Home Health Care Outcomes Under Capitated and Fee-for-Service Payment

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In this article, case-mix-adjusted outcomes of home health care are found to be superior for Medicare fee-for-service (FFS) patients relative to Medicare health maintenance organization (HMO) patients. The superior outcomes for FFS patients were accompanied by higher utilization and cost of home health services, suggesting a volume-outcome (or dose-response) relationship that was further substantiated by within-HMO and within-FFS analyses. The findings suggest that greater attention should be paid to both outcome-based quality assurance and managed care practices that may be overly restrictive in terms of the use of home health services.

INTRODUCTION

Quality of Home Health Care

Home health care occupies a relatively unique position in the health care field. In most health care settings, with the relatively rare exception of physician home visits, the patient or client travels to and, in many cases, remains in a provider setting to receive health care and other support services. In home health care, the provider travels to the patient's home, where care provision can be influenced by various circumstances and attributes not typically encountered in most other types of health care. Effectiveness of care depends not only on the provider's health care expertise but also on patient and family knowledge, adherence to treatment regimens, physical characteristics of the home environment, and the combined ability of provider and family to communicate and motivate. Although the potential merits of home health care are substantial, relatively little precise information has been obtained on its effectiveness, especially in the form of studies that control for the variety of factors that can influence its effectiveness (Martin, Scheet, and Stegman, 1993).

In view of the capacity of home health care to assist in avoiding hospitalization and other forms of institutionalization, it seems logical to expect that managed care programs, and HMOs in particular, would make widespread use of such care. Whether this implies that home health care would result in better patient outcomes or greater effectiveness, however, is unknown. It could be argued that HMOs would be more attuned to the merits of home health care and provide a more coordinated approach to such care. On the other hand, if home health care is viewed by HMOs as a service to be avoided or minimized in order to control costs, then outcomes may be inferior to those in the FFS sector.

The incentives of HMOs to minimize certain types of service utilization, especially inpatient hospital services, are well documented (Parker and Polich, 1988; Manning et al., 1984; Davis et al., 1990). Past studies have examined selected HMO/FFS differences in outcomes, appropriateness, and

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processes of care. Some studies have found or suggested that aggregate outcomes of care may be the same in HMO and FFS settings (Retchin et al., 1992; Carlisle et al., 1992; Davis et al., 1990; Luft, 1988; Retchin and Brown, 1990; Murray et al., 1992). Ware et al. (1986) showed no differences in outcomes for non-poor individuals in both settings. Selected research has also shown that the appropriateness of HMO care may be either superior to or no different from care provided to Medicare patients in the FFS sector. Siu et al. (1988) showed a slightly lower rate of inappropriate hospitalization in HMOs than in FFS settings. Siu et al. (1986) showed no significant difference in appropriateness of hospitalizations between insurance plans requiring no cost sharing and those requiring cost sharing. The Medicare demonstration project showed minimal or no statistical differences in processes of care between HMO and FFS systems for patients with hypertension, diabetes mellitus, and congestive heart failure (Brown et al., 1993). A difference was found for colorectal cancer patients, with HMO physicians more likely than physicians practicing in FFS settings to perform endoscopic or radiologic exams (Langwell and Hadley, 1989). Retchin and Brown (1990) found that many routine and preventive care treatments were performed more frequently for Medicare patients enrolled in HMOs than in FFS systems. No comprehensive work has been undertaken, however, to assess the quality or effectiveness of home health care provided by or through HMO arrangements relative to FFS home health care.

Terminology and Hypotheses

Effectiveness of health care can be measured in various ways (Shaughnessy et al., 1987; Lohr, 1988). In this article, effectiveness is defined in terms of outcomes. Patient status outcome measures reflect the extent of change (including positive, negative, and no change) in functional, physiologic, behavioral, or cognitive status. Utilization outcome measures reflect the use or non-use of health services and include measures such as hospitalization, rehospitalization, emergent or urgent care, and discharge to independent living (Kramer et al., 1990; Shaughnessy et al., 1991). Although mortality can be regarded as a patient status outcome, it is a global and relatively crude measure of effectiveness. As an outcome, mortality can be useful in highlighting egregious problems in the delivery of health services only if risk factor adjustment is sufficiently comprehensive. In fact, to properly assess and compare any patient status outcome, utilization outcome, or mortality measure across different settings, risk factor or case-mix adjustment is critical. When such measures are analyzed in home health care, characteristics of the patient's support system and home environment also must be taken into consideration.

Since other analysis components of this study found evidence in support of case-mix and cost differences in the provision of home health care under HMO and FFS settings, an analysis of outcomes in these two settings is appropriate (Shaughnessy et al., 1994). In particular, in view of the heterogeneity of admitting home health case mix in HMOs (especially in HMOs that own their own home health agencies [HHAs]), and in view of the lower per episode use and cost of home health care in HMOs, the possibility of outcome differences is substantial. A priori, we hypothesized that outcomes for home health patients would be superior in HMOs, since the more extensive management and integration of health care would be expected to produce more effective results for in-home care. However, solely on the basis of the more heterogeneous case mix and especially the

substantially lower per episode use and cost of home health care under HMOs, this hypothesis would appear to be less probable than we originally expected.

METHODS AND DATA

General Approach

In order to compare outcomes between Medicare HMO and Medicare FFS patients admitted to home health care, three types of HHAs were recruited to participate in the study. These consisted of nine HMO-owned agencies, which included only agencies owned and operated by Medicare risk HMOs for the purpose of providing home health care to their enrollees (such agencies not only provide home care to non-Medicare HMO enrollees, but also they occasionally provide care to non-HMO enrollees). Fifteen pure-FFS agencies were recruited as a comparison group. Their patients constituted a comparison group of FFS home health care patients to be analyzed in conjunction with HMO patients from HMO-owned agencies. Pure-FFS agencies could not have more than 5 percent (and typically had less than 2 percent) of their total Medicare admissions accounted for by Medicare HMO patients. Lastly, 14 mixed (or contractual) agencies were recruited. As with the HMO-owned and pure-FFS agencies, the mixed agencies were Medicare-certified. Each mixed agency was required to have a minimum of 15 FFS Medicare admissions per month and 15 Medicare HMO admissions per month from their largest contracting HMO. From the perspective of the outcome analyses documented here, the purpose in recruiting the mixed agencies was twofold. First, outcomes for Medicare HMO versus Medicare FFS patients were compared within the mixed agency pool of patients. Second, by pooling HMO patients from mixed agencies and HMO-owned agencies and comparing their outcomes with FFS patients pooled from pure-FFS and mixed agencies, it would be possible to compare HMO versus FFS outcomes in general. In supplemental analyses, outcomes were compared between Medicare HMO patients admitted to HMO-owned agencies and those admitted to mixed agencies; other comparisons, such as pure-FFS versus mixed-FFS patients, were also analyzed and are reported in summary form in the findings section.

The 38 study agencies were located in 18 States. They were selected so their geographic distribution approximated the locations of Medicare risk HMOs in the United States, subject to other requirements such as the design requirement for different types of HHAs indicated. Dividing the United States into three areas according to Federal regions, the Northeast (Regions I-III), South and Central (Regions IV-VI), and West (Regions VII-X), 24 percent, 36 percent, and 40 percent of Medicare risk HMOs were located in these regions, respectively, during the study time period. Analogously, 19 percent, 31 percent, and 50 percent of our study's HHAs were selected from these respective regions. Although study agencies were not selected to be geographically representative of the distribution of all certified agencies in the country, the FFS patients in the study resembled all Medicare FFS patients in the United States in terms of selected utilization statistics. During the study period, 68 percent of all Medicare home health patients in the United States were discharged within 60 days, while the average Medicare patient received 19.0 visits within the first 60 days after admission. For FFS patients in this study, 71 percent were discharged within

60 days, while the average patient received 18.8 visits within the first 60 days.

Samples and Data Collection

A random sample of 1,632 Medicare home health patients was used in the patient-level analyses. This sample included 943 FFS patients and 689 HMO patients. Of these, 308 patients were sampled from HMO-owned agencies, 529 patients were from pure-FFS agencies, 381 HMO patients were from mixed agencies, and 414 FFS patients were from mixed agencies. Only Medicare patients admitted to study agencies between November 1989 and June 1991 were eligible for the random sample. Since Medicare bill data are neither generally available for HMO patients nor useful for patient status outcomes, we did not use the Medicare statistical files for the patient-level analyses documented here (except for certain data items such as mortality).

For mixed agencies, all Medicare FFS patients 65 years of age or over were eligible for sampling, while only those Medicare HMO patients 65 years of age or over enrolled in the agency's largest contracting HMO were eligible (in two agencies, patients enrolled in the two largest contracting HMOs were included to provide an adequate sample size). In the pure-FFS and HMO-owned agencies, all Medicare beneficiaries 65 years of age or over were eligible for inclusion in the random sample. Onsite training sessions for data collectors and support staff were conducted at each study agency by a research center staff nurse. The training sessions involved agency data collectors (primary care nurses and therapists), administrative staff, and appropriate clerical personnel who would participate in the study. Instruments and directions for their use were reviewed separately. Many agencies videotaped the training sessions. When this was not done, audio tapes of the training sessions were made and left with the agency at the end of training. Data collectors sampled randomly from each week's admissions until the random sample quota of 40 HMO patients or 40 FFS patients was reached (both quotas were used at mixed agencies). Because of time constraints and logistical difficulties at selected field sites, several agencies did not reach their sample quotas, and we therefore collected data on additional patients at other agencies. Separate analyses were undertaken to ascertain whether agencies with larger samples of patients were different from agencies with smaller samples of patients in terms of patient outcomes, with the conclusion that agency-specific sample size was not related to the final conclusions that could be drawn from the study. Agency data collectors completed each instrument by interviewing primary care providers for the patient and by reviewing clinical records. Prior feasibility studies had shown that clinical records alone were inadequate to obtain the types of patient status data needed to measure outcomes for this study. Each site had a data collection coordinator who monitored and managed all study activities at the agency, serving as a liaison between the agency and the research center study team.

Completed questionnaire answer sheets and patient consent forms were mailed to the research center weekly by each agency. The start-of-care (or baseline) questionnaires provided information on health status, diagnoses, treatments, complications, admission source, household and family characteristics, and demographics. Questionnaires were also administered at 3, 6, 9, and 12 weeks after start of care (or until the patient was discharged from the agency) to obtain information on health

status, treatments, complications, and services provided. Other questionnaires were used to provide data on patient attributes and service use when individual patients used specific types of non-home health services (e.g., physician, emergency room, and hospital care) or if the patient was discharged or died.

Thus, the study interval was 12 weeks or less. Discharge was defined such that inpatient hospitalization or admission to a nursing home would be regarded as discharge (at which time patient status information was collected). The rationale for selecting this approach to following patients (i.e., until discharge or 12 weeks, whichever occurred first) was twofold. First, the Medicare home health benefit is targeted predominantly at patients who require relatively brief episodes of home health care (by long-term care standards) to treat a reasonably well-defined or circumscribed problem. For example, typical problems treated in home health care are orthopedic conditions resulting from hip fracture, surgical wounds, and cardiac or pulmonary conditions. Effectiveness of treatment of such problems often can be assessed in terms of improved patient functioning and/or discharge to independent living. Thus, change in patient condition over a relatively short period of time and/or discharge to independent living can be expected to result from effective Medicare-covered home health care. (Although Medicare home health use, including stays and visits, has been increasing in recent years, the vast majority of stays are well under 12 weeks in length.) Secondly, especially in view of the relatively short-term nature of Medicare home health care, followup periods of considerably greater duration (e.g., 6 months, 12 months, or even 2 years) would likely encompass a variety of other types of health care services, including not only physician care but quite possibly hospital care. If a patient has a positive or negative outcome over a 12-month or 2-year period during which he or she received not only home health care but also hospital care, physician care, skilled nursing facility care, etc., it is difficult if not impossible to attribute these outcomes to specific care modalities such as home health care. Since the overriding purpose of this study was to examine the cost and effectiveness of Medicare home health care, we used a circumscribed approach to defining an episode of care, in which the dominant type of care provided during this episode would be home health care (for the average patient). The study design was therefore intended to partially control for the substantial effects of other types of care (especially institutional care) on outcomes and cost.

