograph.
 - Age ≥ 65 years.
 - Lives in community within specified catchment area.
- #### Congestive Heart Failure—Exclusions
- Associated with arrhythmia (ventricular tachycardia or complex ventricular ectopy, bradycardia at rate ≤ 40 beats

per minute, atrial fibrillation with rapid ventricular response ≥ 120 beats per minute, new Mobitz type II heart block, new complete heart block, sinus arrest or pauses ≥ 2 seconds, pacemaker failure to capture or sense).

- B. Associated with known or suspected severe valvular disease of aortic or mitral valves.
- C. In patients requiring continued care for respiratory distress after initial treatment i.e. rales $> 1/2$ lung fields at completion of initial treatment in emergency department or primary care clinic.
- D. Unstable angina.
- E. Myocardial infarction within last 3 months.

Chronic Obstructive Airways Disease—Exclusions

- A. Presence of other significant pulmonary disease e.g. lung cancer, bronchiectasis, pulmonary fibrosis.

Community Acquired Pneumonia—Exclusions

- A. Suspected supportive infection e.g., meningitis, empyema, septic arthritis, endocarditis.
- B. Chest radiograph abnormality due to cause other than community acquired pneumonia e.g., lung cancer, pulmonary emboli, tuberculosis.
- C. Presence of other significant pulmonary disease e.g. lung cancer, bronchiectasis, pulmonary fibrosis.
- D. Pneumonia within 6 weeks of presentation.
- E. Chest radiograph with cavitating lesion.
- F. Immunodeficiency states associated with leukopenia e.g. leukemia, cytotoxic drugs, HIV disease, myeloma, lym-

phoma.

Exclusions for Any of the Target Diagnoses

- A. Need for intensive care setting admission or high patient acuity level: patient requiring pressor agents, mechanical ventilation, or intensive or invasive monitoring. Patient with impending respiratory failure or who requires suctioning more frequently than every two hours, frequent arterial blood gas monitoring, nebulized bronchodilator therapy more frequently than every two hours after initial treatment, or whose oxygen requirements are greater than an FiO_2 of 50%.
- B. Associated with ischemic chest pain or other symptoms suggestive of ischemia or myocardial infarction: new chest pain with electrocardiographic evidence of active ischemia, new chest pain suggestive of ischemia without electrocardiographic changes.
- C. Hospitalized within 7 days of current presentation.
- D. Hypoxemia: $PO_2 < 60$ mm Hg (or > 10 mm Hg change from baseline) or O_2 sat $< 90\%$ after initial treatment while breathing room air.
- E. Arterial blood pH < 7.30 or > 7.55 .
- F. Suspected pulmonary embolism.
- G. Hypotension: systolic blood pressure < 90 mm Hg.
- H. Dialysis dependent patients.
- I. Expected terminal event.
- J. Acute illness requiring hospital admission independent of the target diagnosis, except for the other target conditions.