All questionnaire answer sheets were logged into a computerized tracking system. Longitudinal tracking of information for each patient was triggered by the initial baseline form. Prior to electronically scanning the completed answer sheets, all forms were reviewed by a study team member to ensure consistency in various types of identifying information and appropriateness of answers to single and multiple response questions. Computerized editing and consistency checking were conducted thereafter. Reimbursement occurred monthly for agencies on the basis of the number of forms received. At time of payment, if there were missing data or related problems, a letter was mailed to each agency regarding such issues. If agencies did not respond, followup phone calls were made to the agency data collection coordinator to resolve problems. Agency personnel received tracking forms for use

in maintaining records on sample patients, due dates, and the dates forms were mailed.

Outcome Measures

Ideally, a single measure should be used to quantify an overall outcome for each patient. However, each individual patient is a composite of many different attributes that reflect health status. Unfortunately, we are far from developing one comprehensive measure that captures change across the many different attributes of health status. Therefore, in this article (as in other studies), we have used a number of outcome measures that reflect change in health status. Since Medicare patients often have post-acute conditions or are characterized by exacerbations of chronic problems, both of which tend to result in reduced functioning, measures that reflect functional improvement or stabilization (along with improvement or stabilization in selected physiologic conditions) constitute the more important outcome measures used on the study.

As indicated previously, two general categories of outcome measures were used: patient status outcomes and utilization outcome measures. Patient status outcomes refer to changes in patient health status between baseline (admission) and a followup time point or time points. Utilization outcomes refer to specific types of health services utilization or represent a positive or negative change in the patient's living situation. Such events are regarded as surrogates for changes in patient condition (e.g., hospitalization and discharge to an independent living situation). Table 1 shows the specific patient status indicators used in applying the six general types of outcome measures. These are a subset of the patient status indicators used in the total analysis of outcomes. They were chosen for presentation since the results for the outcome measures for these indicators typify the results for all outcomes. Brief definitions of the mortality and utilization outcome measures are also given.

As an illustration of the patient status outcome measures, consider the patient status indicator of bathing. Improvement in bathing status could occur if the patient was initially dependent in bathing and had improved in terms of his or her bathing disability at the followup time point (either 3 weeks or 12 weeks). Since the bathing disability scale takes on values between 0 and 5 (with higher values indicating progressively more disability) the patient's value on this scale would have to decrease for the improvement-in-bathing status measure to take on the value 1. It is important to note that this variable is not defined for patients who are initially independent in bathing (i.e., cannot improve). The measure that reflects an improvement pattern in bathing takes interim time points into consideration in that the patient not only must improve in bathing by the final time point, but could not have worsened at any of the interim time points in order to achieve a value of 1 for this dichotomous measure. A patient is discharged improved in bathing if the patient was discharged to independent living and improved at the followup point (either 3 weeks or 12 weeks). As with the two preceding measures, this outcome measure is not defined if the patient cannot improve (is independent) at admission. The term stabilization refers to non-worsening, i.e., followup patient status is the same as or better than at start of care. The three definitions for stabilized in bathing, stabilization pattern in bathing, and discharged stabilized in bathing are analogous to the above definitions that entail improvement, except that non-worsening is used instead of

Table 1

Outcome Measures

Patient Status Indicators Defining Outcome Measures[1]

Bathing (0-5)
Grooming (0-4)
Eating (0-6)
Toileting (0-4)
Transferring (0-6)
[2]Number of Mild ADL Impairments (0-5)
[2]Number of Moderate ADL Impairments (0-5)
[2]Number of Severe ADL Impairments (0-5)
Oral Medications Management (0-2)
Light Meal Preparation (0-2)
Cooking Main Meals (0-2)
Laundry (0-2)
Shopping (0-2)
[2]Number of Mild IADL Impairments (0-5)
[2]Number of Severe IADL Impairments (0-5)
[2]Number of Mild IADL Impairments (0-3)
Presence of Catheter (0-1)
Urinary Incontinence (0-2)
Number of Pressure Ulcers (0-5)
Grade of Pressure Ulcers (0-4)
Depression (0-2)

Patient Status Outcomes: General Definitions[3]

Improvement in Status:	If the patient's status improves between admission and the followup point, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot improve (e.g., are independent functionally or do not have the condition or problem) are excluded.
Improvement Pattern in Patient Status:	If the patient's status improves between admission and the followup point, and does not worsen at any interim data collection points, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot improve (e.g., are independent functionally or do not have the condition or problem) are excluded.
Discharged Improved in Status:	If the patient is discharged to an independent living situation and the patient's status improves at discharge, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot improve (e.g., are independent functionally or do not have the condition or problem) are excluded.
Stabilized in Status:	If the patient's status does not worsen between admission and the followup point, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot worsen (e.g., are at the most severe level of functioning or the most severe level of the problem or condition) are excluded.
Stabilization Pattern in Status:	If the patient's status does not worsen between admission and the followup point, and does not worsen at any interim data collection points, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot worsen (e.g., are at the most severe level of functioning or the most severe level of the problem or condition) are excluded.
Discharged Stabilized in Status:	If the patient is discharged to an independent living situation and the patient's status does not worsen between admission and discharge, this variable takes on the value 1—otherwise it is 0. *Case selection:* Patients who cannot worsen (e.g., are at the most severe level of functioning or the most severe level of the problem or condition) are excluded.

Mortality and Utilization Outcome Measures

Mortality:	Several measures of mortality were analyzed, each taking on the value of 1 if the patient died, or 0 if the patient was alive at followup. The followup points were discharge, 12 weeks after admission, and 6 months after admission.
Discharged to Independent Living:	Two measures were analyzed, each taking on the value 1 if the patient was discharged to independent living and 0 otherwise. The measures correspond to discharge to independent living during the first 3 weeks after admission and discharge to independent living during the first 12 weeks after admission, respectively.
Hospitalization:	This measure takes on the value 1 if the patient was hospitalized within the 12-week followup period or at the time of discharge, whichever came first.
Discharge to Hospital for Emergent or Urgent Care:	These measures take on the value 1 if the patient was discharged to the hospital for emergent (urgent) care within the 12 week followup period or at the time of discharge, whichever came first.

[1] The range of possible values is given in parentheses. For each item, 0 indicates the absence of the condition or disability and higher values indicate progressively greater disability or impairment.
[2] The five ADLs used for the outcomes that pertain to number of (mild, moderate, severe) ADL impairments are bathing, grooming, eating, toileting, transferring; the five IADLs used are management of oral medications, light meal preparation, cooking main meals, laundry, and shopping; and the outcome measures that involve only three IADLs used oral medications management, light meal preparation, and shopping.
[3] For each patient status item, six outcome measures were constructed. Followup time points of 3 weeks and 12 weeks were used for each of the above measures, except the pattern variables. These apply only to the 12-week followup point, since they require interim data collection points for their definition. Data collection took place at admission, 3, 6, 9, and 12 weeks. If a patient was discharged between any two time points, discharge was defined to be the followup point for each of the above measures.

NOTES: ADL is activity of daily living. IADL is instrumental activity of daily living.

SOURCE: Shaughnessy, P.W., Schlenker, R.E., and Hittle, D.F., University of Colorado, 1994.

improvement. The mortality and utilization outcome measures defined in Table 1 are self-explanatory.

Although all outcome measures in Table 1 were analyzed, results are presented largely for selected utilization outcomes and for patient status outcomes corresponding to activity of daily living (ADL) and instrumental activity of daily living (IADL) outcomes using the (discharged) improved or stabilized measures, since the pattern measures produced similar results. Followup time points of 3 weeks and 12 weeks were used for each patient status measure. In addition to the patient status items used for outcome measurement, several condition-specific measures were used. For example, supplementing the general functional ADLs in Table 1, more specific functional measures were used for rehabilitation patients—such as improvement and stabilization measures of ability to dress upper body and ability to dress lower body. Analogously, improvement and stabilization measures of pain and knowledge of pain management were analyzed for terminally ill patients. Improvement and stabilization in interpersonal communication were assessed for patients with mental and behavioral conditions. For patients requiring wound care, improvement and stabilization of surgical wounds (as well as stasis ulcers, arterial ulcers, and pressure ulcers) were analyzed. Measures of improvement and stabilization in shortness of breath were examined for cardiac patients. Findings for condition-specific measures are presented in a few instances, to supplement the tabular results for more global measures that were risk factor-adjusted for larger patient groups. The final analysis results presented here focus on the 12-week outcome measures (i.e., 12 weeks or discharge, whichever occurred first) because such measures correspond to the final time point of the study interval and therefore more comprehensively reflect the effectiveness of home health care.

Case-Mix Measures and Covariates

Risk factors (case-mix variables and other factors) used to adjust the outcome measures through logistic regression models are presented in Table 2. Thereafter, demographic and environmental characteristics that are potentially relevant to home health care outcomes are enumerated. Several of the variables listed as "diagnosis" variables were considered separately for primary diagnoses and for primary or secondary diagnoses. A number of variations of case-mix variables and covariates in Table 2 were used in initially estimating the logistic regression models for outcomes. For example, various dichotomies which denote the presence or absence of different levels of disability were derived using the scales for ADL and IADL impairments. For the most part, however, we found that the scale measures shown in Table 2 were the most useful independent variables in such models. These case-mix variables usually explained more variation in outcome measures than dichotomies.

Reliability and Statistical Methods

An interrater reliability analysis was undertaken using the patient status measures presented in Table 1. The test was conducted at 7 HHAs, using admission data on 43 patients. Two data collectors independently interviewed the HHA staff member responsible for the patient's admission assessment. Interrater reliability coefficients for the patient status measures in Table 1 were typically greater than .70 for both Cohen's kappa and Pearson's r.

Table 2

Case-Mix Measures and Covariates Used to Adjust Outcome Measures

Case Mix Variables (Range)[1]

Bathing Dependency Scale (0-5)
Grooming Dependency Scale (0-4)
Feeding Dependency Scale (0-6)
Toileting Dependency Scale (0-4)
Transferring Dependency Scale (0-6)
Number of Mild ADL Impairments (0-5)
Number of Severe ADL Impairments (0-5)
Oral Medications Dependency Scale (0-2)
Light Meal Preparation Dependency Scale (0-2)
Full Meal Preparation Dependency Scale (0-2)
Laundry Dependency Scale (0-2)
Shopping Dependency Scale (0-2)
Number of Mild IADL Impairments (0-5)
Number of Severe IADL Impairments (0-5)
Vision Impairment (0-1)
Hearing Impairment (0-1)
Urinary Incontinence (0-1)
Grade of Pressure Ulcer (0-4)
Quadriplegia (0-1)
Hemiplegia (0-1)
Dehydration (0-1)
Internal Bleeding (0-1)
Lethargic Mental State (0-1)
Demonstrated Behavioral/Memory Deficit (0-1)
Demonstrated Behavioral/Impaired Decisions (0-1)
Rehabilitative Potential Scale (0-2)
Recovery Potential Scale (0-1)
Orthopedic/Neurologic Impairment Affecting Lower Limbs (0-1)
Orthopedic/Neurologic Impairment Affecting Lower Limbs or Neurologic Functioning (0-1)
Nonrehabilitative Neuromuscular Condition (0-1)
Open Wounds with Live-in Caregiver (0-1)
End-Stage Condition (0-1)
Cardiac Conditions (0-1)
Pulmonary Conditions (0-1)
Diabetes Mellitus (0-1)

Case Mix Variables (Range)[1]—Continued

Urinary Incontinence or Catheter (0-1)
Gastrointestinal Disorder (0-1)
Mental/Behavioral Disorder (0-1)
Diagnosis: Infection (0-1)
Diagnosis: Neoplasms (0-1)
Diagnosis: Endocrine, Nutritional (0-1)
Diagnosis: Mental Disorder (0-1)
Diagnosis: Nervous System (0-1)
Diagnosis: Circulatory System (0-1)
Diagnosis: Respiratory System (0-1)
Diagnosis: Genitourinary System (0-1)
Diagnosis: Skin Subcutaneous (0-1)
Diagnosis: Musculoskeletal System (0-1)
Diagnosis: Fractures (0-1)
Diagnosis: Other Injury (0-1)
Personal Care Likelihood Index[2] (0-100 percent)
Functional/Behavioral Care Likelihood Index[3] (0-100 percent)

Demographic/Environmental Covariates (Range)[1]

Age (Years)
Female (0-1)
Married (0-1)
Prior Location—Nursing Home (0-1)
Prior Location—Rehabilitation Unit/Facility (0-1)
Prior Location—Residential Care/Board Home (0-1)
Prior Location—Private Residence (0-1)
Prior Location—Hospital (0-1)
Resides in Own Home (0-1)
Resides in Family Member's Home (0-1)
Resides in Board-and-Care Facility (0-1)
Living Situation—Alone (0-1)
Living Situation—With Spouse (0-1)
Living Situation—With Child(ren) (0-1)
Died While a Home Care Patient (0-1)

[1]Variable names are intended to be self-explanatory. The variable ranges are in parentheses. Ranges in which the largest value is one denote dichotomies, while all others denote at least ordinally scaled variables. For several of the variables that correspond to patient status scales (e.g., bathing dependency scale), dichotomous variables were also used as case-mix variables to reflect the presence or absence of a given level of dependency. For example, three dichotomies were used for bathing to denote mild, moderate, and severe bathing disabilities by dichotomizing the 0-5 scale at different levels.
[2]This personal care index reflects the percentage of the following conditions inherent in the patient or his/her environment: age $\geq$ 80, severe IADL dependency in light meal preparation, severe IADL dependency in full meal preparation, severe IADL dependency in laundry, severe IADL dependency in shopping, receives informal assistance in homemaking, moderate or no rehabilitation potential, and moderate or no recovery potential.
[3]This functional care index reflects the percentage of the following conditions inherent in the patient or his/her environment: age $\geq$ 80, severe dependency in medications management (counted twice), severe ADL dependency in bathing, receiving informal ADL care, end-stage/terminal condition, little or no rehabilitation potential or little or no recovery potential, resides in board-and-care home or congregate living, neuromuscular nonrehabilitative condition, mental/behavioral condition, and mild or severe urinary incontinence.

NOTES: ADL is activity of daily living. IADL is instrumental activity of daily living.

SOURCE: Shaughnessy, P.W., Schlenker, R.E., and Hittle, D.F., University of Colorado, 1994.

Although a few of the variables had reliability coefficients somewhat less than .70, the interrater reliability for the patient status indicators upon which the outcome measures are based was always greater than .60. Reliability tests were not conducted for the outcome measures themselves, because the interrater reliability data were collected only at admission. However, since care providers and data collectors were typically more familiar with the patient at followup time points than at admission, it is likely that interrater reliability for followup time points would have been greater than at admission.

Profiles of (unadjusted) outcome measures were initially compared using statistical tests for mean differences for each of the three major comparisons of interest: all HMO patients versus all FFS patients; HMO patients from HMO-owned agencies versus pure-FFS patients; and mixed-HMO

versus mixed-FFS patients (the same statistical tests were used for the other unadjusted comparisons that are reported in summary form in the findings section). All analyses were conducted at the patient level. The primary statistical tests used were Fisher's exact test and the chi-square test for the difference between two proportions, since most outcome measures were dichotomous. Additional outcome measures were used in the initial screening stages of the analysis, several of which were continuous or nearly continuous. In these cases, the appropriate equal variance or unequal variance *t*-test for mean differences was used or, if the underlying distribution was found to be non-normal, a Wilcoxon test for shift differences was used.

Aggregate outcome measures other than those indicated in Table 1 were used in analyzing the initial profiles, such as changes in the total number of ADL or IADL dependencies; the extent to which the total number of ADL, IADL, or physiologic dependencies/conditions improved, subject to the constraint that none had worsened over time; and changes in the count of mild, moderate, or severe disabilities between admission and followup time points. However, the initial findings indicated that the results for the patient status measures and the mortality and utilization outcome measures defined in Table 1 provided a representative overview of the patterns that emerged from using all measures, including additional dichotomous and aggregate outcome measures.

After selecting outcome measures for the final analyses, case-mix or risk factor/covariate adjustment was conducted using logistic regression because the final outcome measures were dichotomous. Ordinary least squares regression was employed in some of the preliminary multivariate analyses using certain aggregate or near-continuous outcome measures. Logistic regression models for outcome variables were estimated by first specifying expected relationships on conceptual and clinical grounds, and then examining correlation matrices among the independent variables and outcome measures. Independent variables were chosen substantively on the basis of their combined clinical and statistical relationship with each individual outcome measure. Stepwise logistic regression was used in conjunction with clinical and substantive judgment to eliminate insignificant case-mix variables or covariates, always forcing the "treatment" or group membership variable to be in the model. For example, for the "pure" comparison, the treatment variable takes on the value 1 if the patient is an HMO patient from an HMO-owned agency, and 0 if the patient is an FFS patient from a pure-FFS agency. This variable was always included in the models involving this comparison. The statistical significance of the coefficient (or odds ratio) for the treatment variable was then used as the significance of the case-mix- and covariate-adjusted mean difference between the two groups of interest. For each final outcome measure, the unadjusted mean difference and its statistical significance are presented in the findings section, along with the case-mix- and covariate-adjusted mean difference, which can be computed by holding one of the two original group means constant and computing the other using the case-mix-adjusted odds ratio. (The one exception to the case-mix-adjustment process, i.e., where case-mix adjustment was not done, involved the condition-specific outcomes, such as improvement in dressing upper body for rehabilitation patients. Since sample sizes for such conditions were sometimes relatively small and since these types

of analyses were regarded as descriptive and supplemental to the analyses based on the overall samples, case-mix adjustment was not considered appropriate.)

Conducting the large number of individual statistical tests required for these analyses increased the probabilities of family error rates (i.e., the likelihood of spurious significance increases with the number of statistical tests). In initially analyzing the outcome profiles, the effects of simultaneous testing were examined using four-group logistic regression analyses and four-group discriminant analyses. These analyses entailed simultaneous comparison of the four profiles of variables corresponding to patients from pure-FFS agencies, HMO-owned agencies, and mixed agencies (which provided two groups of patients, HMO and FFS patients). While the analyses reduced the number of significant variables to some extent, they did not change the overall pattern of findings. Since the two-group analyses were more substantively informative, the final results are presented in the form of several two-group comparisons. Supplemental two-group analyses were also important to establishing and cross-validating patterns of findings. The intent of the supplemental analyses was to examine outcomes for specific groups of patients (e.g., rehabilitation patients, those with wounds, patients requiring intravenous therapy, patients without a willing and able caregiver at home). These stratified analyses (stratified by condition or patient circumstance) were conducted because, while multivariate procedures permit the simultaneous assessment of several risk factors on dependent variables, they perforce assume an underlying structure or functional form for the interrelationships between risk factors and dependent variables such as outcomes. If the overall outcome findings persist by comparing HMO and FFS patients across strata, the credibility and consistency of the multivariate findings is enhanced, because the patterns of results are then pervasive for separate groups of patients independently of assuming and estimating specific (types of associative) relationships among independent variables—and between independent and dependent variables. For this reason, analyses were conducted that controlled for risk factors through both multivariate procedures and stratification. Hence, final inferences were based on the two-group (stratified and risk-factor-adjusted) comparisons, taking into consideration the results of simultaneous testing and, most importantly, basing interpretations on patterns of findings rather than on a single variable or only a few specific variables.

Illustrative Logistic Regression Results

Tables 3 and 4 contain two logistic regression models intended to illustrate the methodology used in adjusting outcome measures for risk factors and other covariates. The logistic regression model in Table 3 pertains to the outcome of stabilized in transferring within 12 weeks (or discharge, whichever came first), providing a comparison of Medicare HMO patients with Medicare FFS patients (i.e., HMO patients from HMO-owned and contractual agencies were pooled for this analysis, as were FFS patients from pure-FFS and contractual agencies). The unadjusted mean for HMO patients is 89.7 percent, significantly lower than the unadjusted mean for FFS patients (92.8 percent). This difference is reflected by an odds ratio of .676, which is significantly less than 1.0 (p = .080 using a two-tailed test, or p = .040 using a one-tailed test).

Table 3

A Case-Mix-Adjusted Comparison of the Percentages of Medicare HMO Patients Versus Medicare FFS Patients Who Stabilized in Transferring Within 12 Weeks[1]

Rates and Odds Ratios for Stabilization in Transferring	Unadjusted[2]	Case-Mix-Adjusted[3]
HMO Patients (in Percent)	89.7	86.6
FFS Patients (in Percent)	92.8	92.8
HMO Odds Ratio	.676	.500
Significance	.080	.004
Logistic Regression R^2: [4] .142		
Significance: [4] <.001		
Percent of Cases Correctly Classified: 91.6		
Independent Variables	Coefficients	Significance[5]
HMO Patient (0-1)	-0.69	.004
Urinary Incontinence/Catheter (0-1)	-1.22	<.001
Transferring Dependency Score (0-6)	0.76	<.001
Grooming Dependency Score (0-4)	-0.35	.002
End-Stage Condition (0-1)	-0.73	.033
Laundry Dependency Score (0-2)	-0.86	.046
Functional/Behavioral Care Likelihood Index (0-100 Percent)	-0.02	.058
Light Meal Preparation Dependency Score (0-2)	-0.46	.058
Constant	5.49	.090

[1]Patients were followed at 3-week intervals for 12 weeks or until discharge.

[2]The outcome variable takes on the value 1 if the patient stabilized in transferring prior to discharge or 12 weeks after admission, whichever came first—otherwise it is 0. The unadjusted odds ratio and its significance are based on logistic regression with only the HMO dichotomy as the independent variable, b as its coefficient, $\exp(b)$ as the estimate of the odds ratio, and the significance level is the p-value for the chi-square test corresponding to the log of the likelihood ratios (with and without the HMO variable in the logistic regression).

[3]*The estimate of the adjusted odds ratio is* $\exp(b)$, *where* b *is the coefficient of the HMO variable in the full logistic regression model. Its significance is* that associated with b in the logistic regression equation, based on a chi-square test using the Wald statistic. The adjusted mean for HMO agency patients is obtained from the adjusted odds ratio, using the original mixed agency mean.

[4]The R^2 is analogous to the R^2 in ordinary least squares regression and is given by $(X^2 - 2p)/(-2L_0)$, where X^2 is the overall chi-square for the model, p is the number of independent variables, and L_0 is the log-likelihood with only the intercept in the model. The significance level is the p-value for the overall chi-square.

[5]Significance levels correspond to the chi-square tests for the respective independent variables using the Wald statistic, as described for the HMO variable in note 3.

NOTES: HMO is health maintenance organization. FFS is fee-for-service.

SOURCE: Based on random samples of 689 HMO patients and 943 FFS patients admitted to 23 home health agencies (9 HMO-owned and 14 contractual) and 29 home health agencies (15 pure-FFS and 14 contractual), respectively, between November 1989 and June 1991.

After case-mix adjustment using logistic regression, the difference in the mean values for the outcome is even greater, with a significant odds ratio of .500 (p = .004). In this case, the case-mix-adjusted mean for the outcome variable for HMO patients (86.6 percent) was computed by holding constant the mean for FFS patients (92.8 percent), and using the case-mix-adjusted odds ratio to compute the mean for HMO patients. This particular logistic regression model contains eight independent variables. Each such model was estimated allowing independent variables to enter the model if they were significant at $p < .15$. The "treatment" variable (i.e., the dichotomy that corresponds to whether the patient is an HMO patient) has a negative coefficient, indicating that the outcome is lower for HMO patients. In fact, the only variable with a positive coefficient in this model is the transferring dependency score (this is the transferring dependency scale from Table 2). Since this model uses stabilization in transferring as the outcome variable, patients who were unable to worsen (i.e., took on the value 6 for the transferring dependency scale) were excluded from the analysis. The positive sign for the coefficient of this transferring scale independent variable indicates that the more severely disabled in transferring a patient is initially, the more likely the patient is to stabilize (i.e., less likely to

Table 4

A Case-Mix-Adjusted Comparison of the Percentage of Medicare HMO Patients Admitted to High Resource Consumption (RC) Versus Low RC Agencies Who Were Stabilized in Bathing and Discharged to Independent Living Within 12 Weeks: Logistic Regression[1]

Rates and Odds Ratios for Stabilized in Bathing and Discharged to Independent Living	Unadjusted[2]	Case-Mix-Adjusted[3]
High RC Agency Patients (in Percent)	74.0	69.6
Low RC Agency Patients (in Percent)	60.9	60.9
High RC Agency Odds Ratio	1.830	1.469
Significance	.018	.171

Logistic Regression R^2: [4].171
Significance: [4]<.001
Percent of Cases Correctly Classified: 74.2

Independent Variables	Coefficients	Significance[5]
High RC Agency (0-1)[1]	0.38	.171
Rehabilitative Potential (0-2)	0.58	.004
Transferring Dependency Score (0-6)	-2.50	.018
Mental/Behavioral Condition (0-1)	-0.95	.026
Orthopedic Impairment Affecting Lower Limbs (0-1)	1.15	.028
Open Wounds, No Live-in Caregiver (0-1)	1.67	.030
Resides in Own Home (0-1)	0.71	.048
Constant	-0.25	.090

[1]Four of the original nine HMO-owned agencies were excluded because data were not available. Patients were followed at 3-week intervals for 12 weeks or until discharge. The 19 agencies were divided into "high" and "low" groups on the basis of their median RC values. These values were computed for a given patient by assigning a dollar value to each home health visit (by discipline) and aggregating such values over all visits during the study interval. Each agency was assigned its median patient-level RC value. The 10 agencies with the highest RC values constituted the "high" group, while those with the lowest 9 values constituted the "low" group. The "high RC agency" variable takes on the value 1 or 0 depending on whether the patient is in a "high RC" or "low RC" agency, respectively.

[2]The outcome variable takes on the value 1 if the patient stabilized in bathing and was discharged to independent living within 12 weeks of admission—otherwise it is 0. The unadjusted odds ratio and its significance are based on logistic regression with only the high RC agency dichotomy as the independent variable, b as its coefficient, $\exp(b)$ as the estimate of the odds ratio, and the significance level is the p-value for the chi-square test corresponding to the log of the likelihood ratios (with and without the high RC agency variable in the logistic regression).

[3]The estimate of the adjusted odds ratio is $\exp(b)$, where b is the coefficient of the high RC agency variable in the full logistic regression model. Its significance is that associated with b in the logistic regression equation, based on a chi-square test using the Wald statistic. The adjusted mean for high RC agency patients is obtained from the adjusted odds ratio, using the original mixed agency mean.

[4]The R^2 is analogous to the R^2 in ordinary least squares regression and is given by $(X^2 - 2p)/(-2L_0)$, where X^2 is the overall chi-square for the model, p is the number of independent variables, and L_0 is the log-likelihood with only the intercept in the model. The significance level is the p-value for the overall chi-square.

[5]Significance levels correspond to the chi-square tests for the respective independent variables using the Wald statistic, as described for the high RC agency variables in note 3.

NOTE: HMO is health maintenance organization.

SOURCE: Based on a random sample of 995 (468 low RC and 527 high RC) HMO patients admitted to 19 home health agencies (5 HMO-owned and 14 contractual) between November 1989 and June 1991.

worsen)—a relationship that should obviously be taken into consideration in the case-mix-adjustment process for the (dichotomous) outcome variable of stabilization in transferring within 12 weeks.

The negative coefficients for the case-mix variables corresponding to urinary incontinence or catheter, grooming dependency score, end-stage condition, laundry dependency score, functional/behavioral care (likelihood) index, and light meal preparation dependency score indicate that patients with these conditions (or greater degrees of dependency in these areas) are less likely to stabilize in transferring. All of these relationships should be intuitively clear, although the functional/behavioral care (likelihood) index warrants comment. This index was computed as the percentage of several conditions inherent in the patient or his or her environment (see Table 2). The basic purpose of the index is to provide a measure of the potential chronicity of the patient's overall condition. Thus, higher values for this particular index are associated with a lower likelihood of stabilization in transferring. In all, since several of the independent variables

or conditions were more severe among FFS patients (e.g., the several dependency scores and urinary incontinence or catheter), these independent variables are the primary reason why one would expect inferior stabilization (in transferring) outcomes for FFS patients. Since this did not occur, these factors constitute the primary reason why case-mix adjustment increases the already significant discrepancy between the stabilization outcome rates for the two patient groups.

The logistic regression model in Table 4 illustrates an approach that was taken in one of the supplemental analyses. HMO patients were divided into high and low resource consumption (RC) groups depending on whether the agency that provided care to each patient was a high or low RC agency. In the context of the cost analysis component of the study, an RC measure was computed for each patient by multiplying the number of visits from each home health discipline times the national average Medicare-determined cost for the visit. This yielded an overall cost per episode or RC value for each patient. The median RC value among all study patients was computed for each agency, and agencies were divided into "high RC" and "low RC" groups depending on whether they were ranked in the upper or lower 50 percent of agencies according to their RC values. Thus, the high RC group tended to provide more visits and cost more to the Medicare program than the low RC group. The issue under consideration in this supplemental analysis (which entailed analyzing a number of outcome variables) was whether higher resource consumption resulted in superior patient-level outcomes.

As is apparent from Table 4, the unadjusted, significant mean difference and odds ratio (p = .018) were reduced to under 9 percentage points and a value of 1.469, respectively, through case-mix adjustment. The resulting mean difference and odds ratio were insignificant (p = .171). While the positive coefficient for the high RC agency variable would imply that superior outcomes are associated with higher RC among HMO patients, this hypothesis cannot be accepted on the basis of this particular model because the high RC coefficient is insignificant. The model contains six other independent variables, two of which have negative coefficients: transferring dependency score and mental or behavioral condition. The negative coefficients for each of these variables indicates that greater dependency in these two areas results in lower likelihood of stabilization in bathing and discharge to independent living—as would be expected. The positive coefficients for the variables corresponding to rehabilitation potential and orthopedic impairment affecting lower limbs are in keeping with the expectation that patients with a positive rehabilitation prognosis would be more likely to stabilize in bathing and be discharged to an independent living environment. The variable that corresponds to open wounds with no live-in caregiver suggests both an acute condition (e.g., a post-surgical wound that is expected to heal) and a home environment where the patient has heretofore taken care of himself or herself—again carrying the expectation that the patient is likely to stabilize in the bathing ADL and be discharged to independent living. Lastly, if the patient resides in his or her own home, the environment is conducive to stabilization and discharge to independent living. After adjustment for the several independent variables in Table 4 that are related to the outcome measure of stabilized in bathing and discharge to independent living, the mean difference between high RC agency patients and low RC agency patients is therefore eliminated. As will be discussed later, however, case-mix

adjustment did not eliminate all such outcome differences (for the high RC versus low RC comparisons).

The logistic regression R^2s in Tables 3 and 4 are akin to but not the same as the R^2s for ordinary least squares regression. Along with the percentage of cases correctly classified, the R^2-statistic represents an overall measure of the goodness of fit of the logistic regression model.

FINDINGS

Utilization by Length of Stay

Descriptive statistics on utilization are presented in Table 5. It is apparent from this table that both total visits and visits per week during the first 60 days after admission are substantially higher for FFS patients than for HMO patients. Further, patients admitted to HMO-owned agencies have fewer total visits and lower visit intensities during the first 60 days than HMO patients receiving care under contractual arrangements with mixed agencies. The higher visit count and visit intensity for mixed-FFS patients relative to pure-FFS patients is partly due to case-mix differences (Shaughnessy et al., 1994) and due possibly to the fact that pure-FFS agencies tend to be smaller than mixed agencies. (The median number of Medicare admissions per month for the pure-FFS agencies was 47, compared with 105 for the contractual [mixed] agencies, which were perforce larger due to the design requirement that such agencies admit at least 15 Medicare FFS and 15 HMO patients per month.)

A higher proportion of mixed HMO patients were discharged within the first 3 weeks, relative to all other types of patients. In addition, a higher percentage of HMO patients admitted to HMO-owned agencies were retained for 12 weeks or longer after admission. These utilization statistics may reflect case-mix differences and/or philosophical differences that determine the manner in which home health care is provided. They also demonstrate the need to take into consideration differences in lengths of stay (LOSs) among the different types of home health patients (i.e., by HHA type) when considering outcomes over a fixed period of time. For example, in considering outcomes that correspond to patient status change (e.g., improvement

Table 5

Utilization Statistics: Total Visits and Visit Intensity During the First 60 Days of Care, and 3- and 12-Week Discharge Rates

	Patient-Level Means[1]					
Total Visits, Intensity, and Discharge Rates	Pooled HMO	Pooled FFS	Mixed HMO	Mixed FFS	HMO-Owned	Pure-FFS
Total Visits Until 60 Days or Discharge	12.7	***18.8	14.9	***22.4	8.7	***15.0
Visits per Week Until 60 Days or Discharge	3.1	***4.4	3.6	***4.9	2.3	***3.9
Percent Discharged Within 3 Weeks of Admission	*37.9	33.1	**40.9	31.4	32.8	34.5
Percent Discharged Later Than 12 Weeks After Admission	15.4	12.6	12.8	11.4	**20.0	13.6

*$.05 \le p < .10$.
**$.01 \le p < .05$.
*** $p < .01$.

[1]Significance levels are based on Fisher's exact test, the chi-square test, the two-sample *t*-test with separate or pooled variance estimates, or the Wilcoxon test, whichever was appropriate in view of the measurement scale and underlying distribution.

NOTES: HMO is health maintenance organization. FFS is fee-for-service.

SOURCE: Based on random samples of 381, 414, 308, and 529 patients from mixed HMO, mixed FFS, HMO-owned, and pure-FFS agencies, respectively.

or stabilization) until 12 weeks or discharge, whichever occurred first, it is apparent that the length of the intervals over which outcomes are measured will vary for patients from selected types of agencies. For this reason, LOS was used as an independent variable in logistic regression models that adjusted for case mix (in instances when it was statistically significant). In addition, separate (multivariate) analyses were conducted for patients who were discharged (also using LOS as an independent variable) relative to those who were not discharged within 12 weeks. Number of visits over the study interval, however, was not used as an independent variable in these analyses because it is, in large part, the main component of the treatment effect (where the treatments consist of the four different HHA types). The reason LOS was used as an independent variable is to adjust for the natural progression of patient change over time. Although LOS is perforce partly collinear with number of visits, the relationship is by no means perfectly collinear, and therefore permits compensation for the natural progression of patient change.

Outcomes for HMO Patients Versus FFS Patients

As noted earlier for the sake of comparability, a common set of outcome measures was used for the main two-group comparisons (all FFS versus all HMO, contractual FFS versus contractual HMO, and pure-FFS versus HMO-owned). The outcome measures selected for inclusion in Table 6 (and the two subsequent tables) were chosen because the findings for these variables are representative of the findings for the total set of variables analyzed. For example, since the outcome measures corresponding to improvement or stabilization basically yielded the same results as the improvement pattern and stabilization pattern measures, only results for improvement and stabilization measures are presented here. All patient status outcomes in Table 6 correspond to the time interval from start of care (admission) until discharge or 12 weeks, whichever occurred first. As discussed, we also examined outcomes for the shorter interval consisting only of the first 3 weeks after start of care. However, since the majority of patients continued to receive home health care after 3 weeks, this relatively short time interval was not adequate to evaluate the outcomes of home health care for most study patients (nonetheless, the key findings from the 3-week outcome analyses are summarized). For both the 3-week and 12-week intervals, separate analyses were conducted using patients who were discharged and those who were not. For patients who were discharged for each of the two time intervals, LOS was used as a covariate in the logistic regression analyses. The results of these stratified analyses (for discharged and non-discharged patients separately) yielded basically the same findings and inferences as the analyses that pertained to combining discharged and non-discharged patients for each of the two time intervals. Thus, the findings presented in the tables in this section are based on all patients, regardless of whether they were discharged by the end of the 12-week interval. LOS entered as a statistically significant covariate in some of the multivariate analyses, but in general did not tend to substantially alter the statistical significance of the treatment variable (i.e., the HMO variable).

The unadjusted means for outcome measures in Table 6 (and subsequent tables) are not necessarily identical to the means that would be obtained if covariates were not taken into consideration. This is

due to the case-mix- and covariate-adjustment process. Cases with missing data for covariates appearing in the final logistic regression model were excluded, thereby lowering the sample size for the case-mix-adjusted results. For comparability, the unadjusted means for outcome measures were therefore based on the same cases as the case-mix-adjusted findings. Hence, since separate logistic regression models were developed for each comparison (for every outcome variable), the unadjusted means for a given group of patients (e.g., HMO patients) could differ slightly from the means that would be computed if case-mix variables or covariates were disregarded. By and large, however, such differences were minimal (nearly always less than one percentage point). After attempting to estimate uniform logistic regression models for each outcome measure that would use the same case-mix variables and covariates for different two-group comparisons, we concluded that different risk factors were influencing outcomes for different comparisons (e.g., the mixed versus pure comparisons). This is apparently because the distribution of patient conditions and other covariates, and their relationship to outcomes, differs from one provider type to another. Consequently, we estimated separate logistic regression models for (the same) outcome variables when comparing different pairs of patient groups.

Table 6 provides unadjusted mean values for each outcome and statistical significance levels, and the case-mix-adjusted mean difference and its statistical significance level, respectively. These values were computed using logistic regression as illustrated earlier (for example, the results for stabilized in transferring correspond to the illustrative logistic regression model presented earlier in Table 3).

The first block of measures in Table 6 contains the results for aggregate improvement indicators that reflect improvement in the number of ADLs or IADLs. Two of these outcome measures yield statistically significant differences, which demonstrate that the case-mix-adjusted percentage of patients who improve in the number of mild and moderate ADL disabilities are 8.4 and 15.9 percentage points, respectively, greater for FFS than HMO patients. Analogously, the second category of variables, consisting of improvement measures for specific functional areas, yields four statistically significant findings (at $p < .10$, using a two-tailed test). In particular, case-mix-adjusted outcomes for FFS patients are superior to those for HMO patients for improvement in eating, toileting, medications management, and shopping. This same pattern of superior outcomes for FFS patients persists wherever statistically significant results occur in the next three categories of outcomes that correspond to discharged improved to independent living, stabilization, and aggregate stabilization indicators. The final category of patient status outcomes (discharged stabilized to independent living) yielded no statistically significant findings. This is also the case for the mortality and utilization outcome indicators.

As previously discussed, when conducting a large number of statistical comparisons, it is possible to obtain spurious differences. The fact that all statistically significant differences yield superior outcomes for FFS patients, however, and the fact that there are more than a few such differences provide evidence in support of rejecting the null hypothesis of no outcome differences in favor of superior outcomes for FFS patients. Further, as important as the number of significant differences is the direction of the mean differences for all outcome measures (insignificant as well as

Table 6

A Comparison of Outcomes[1] for HMO Patients Versus FFS Patients: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	All HMO Mean[3]	All FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Improvement Indicators[6]						
Improved in Number of ADL Disabilities (5 ADLs):		Percent			Percent	
Mild Level	42.6	50.7	-8.1	.034	-8.4	.037
Moderate Level	43.4	56.5	-13.0	.009	-15.9	.003
Severe Level	31.8	50.0	-18.2	.051	-14.9	.136
Not Worsened in Any ADL and Improved in at Least One ADL Disability (5 ADLs)	47.1	51.9	-4.7	.181	-3.9	.290
Improved in Number of IADL Disabilities (3 IADLs):						
Severe Level	31.9	36.7	-4.8	.156	-5.4	.129
Improvement In						
Bathing	42.7	45.6	-2.9	.420	-2.9	.455
Grooming	50.0	52.8	-2.8	.596	-7.4	.216
Eating	34.5	48.2	-13.7	.047	-14.3	.058
Toileting	40.7	52.8	-12.1	.038	-14.0	.032
Transferring	49.3	56.9	-7.6	.150	-8.3	.146
Medications Management	25.9	31.6	-5.6	.164	-7.6	.083
Light Meal Preparation	26.6	29.2	-2.6	.416	-2.8	.432
Cooking Main Meals	21.9	22.6	-0.7	.794	-1.8	.555
Laundry	20.2	21.1	-0.9	.729	-2.1	.459
Shopping	19.4	22.1	-2.7	.310	-5.1	.058
Discharged to Independent Living and Improved In[7]						
Bathing	38.9	43.5	-4.6	.272	-3.6	.422
Grooming	44.2	48.1	-3.9	.517	-4.3	.544
Eating	25.5	40.4	-14.9	.062	-17.2	.050
Toileting	39.3	48.6	-9.3	.165	-10.2	.196
Transferring	41.6	47.8	-6.2	.284	-4.6	.470
Medications Management	23.5	32.1	-8.6	.059	-10.4	.033
Light Meal Preparation	27.2	29.3	-2.1	.576	-1.1	.784
Cooking Main Meals	20.2	25.6	-5.4	.111	-5.7	.134
Laundry	19.1	20.5	-1.4	.635	-1.2	.713
Shopping	20.3	21.7	-1.3	.652	-2.2	.466
Stabilized In						
Bathing	84.4	83.2	1.3	.601	1.3	.613
Grooming	88.0	89.6	-1.6	.436	-4.4	.065
Eating	90.5	92.6	-2.2	.207	-4.2	.043
Toileting	90.3	92.6	-2.3	.202	-4.9	.024
Transferring	89.7	92.8	-3.1	.080	-6.2	.004
Medications Management	87.9	89.6	-1.7	.449	-3.4	.200
Light Meal Preparation	85.3	82.8	2.5	.398	1.6	.619
Cooking Main Meals	75.4	76.0	-0.6	.895	1.0	.840
Laundry	81.5	75.2	6.3	.209	1.6	.801
Shopping	85.2	73.3	11.8	.041	10.2	.145
Catheter	99.1	98.4	0.6	.382	0.4	.609
Urinary Incontinence	95.2	95.5	-0.4	.787	-0.4	.801
Number of Pressure Ulcers	98.4	97.2	1.3	.182	1.1	.309
Grade of Pressure Ulcers	96.1	97.3	-1.1	.303	-1.6	.197
Depression	93.2	91.5	1.7	.329	1.0	.590

See footnotes at end of table.

Table 6—Continued

A Comparison of Outcomes[1] for HMO Patients Versus FFS Patients: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	All HMO Mean[3]	All FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Stabilization Indicators[8]		Percent			Percent	
Stabilized in Number of ADL Disabilities (5 ADLs):						
Mild Level	82.7	86.2	-3.5	.163	-7.6	.011
Moderate Level	83.6	86.8	-3.2	.157	-6.1	.018
Severe Level	94.3	93.6	0.7	.645	-0.6	.752
Not Worsened in Any ADL Disability (5 ADLs)	72.6	73.7	-1.1	.683	-4.0	.195
Stabilized in Number of IADL Disabilities (5 IADLs):						
Mild Level	78.4	80.7	-2.4	.510	-5.3	.202
Severe Level	82.6	84.2	-1.6	.559	-0.5	.858
Stabilized in Number of IADL Disabilities (3 IADLs):						
Mild Level	80.2	82.4	-2.2	.508	-3.9	.276
Discharged to Independent Living and Stabilized in[7]						
Bathing	67.8	72.3	-4.5	.181	-2.2	.544
Grooming	73.1	77.8	-4.7	.129	-5.0	.133
Eating	72.3	76.2	-3.9	.200	-4.7	.173
Toileting	74.4	77.7	-3.3	.288	-4.7	.169
Transferring	73.1	76.4	-3.3	.283	-4.2	.212
Medications Management	74.6	77.2	-2.5	.464	-1.9	.611
Light Meal Preparation	74.0	75.2	-1.2	.759	-0.9	.832
Cooking Main Meals	63.4	71.9	-8.5	.121	-4.9	.410
Mortality						
Discharged Due to Death	6.6	5.9	0.7	.625	0.6	.685
Utilization Outcomes						
Discharged to Independent Living Within 12 Weeks	65.4	65.6	-0.2	.954	-0.5	.882
Hospitalized Within 12 Weeks of Start of Care	21.1	23.6	-2.5	.354	-1.6	.570
Hospitalization Within 12 Weeks for:						
Emergent Care	12.4	14.7	-2.3	.302	-1.8	.446
Urgent Care	1.9	1.9	0.0	.990	0.1	.867

[1]At 12 weeks or discharge, whichever occurred first.

[2]Sample sizes may be lower for individual variables due to case selection, depending on how the outcome variable is defined, missing data on selected outcome variables, or missing data on covariates used in the adjustment process.

[3]All outcome variables are dichotomous, and means are therefore percents. Since some continuous variables were used in the initial analyses, the notes on statistical significance and model estimation describe the approaches taken for both types of outcome variables.

[4]The unadjusted significance level for dichotomous variables (continuous variables) is that of the odds ratio (coefficient) in a logistic regression (ordinary regression) model using only the HMO indicator as an independent variable. This approach to computing the unadjusted significance level is equivalent to a chi-square test for a 2x2 contingency table (logistic regression) or a 2-sample *t*-test (ordinary regression).

[5]The mean difference for dichotomous variables (continuous variables) was adjusted for case mix using logistic regression (ordinary regression). The significance for the adjusted mean difference is the significance of the odds ratio, i.e., exp (*b*), where b is the coefficient of the pooled HMO versus pooled FFS dichotomy in a logistic regression model (or of the coefficient of *b* in an ordinary regression model for continuous variables), with case-mix covariates in the model.

[6]Each aggregate improvement indicator is a dichotomy indicating whether the patient improved by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities decreased (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. The fourth aggregate indicator denotes whether the patient improved in at least one of these five ADLs and did not worsen in any over the study interval. The fifth aggregate improvement indicator denotes whether the patient improved in the number of severe IADL disabilities (for three IADLs: medications management, light meal preparation, shopping) over the study interval.

[7]All variables in this category refer to whether the patient was discharged to independent living and improved (or stabilized) in the indicated functional category. In general, the mean values for each functional measure in this group of variables tend to be lower than for the corresponding improvement-only (stabilization-only) variables. In instances where this is not the case, it is because data were missing on whether the patient was discharged to independent living.

[8]Each aggregate stabilization indicator is a dichotomy indicating whether the patient stabilized by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities did not increase (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. The fourth variable is a dichotomy that refers to whether the patient did not worsen in any of these five ADLs. The next two variables refer to whether the patient stabilized or did not worsen according to mild and severe definitions of five IADLs (cooking main meals, laundry, medications management, light meal preparation, shopping). The last variable denotes whether the patient stabilized (did not worsen) with respect to the three IADLs of medications management, light meal preparation, shopping.

NOTES: HMO is health maintenance organization. FFS is fee-for-service. ADL is activity of daily living. IADL is instrumental activity of daily living.

SOURCE: Random admission samples of 689 HMO patients and 943 FFS patients.

significant differences). In particular, the case-mix-adjusted mean difference column contains far more negative than positive differences, indicating that mean values for HMO outcomes generally tend to be lower after case-mix adjustment than mean values for FFS outcomes. Using the number of positive and negative signs of the case-mix-adjusted mean differences as an overall indicator to compare the two outcome profiles, a non-parametric sign test leads to the overall conclusion that the outcomes for HMO patients are inferior to outcomes for FFS patients ($p < .001$).

Outcomes for HMO-Owned Versus Pure-FFS Agencies

Three of the aggregate improvement indicators in Table 7 yield significantly superior outcomes for FFS patients receiving care from pure-FFS agencies relative to HMO patients receiving care from HMO-owned agencies. Although three of the individual improvement measures in Table 7 resulted in significant unadjusted outcome differences, all such outcomes were insignificant after case-mix adjustment for the HMO-owned versus pure-FFS comparison. Several of the unadjusted outcome differences for the discharged-to-independent-living-and-improved results were also adjusted to insignificance. However, the discharged-to-independent-living-and-improved in eating measure remained statistically significant after case-mix adjustment, and was superior for FFS patients. Analogously, four stabilization outcome measures resulted in significantly better case-mix-adjusted outcomes for FFS patients (i.e., stabilization in grooming, eating, toileting, and grade of pressure ulcers). Three of the aggregate stabilization indicators (stabilized in number of mild ADL disabilities, stabilized in number of moderate ADL disabilities, and not worsened in any ADL disability) also resulted in superior case-mix-adjusted outcomes for FFS patients. The only patient status outcome that was significantly higher for HMO patients after case-mix adjustment was the outcome corresponding to discharged to independent living and stabilized in light meal preparation. The mortality and utilization outcomes did not yield significant differences, except for hospitalization within 12 weeks for urgent care, which was higher (and therefore superior) for pure-FFS patients. However, the overall hospitalization rate was not significantly different for the two patient groups.

As an overall test of the potential difference between outcome profiles, the sign test again indicated that substantially more case-mix-adjusted mean differences pointed to superior outcomes for patients in the pure-FFS sample ($p < .005$). Thus, the selected individual measures that yielded significant case-mix-adjusted differences and the directional nature of the profile of mean differences for all patient status outcome variables both point to superior outcomes for FFS patients. However, the number of individual measures that yielded significant differences is not as great in Table 7 as in Table 6 (i.e., the combined HMO versus FFS comparison table). Further, it is important to analyze the magnitude of the unadjusted mean differences relative to the case-mix-adjusted mean differences. In Table 7, approximately two-thirds of the case-mix-adjusted mean differences are larger (i.e., negative values tend to become "less negative" or positive in some cases, and positive values tend to become larger) than the unadjusted mean differences, indicating that case-mix adjustment raised the HMO mean, relative to the FFS mean, for most outcomes. In other words, case-mix adjustment reduces but does not eliminate the lower outcome performances of HMO-owned relative to pure-FFS agencies. This is

due primarily to the greater diversity of case mix in HMO-owned agencies, which tend to admit more patients with problems that do not improve or stabilize to the same degree as the problems that more typically characterize patients admitted to pure-FFS agencies. A reverse pattern occurs in Table 6 (and in Table 8), where about 80 percent of the outcome measures resulted in adjusted mean differences that were smaller (i.e., negative values tend to become "more" negative, and positive values tend to become smaller or negative) than the unadjusted mean differences. In this case, case-mix adjustment indicated that HMO outcome results were actually worse relative to FFS agencies than implied by the unadjusted differences. The Table 6 results were dominated by the pooled HMO and FFS case-mix patterns, which were not only insufficient to bring the inferior HMO outcomes closer to the FFS outcomes, but in fact serve to highlight the expectation that HMO patients in general should have had more positive outcomes than they actually did (relative to FFS patients). Thus, the influence of the case mix of the contractual HMO patients had a stronger effect on the outcome adjustment process (for Table 6) than the case mix of the patients admitted to HMO-owned agencies. This is further discussed later.

Outcomes for HMO Versus FFS Patients Admitted to Mixed Agencies

One of the five aggregate improvement indicators in Table 8 resulted in significant case-mix-adjusted outcomes that were superior for contractual FFS patients relative to contractual HMO patients. Analogously, two improvement measures, three discharged-to-independent-living-improved measures, two stabilized measures, two aggregate stabilization indicators, and five discharged-to-independent-living-stabilized measures also yielded significant case-mix-adjusted differences—all pointing to superior outcomes for FFS patients. In addition, the mortality indicator (discharged due to death) was significantly higher for contractual HMO patients (although, as indicated, we do not believe mortality is sufficiently sensitive to be a valid outcome of home health care by itself). Lastly, after case-mix adjustment, the hospitalization rate for emergent care is seven percentage points higher for FFS patients, while the hospitalization rate for urgent care is three percentage points higher for HMO patients. Overall hospitalization rates for the two patient groups, however, were not significantly different.

As previously, an analysis of the signs of the case-mix-adjusted mean differences provided an overall test of the difference between the two outcome profiles. Once again, the non-parametric sign test leads to rejecting the null hypothesis of no outcome differences in favor of superior outcomes for contractual FFS patients relative to contractual HMO patients ($p < .001$). Unlike the HMO-owned versus pure-FFS comparison in Table 7, nearly all mean differences in Table 8 decreased (i.e., moved in a "downward" direction—even among negative values) after case-mix adjustment. That is, HMO outcomes were adjusted to even lower values than those observed. Hence, in view of the case-mix characteristics of the two patient groups, and under the null hypothesis of no outcome differences, the unadjusted mean values for outcome measures for contractual HMO patients should have been higher relative to contractual FFS patients than were actually observed.

Additional Case-Mix-Adjusted Comparisons

The analyses of 3-week outcomes (rather than 12-week outcomes) resulted in relatively

Table 7

A Comparison of Outcomes[1] for Patients Admitted to HMO-Owned Versus Pure-FFS Agencies: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	HMO-Owned Mean[3]	Pure-FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Improvement Indicators[6]						
Improved in Number of ADL Disabilities (5 ADLs):		Percent			Percent	
Mild Level	36.2	50.6	-14.4	.008	-15.9	.009
Moderate Level	32.9	53.5	-20.5	.002	-17.7	.015
Severe Level	33.3	46.3	-13.0	.267	-3.4	.811
Not Worsened in Any ADL and Improved in at Least One ADL Disability (5 ADLs)	40.1	52.7	-12.6	.014	-10.3	.066
Improved in Number of IADL Disabilities (3 IADLs): Severe Level	30.6	37.1	-6.5	.187	-7.9	.155
Improvement in						
Bathing	38.5	44.0	-5.5	.272	-1.7	.762
Grooming	46.7	51.9	-5.2	.457	-1.2	.883
Eating	29.6	44.0	-14.4	.091	-6.8	.498
Toileting	39.7	52.1	-12.4	.112	-10.4	.257
Transferring	43.4	55.9	-12.6	.069	-11.7	.126
Medications Management	17.6	27.2	-9.5	.069	-8.9	.137
Light Meal Preparation	23.4	28.1	-4.6	.312	0.3	.959
Cooking Main Meals	20.2	21.0	-0.7	.848	-0.8	.856
Laundry	21.3	20.1	1.2	.759	2.6	.588
Shopping	21.4	21.9	-0.5	.890	-3.3	.408
Discharged to Independent Living and Improved in[7]						
Bathing	32.1	40.2	-8.0	.155	-3.9	.565
Grooming	31.7	46.2	-14.5	.066	-8.8	.375
Eating	12.8	41.5	-28.7	.004	-26.9	.015
Toileting	28.6	47.9	-19.3	.028	-13.4	.234
Transferring	32.3	49.1	-16.8	.030	-12.4	.150
Medications Management	15.2	26.8	-11.6	.049	-10.2	.147
Light Meal Preparation	23.6	27.6	-3.9	.455	7.5	.310
Cooking Main Meals	19.5	22.5	-3.0	.509	-0.5	.929
Laundry	19.0	17.5	1.5	.710	6.3	.219
Shopping	22.7	19.6	3.1	.464	2.1	.659
Stabilized in						
Bathing	80.9	83.8	-2.9	.434	0.5	.889
Grooming	84.5	90.0	-5.5	.070	-7.3	.035
Eating	85.5	91.8	-6.3	.025	-6.5	.047
Toileting	88.1	93.2	-5.0	.058	-8.0	.020
Transferring	88.1	92.6	-4.5	.085	-3.4	.211
Medications Management	85.4	88.0	-2.7	.440	-4.5	.257
Light Meal Preparation	86.6	81.2	5.4	.229	5.0	.317
Cooking Main Meals	76.0	69.6	6.4	.375	11.7	.135
Laundry	77.9	72.2	5.8	.421	8.0	.424
Shopping	83.7	71.4	12.2	.151	-1.0	.952
Catheter	99.0	98.1	0.9	.444	1.4	.212
Urinary Incontinence	93.8	96.0	-2.2	.297	-1.0	.631
Number of Pressure Ulcers	98.5	97.5	1.0	.449	1.0	.497
Grade of Pressure Ulcers	94.9	97.8	-2.8	.094	-3.5	.091
Depression	88.3	90.6	-2.3	.416	-1.4	.635

See footnotes at end of table.

Table 7—Continued

A Comparison of Outcomes[1] for Patients Admitted to HMO-Owned Versus Pure-FFS Agencies: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	HMO-Owned Mean[3]	Pure-FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Stabilization Indicators[6]		Percent			Percent	
Stabilized in Number of ADL Disabilities (5 ADLs):						
Mild Level	79.8	86.8	-7.0	.057	-13.8	.004
Moderate Level	80.5	87.4	-6.9	.040	-13.9	.001
Severe Level	91.4	92.2	-0.8	.758	-1.2	.687
Not Worsened in Any ADL Disability (5 ADLs)	66.2	72.3	-6.1	.136	-8.7	.056
Stabilized in Number of IADL Disabilities (5 IADLs):						
Mild Level	78.8	76.6	2.2	.682	-1.0	.871
Severe Level	81.5	82.0	-0.5	.901	4.5	.303
Stabilized in Number of IADL Disabilities (3 IADLs):						
Mild Level	81.7	79.5	2.3	.655	0.2	.968
Discharged to Independent Living and Stabilized in[7]						
Bathing	62.2	70.5	-8.3	.094	-7.1	.208
Grooming	70.9	75.0	-4.1	.393	-1.4	.789
Eating	66.0	74.4	-8.4	.067	-5.8	.282
Toileting	72.7	76.5	-3.8	.400	-2.3	.645
Transferring	70.4	73.2	-2.8	.549	2.3	.650
Medications Management	74.6	73.0	1.6	.748	4.0	.482
Light Meal Preparation	77.4	70.1	7.3	.219	12.8	.044
Cooking Main Meals	69.2	64.6	4.6	.576	9.0	.339
Mortality						
Discharged Due to Death	4.5	6.2	-1.7	.354	-2.8	.140
Utilization Outcomes						
Discharged to Independent Living Within 12 Weeks	61.5	64.9	-3.4	.406	-1.0	.839
Hospitalized Within 12 Weeks of Start of Care	18.6	20.8	-2.2	.541	-3.2	.386
Hospitalization Within 12 Weeks for:						
Emergent Care	12.4	11.5	1.0	.731	0.1	.961
Urgent Care	0.5	2.9	-2.4	.083	-2.6	.054

[1]At 12 weeks or discharge, whichever occurred first.

[2]Sample sizes may be lower for individual variables due to case selection, depending on how the outcome variable is defined, missing data on selected outcome variables, or missing data on covariates used in the adjustment process.

[3]All outcome variables are dichotomous, and means are therefore percents. Since some continuous variables were used in the initial analyses, the notes on statistical significance and model estimation describe the approaches taken for both types of outcome variables.

[4]The unadjusted significance level for dichotomous variables (continuous variables) is that of the odds ratio (coefficient) in a logistic regression (ordinary regression) model using only the HMO indicator as an independent variable. This approach to computing the unadjusted significance level is equivalent to a chi-square test for a 2x2 contingency table (logistic regression) or a 2-sample *t*-test (ordinary regression).

[5]The mean difference for dichotomous variables (continuous variables) was adjusted for case mix using logistic regression (ordinary regression). The significance for the adjusted mean difference is the significance of the odds ratio, i.e., exp (*b*), where *b* is the coefficient of the HMO versus FFS dichotomy in a logistic regression model (or of the coefficient of *b* in an ordinary regression model for continuous variables), with case-mix covariates in the model.

[6]Each aggregate improvement indicator is a dichotomy indicating whether the patient improved by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities decreased (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. The fourth aggregate indicator denotes whether the patient improved in at least one of these five ADLs and did not worsen in any over the study interval. The fifth aggregate improvement indicator denotes whether the patient improved in the number of severe IADL disabilities (for three IADLs: medications management, light meal preparation, shopping) over the study interval.

[7]All variables in this category refer to whether the patient was discharged to independent living *and* improved (or stabilized) in the indicated functional category. In general, the mean values for each functional measure in this group of variables tend to be lower than for the corresponding improvement-only (stabilization-only) variables. In instances where this is not the case, it is because data were missing on whether the patient was discharged to independent living.

[8]Each aggregate stabilization indicator is a dichotomy indicating whether the patient stabilized by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities did not increase (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. The fourth variable is a dichotomy that refers to whether the patient did not worsen in any of these five ADLs. The next two variables refer to whether the patient stabilized or did not worsen according to mild and severe definitions of five IADLs (cooking main meals, laundry, medications management, light meal preparation, shopping). The last variable denotes whether the patient stabilized (did not worsen) with respect to the three IADLs of medications management, light meal preparation, shopping.

NOTES: HMO is health maintenance organization. FFS is fee-for-service. ADL is activity of daily living. IADL is instrumental activity of daily living.

SOURCE: Random admission samples of 308 HMO patients and 529 FFS patients from HMO-owned and pure-FFS home health agencies, respectively.

Table 8

A Comparison of Outcomes[1] for HMO Versus FFS Patients Admitted to Contractual (Mixed) Agencies: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	Mixed-HMO Mean[3]	Mixed-FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Improvement Indicators[6]						
Improved in Number of ADL Disabilities (5 ADLs):		Percent			Percent	
Mild Level	46.7	49.7	-3.1	.567	-5.3	.340
Moderate Level	48.2	60.0	-11.8	.103	-16.3	.036
Severe Level	28.6	63.0	-34.4	.043	([8])	([8])
Not Worsened in Any ADL and Improved in at Least One ADL Disability (5 ADLs)	53.5	53.3	0.2	.972	-1.3	.791
Improved in Number of ADL Disabilities (3 IADLs):						
Severe Level	33.2	36.8	-3.6	.449	-5.3	.312
Improvement in						
Bathing	45.6	46.3	-0.7	.883	-3.1	.554
Grooming	56.4	53.2	3.2	.673	-0.6	.947
Eating	40.0	53.6	-13.6	.232	-13.5	.314
Toileting	42.3	51.9	-9.6	.283	-16.8	.123
Transferring	55.4	57.4	-2.0	.791	-2.9	.724
Medications Management	33.3	38.1	-4.8	.450	-7.7	.275
Light Meal Preparation	29.7	31.6	-1.9	.693	-7.8	.137
Cooking Main Meals	23.5	24.5	-1.0	.807	-2.5	.560
Laundry	19.1	23.3	-4.2	.262	-7.1	.056
Shopping	17.9	22.2	-4.3	.243	-6.5	.092
Discharged to Independent Living and Improved In[7]						
Bathing	43.0	48.4	-5.5	.349	-7.4	.251
Grooming	53.2	50.0	3.2	.711	-2.7	.779
Eating	45.5	40.5	5.0	.702	-3.7	.801
Toileting	52.5	49.1	3.4	.743	-6.1	.615
Transferring	52.5	46.4	6.1	.489	2.5	.798
Medications Management	29.9	40.0	-10.1	.165	-10.2	.193
Light Meal Preparation	30.4	33.3	-2.9	.586	-10.8	.059
Cooking Main Meals	22.5	29.4	-7.0	.140	-9.1	.065
Laundry	18.5	24.9	-6.4	.134	-8.8	.044
Shopping	19.0	23.2	-4.2	.315	-3.3	.486
Stabilized In						
Bathing	87.1	81.9	5.2	.113	2.8	.478
Grooming	90.3	88.3	1.9	.490	-2.0	.606
Eating	94.0	93.2	0.8	.714	-2.0	.504
Toileting	91.5	91.8	-0.3	.891	-3.5	.297
Transferring	90.4	93.2	-2.8	.252	-5.2	.084
Medications Management	90.4	89.5	0.9	.756	-1.2	.721
Light Meal Preparation	84.0	85.1	-1.1	.781	-6.0	.222
Cooking Main Meals	75.2	82.8	-7.6	.196	-12.0	.093
Laundry	84.1	78.7	5.4	.433	1.4	.866
Shopping	85.7	78.4	7.3	.362	3.7	.709
Catheter	99.1	98.8	0.3	.717	-0.5	.754
Urinary Incontinence	98.9	99.2	-0.3	.999	/[8]	/[8]
Number of Pressure Ulcers	98.1	96.7	1.3	.341	0.8	.604
Grade of Pressure Ulcers	97.2	96.3	1.0	.543	-0.6	.787
Depression	97.0	93.1	3.9	.061	3.0	.228

See footnotes at end of table.

Table 8—Continued

A Comparison of Outcomes[1] for HMO Versus FFS Patients Admitted to Contractual (Mixed) Agencies: Unadjusted and Adjusted for Case Mix and Other Covariates[2]

Outcome Variables[3]	Unadjusted				Case-Mix-Adjusted	
	Mixed-HMO Mean[3]	Mixed-FFS Mean[3]	Mean Difference	Significance[4]	Mean Difference[5]	Significance[5]
Aggregate Stabilization Indicators[9]		Percent			Percent	
Stabilized in Number of ADL Disabilities (5 ADLs):						
Mild Level	85.0	85.0	0.0	.995	-3.7	.354
Moderate Level	86.4	85.6	0.8	.790	-0.7	.852
Severe Level	96.6	95.5	1.1	.531	-1.0	.704
Not Worsened in Any ADL Disability (5 ADLs)	78.3	73.9	4.4	.243	1.0	.807
Stabilized in Number of IADL Disabilities (5 IADLs):						
Mild Level	76.4	83.6	-7.2	.129	-13.1	.029
Severe Level	83.1	87.0	-3.9	.263	-4.4	.244
Stabilized in Number of IADL Disabilities (3 IADLs):						
Mild Level	79.1	85.2	-6.2	.166	-10.7	.043
Discharged to Independent Living and Stabilized in[7]						
Bathing	71.3	74.9	-3.6	.434	-6.3	.228
Grooming	76.0	82.4	-6.4	.124	-9.4	.046
Eating	77.1	79.3	-2.2	.585	-4.9	.280
Toileting	75.6	79.9	-4.2	.319	-7.0	.139
Transferring	76.0	80.7	-4.7	.249	-8.4	.069
Medications Management	75.9	80.6	-4.7	.291	-9.6	.079
Light Meal Preparation	73.4	82.1	-8.7	.086	-9.6	.078
Cooking Main Meals	60.2	78.4	-18.1	.016	-17.8	.032
Mortality						
Discharged Due to Death	8.0	5.2	2.8	.167	4.2	.089
Utilization Outcomes						
Discharged to Independent Living Within 12 Weeks	68.8	66.4	2.4	.561	1.8	.696
Hospitalized Within 12 Weeks of Start of Care	21.9	26.5	-4.6	.218	-4.1	.284
Hospitalization Within 12 Weeks for:						
Emergent Care	10.8	18.5	-7.7	.016	-7.0	.035
Urgent Care	3.7	0.7	2.9	.042	3.0	.040

[1]At 12 weeks or discharge, whichever occurred first.

[2]Sample sizes may be lower for individual variables due to case selection, depending on how the outcome variable is defined, missing data on selected outcome variables, or missing data on covariates used in the adjustment process.

[3]All outcome variables are dichotomous, and means are therefore percents. Since some continuous variables were used in the initial analyses, the notes on statistical significance and model estimation describe the approaches taken for both types of outcome variables.

[4]The unadjusted significance level for dichotomous variables (continuous variables) is that of the odds ratio (coefficient) in a logistic regression (ordinary regression) model using only the HMO indicator as an independent variable. This approach to computing the unadjusted significance level is equivalent to a chi-square test for a 2x2 contingency table (logistic regression) or a 2-sample *t*-test (ordinary regression).

[5]The mean difference for dichotomous variables (continuous variables) was adjusted for case mix using logistic regression (ordinary regression). The significance for the adjusted mean difference is the significance of the odds ratio, i.e., exp (*b*), where *b* is the coefficient of the HMO versus FFS dichotomy in a logistic regression model (or of the coefficient of *b* in an ordinary regression model for continuous variables), with case mix covariates in the model.

[6]Each aggregate improvement indicator is a dichotomy indicating whether the patient improved by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities decreased (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. Since a stable logistic regression model could not be estimated for the aggregate improvement indicator of severe ADL disabilities for the HMO versus FFS comparison in this table, no case-mix-adjusted mean difference is given. The fourth aggregate indicator denotes whether the patient improved in at least one of these five ADLs and did not worsen in any over the study interval. The fifth aggregate improvement indicator denotes whether the patient improved in the number of severe IADL disabilities (for three IADLs: medications management, light meal preparation, shopping) over the study interval.

[7]All variables in this category refer to whether the patient was discharged to independent living and improved (or stabilized) in the indicated functional category. In general, the mean values for each functional measure in this group of variables tend to be lower than for the corresponding improvement-only (stabilization-only) variables. In those instances where this is not the case, it is because data were missing on whether the patient was discharged to independent living.

[8]Stable logistic regression equation could not be estimated.

[9]Each aggregate stabilization indicator is a dichotomy indicating whether the patient stabilized by 12 weeks or discharge. The first three aggregate indicators denote whether the total number of ADL disabilities did not increase (for the ADLs bathing, grooming, eating, toileting, transferring)—according to mild, moderate, and severe definitions of disability for each of the ADLs, respectively. The fourth variable is a dichotomy that refers to whether the patient did not worsen in any of these five ADLs. The next two variables refer to whether the patient stabilized or did not worsen according to mild and severe definitions of five IADLs (cooking main meals, laundry, medications management, light meal preparation, shopping). The last variable denotes whether the patient stabilized (did not worsen) with respect to the three IADLs of medications management, light meal preparation, shopping.

NOTES: HMO is health maintenance organization. FFS is fee-for-service. ADL is activity of daily living. IADL is instrumental activity of daily living.

SOURCE: Random admission samples of 381 HMO patients and 414 FFS patients from mixed home health agencies.

inconclusive findings. For the most part, the differences between HMO and FFS outcomes were minimal. The one exception where a reasonably pronounced pattern of superior outcomes was found to exist was among the HMO contractual patients for the 3-week discharged-to-independent-living-stabilized variables. However, this difference was an artifact of the early discharge policies of HMOs that contracted with mixed agencies for home health care. As shown in Table 5, substantially more contractual HMO patients than other types of patients were discharged within 3 weeks. Consequently, most patients who were not discharged in a worsened condition (a worsened condition rarely results in discharge unless it is to a more intense level of care) contributed to the discharged-to-independent-living-stabilized outcomes. This artificially (or "temporarily") inflated the means for the outcome variables for contractual HMO patients, since the corresponding 12-week measures actually yielded inferior outcomes for contractual HMO patients.

Comparisons analogous to those documented in Tables 6-8 were also conducted for contractual FFS patients versus pure-FFS patients and for contractual HMO patients versus patients admitted to HMO-owned agencies. Although the patterns of findings were not as conclusive as those for the HMO versus FFS comparisons, we found a tendency for contractual FFS patients to have somewhat superior outcomes, relative to pure-FFS patients, and for contractual HMO patients to have modestly superior outcomes relative to patients admitted to HMO-owned agencies.

Since the cost analyses for this study found progressively lower costs per episode for contractual FFS patients, pure-FFS patients, contractual HMO patients, and HMO patients admitted to HMO-owned agencies, and since the overall pattern of superiority in outcomes follows this same sequence, it appears a volume-outcome relationship exists that points to a positive association between utilization, cost per episode, and patient status outcomes in the home health field. To further test this relationship, we assigned each HHA its median RC value among all sampled patients in the agency. Agencies were then ranked from highest to lowest in terms of RC. We then compared patient status outcomes for the agencies in the upper 50 percent with those in the lower 50 percent according to this RC ranking. In order to avoid the separate effects of the four different types of agency-payer treatments, we examined case-mix-adjusted outcomes for the high versus low RC groups separately for each of the four different agency-payer combinations (i.e., pure-FFS patients, HMO patients admitted to HMO-owned agencies, contractual FFS patients, and contractual HMO patients).[1] An outcome-volume relationship was substantiated within each of these comparisons—to varying degrees. The most pronounced set of findings resulted from comparing the high RC agencies to the low RC agencies for contractual HMO patients. For this comparison, there was a relatively strong and clear pattern of superior outcomes for contractual HMO patients who received care from HHAs that provided more visits (i.e., had higher cost per episode). Of the 21 outcome measures that yielded case-mix-adjusted statistical differences, 20 were superior for the high RC group of patients.

[1]Because RC data were available for only five of the nine HMO-owned agencies, the high versus low RC comparison was not conducted separately for patients admitted to these agencies. Rather, two comparisons were conducted involving HMO patients—one involving contractual HMO patients and the other involving contractual HMO patients pooled with patients admitted to HMO-owned agencies. The results for the contractual HMO patients alone yielded a stronger pattern of superior outcomes for the high RC group.

Outcome and Utilization Findings by Strata

Selected findings from several condition-specific stratified analyses are presented in Table 9. The results in this table are selective, but they are representative of findings for a variety of patient conditions and circumstances. They also serve to illustrate the pervasiveness of and potential reasons for the outcome results previously presented. (In these and subsequent comparisons, terminally ill patients were excluded. Also, as noted earlier, case-mix adjustment was not carried out for the stratified analyses.) Findings for the first three strata presented in Table 9 pertain to outcome and utilization results for rehabilitation patients, with each stratum referring to one of the three types of HMO versus FFS comparisons in Tables 6-8. The last stratum for which results are presented in Table 9 consists of all HMO and all FFS cardiac patients.

The overall pattern of superior functional outcomes for FFS patients is apparent in Table 9 (functional outcomes are particularly relevant for these patient strata). As noted earlier, the outcomes chosen for the HMO-owned versus pure-FFS comparison of rehabilitation patients are condition-specific. That is, information on ability to dress upper and lower body was collected longitudinally only for rehabilitation patients. For all four strata, it is apparent that total visits and visit intensity (visits per week) are higher for FFS patients, relative to HMO patients. For rehabilitation patients, several discipline-specific findings are noteworthy. Differences of approximately 9 total visits and 1.7 visits per week were found for all HMO versus all FFS patients, with FFS patients receiving more visits. This was due largely to considerably more home health aide visits. Overall, the pattern of more total visits and higher visit intensity for FFS patients resulted in superior rehabilitation outcomes. Although of borderline significance, physical therapy visits and visit intensity were greater for FFS patients. Substantial differences in home health aide visits and visit intensity are also apparent in the contract HMO versus contract FFS comparison for rehabilitation patients. A generally insignificant but lower pattern of visits from all disciplines is apparent for rehabilitation patients receiving care from HMO-owned agencies (sample sizes are relatively small). Outcome differences for this comparison were not as great as for the first two comparisons, however. A similar overall profile of more visits and greater visit intensities associated with superior outcomes for FFS cardiac patients is also evident. For such patients, however, the difference in skilled nursing visits was even larger than the difference in home health aide visits.

In addition to physiologic conditions such as those exemplified by the strata in Table 9, two-group comparative analyses were conducted for patient strata defined using other types of conditions and circumstances. The selected findings presented for the five strata in Table 10 also typify a larger set of findings. They correspond to outcome and discipline-specific visit comparisons for all HMO versus all FFS patients. The strata are defined in terms of whether the patient was admitted to home health care from an acute-care hospital, the presence or absence of a willing and able caregiver at home, and the extent of need for personal care. Once again, the persistent differences in outcomes by stratum demonstrate the pervasiveness of the HMO versus FFS outcome findings that were evident from the case-mix-adjusted analyses based on pooling all patients. As with the comparisons in Table 9, terminally

Table 9

Health Status Outcomes and Discipline-Specific Visits, by Type of Home Health Patient: HMO Versus FFS Patients[1]

Patient Stratum and Outcome Measure	Means		
	HMO	FFS	Significance[3]
Rehabilitation Patients[4]	Percent		
Improvement in Bathing	24	43	.049
Improved in Number of Moderate ADL Disabilities	35	55	.084
Stabilized in Eating	78	91	.082
Rehabilitation Patients[5]			
Improved in Number of Moderate ADL Disabilities	31	60	.078
Not Worsened in Any ADL and Improved in At Least One ADL Disability	25	54	.051
Stabilized in Eating	65	98	.001
Rehabilitation Patients[6]			
Improved in Dressing Upper Body	11	34	.098
Improved in Dressing Lower Body	17	46	.040
Cardiac Patients[7]			
Improvement in Eating	32	52	.050
Improved in Number of Moderate ADL Disabilities	38	60	.001
Improved in Number of Severe IADL Disabilities	32	39	.092

Patient Stratum and Provider Discipline	Mean Number of Visits[2]			Mean Visits per Week[2]		
	HMO	FFS	Significance[3]	HMO	FFS	Significance[3]
Rehabilitation Patients[4]						
Total	20.52	29.42	.053	3.92	5.60	<.001
Skilled Nursing	8.66	9.08	.454	1.66	1.88	.064
Home Health Aide	2.63	8.35	.001	0.35	1.30	<.001
Physical Therapist	5.98	6.99	.128	1.10	1.40	.093
Occupational Therapy	1.74	2.61	.302	0.39	0.55	.149
Social Services	0.23	0.58	.009	0.04	0.13	.010
Rehabilitation Patients[5]						
Total	22.09	36.42	.021	3.82	6.17	<.001
Skilled Nursing	9.78	10.23	.245	1.95	1.97	.213
Home Health Aide	2.87	12.61	.001	0.44	1.91	<.001
Physical Therapist	7.05	7.93	.315	1.11	1.38	.030
Occupational Therapy	1.96	3.27	.316	0.27	0.53	.149
Social Services	0.14	0.50	.038	0.02	0.10	.038
Rehabilitation Patients[6]						
Total	17.85	22.86	.345	4.08	5.07	.024
Skilled Nursing	6.77	7.93	.94	1.19	1.80	.155
Home Health Aide	2.23	4.36	.082	0.22	0.74	.053
Physical Therapist	4.15	6.11	.129	1.09	1.42	.395
Occupational Therapy	1.39	2.00	.623	0.58	0.57	.612
Social Services	0.39	0.66	.156	0.09	0.16	.178
Cardiac Patients[7]						
Total	12.51	21.90	<.001	2.99	4.27	<.001
Skilled Nursing	8.38	12.56	<.001	2.14	2.62	.001
Home Health Aide	2.04	5.56	<.001	0.41	0.87	<.001
Physical Therapist	1.55	2.37	<.001	0.31	0.49	<.001
Occupational Therapy	0.31	0.68	.057	0.08	0.15	.036
Speech Therapy	0.11	0.41	.034	0.02	0.07	.033
Social Services	0.13	0.34	<.001	0.04	0.08	<.001

[1]Terminally ill patients were excluded from these samples. The information on some variables, including not only outcomes but total visits and visits per week, may be based on lower sample sizes owing to missing data for selected patients.

[2]The mean number of visits and mean visits per week for each provider discipline are based on the period from admission until discharge or until 12 weeks, whichever occurred first. Thus, the visit intensity (visits-per-week) values for each patient are based on the total number of visits during this study interval divided by the number of weeks (or fraction thereof) during the study interval (maximum of 12). Statistics for selected provider disciplines are presented for each patient stratum in order to demonstrate certain trends or statistical patterns. For example, statistics for all six disciplines are presented only for cardiac patients. The "total" row for each of the four patient strata, however, pertains to the sum of visits across all disciplines, not only those presented in this table.

[3]Significance levels are based on Fisher's exact test or its chi-square approximation for all outcome measures. For the discipline-specific mean comparisons of total visits and visits per week, significance levels are based on the two-sample *t*-test with separate or pooled variance estimates, or the Wilcoxon test, whichever was appropriate in view of the underlying distribution.

[4]All HMO patients versus all FFS patients. Random admission samples of 44 HMO and 139 FFS patients.

[5]Contract HMO versus contract FFS. Random admission samples of 24 HMO and 69 FFS patients.

[6]HMO-owned versus pure-FFS. Random admission samples of 20 HMO and 70 FFS patients.

[7]All HMO patients versus all FFS patients. Random admission samples of 290 HMO and 475 FFS patients.

NOTES: HMO is health maintenance organization. FFS is fee-for-service. ADL is activity of daily living. IADL is instrumental activity of daily living.

ill patients were excluded from the stratum-specific analyses in Table 10. Functional outcomes were typically superior for FFS patients for all strata analyzed (with two exceptions as noted). The superior outcomes for most strata were uniformly accompanied by more total visits and typically by more discipline-specific visits for FFS patients. Substantial differences in skilled nursing and home health aide visits and visit intensities are apparent for several strata. HMOs generally tend to use considerably fewer home health aide visits than provided in the FFS sector. This may be due to a tendency to regard personal care services as less important from an overall health maintenance perspective, as might be expected under a more medical model of long-term care. It is not possible to discern from these data the extent to which home health aide visits (as opposed to somewhat more visits from other disciplines and a different mix of visits from other disciplines) account for the superior outcomes for FFS patients.

For patients with no willing and able caregiver at home, more detailed information on home health aide visits by agency type is noteworthy. Table 11 shows a substantial difference between HMO patients admitted to HMO-owned agencies, relative to both HMO and FFS patients admitted to contractual agencies or pure-FFS agencies. The mean number of home health aide visits and the mean visit intensities for the non-HMO-owned agencies do not differ significantly from one another. However, all differ significantly from the corresponding values for HMO-owned agencies. Noting that these visit statistics are for patients without a willing and able caregiver at home, the (approximate) tenfold difference in total visits and threefold difference in visit intensities are substantial. Functional outcomes for patients admitted to HMO-owned agencies were inferior to functional outcomes for the other three patient groupings, reinforcing the likely underprovision of aide services by HMO-owned agencies (for patients without willing and able caregivers at home). Although the absence of a caregiver at home may be associated with less need for such a caregiver, the outcome differences suggest more personal care services may be beneficial for patients admitted to HMO-owned agencies. Interestingly, the home health aide visit and visit intensity measures for HMO-owned agencies were nearly the same for patients with and without willing and able caregivers at home. This was not the case for the other three groups of patients, which were characterized by substantially more home health aide visits to patients with no willing and able caregiver at home (i.e., relative to patients with such caregivers in the home). These results must be qualified by the relatively small sample sizes that occur when conducting stratified analyses, although as noted, the outcome and utilization differences between patients admitted to HMO-owned agencies and other types of patients were statistically significant.

Stratified analyses were conducted for a large number of patient conditions and circumstances with the general patterns of findings similar to those in Tables 9 and 10.[2]

[2]Stratified analyses included, but were not restricted to the following patient conditions and circumstances: all patients admitted from a hospital; patients admitted from a hospital who were discharged from home care within 12 weeks of admission to home care; patients admitted to home care from a hospital and who were not discharged from home care over the 12-week study interval; patients who were admitted from the community; patients without a willing and able caregiver at home; patients with a willing and able caregiver at home; patients with rehabilitative care needs; patients with open wounds or lesions; patients with end-stage conditions; patients receiving intravenous therapy; cardiac patients; patients with mental or behavioral disorders; patients with moderate rehabilitative potential; patients with a moderate recovery prognosis; patients with an above average need for personal care; patients with a below average need for personal care; patients with above average functional disabilities; and patients with below average functional disabilities. In addition, long-stay and short-stay patients were analyzed separately, discharged and non-discharged patients were analyzed separately, and a number of other patient strata were used to examine potential outcome differences according to case mix and environmental attributes. Terminal patients were excluded from all strata (with the exception of the end-stage condition stratum).

Table 10

Health Status and Utilization Outcomes and Discipline-Specific Visits, by Type of Home Health Patient: All HMO Versus FFS Patients[1]

Patient Stratum and Outcome Measure	Means		
	HMO	FFS	Significance[3]
Admitted From Hospital[4]	Percent		
Improvement in Bathing	46	54	.079
Improved in Toileting	43	59	.068
Not Worsened in Any ADL	73	81	.027
No Willing and Able Caregiver at Home[5]	Percent		
Improved in Number of Severe IADL Disabilities	20	39	.035
Stabilized in Eating	87	95	.074
Discharged to Independent Living and Stabilized in Grooming	60	74	.096
Willing and Able Caregiver at Home[6]			
Improvement in Toileting (in Percent)	40	54	.039
Improvement in Medications Management (in Percent)	27	38	.031
Number of Emergent Care Visits	.25	.14	.077
Above Average Need for Personal Care[7]	Percent		
Improvement in Eating	35	48	.097
Improvement in Toileting	36	53	.008
Discharged to Independent Living and Stabilized in Bathing	61	70	.079
Below Average Need for Personal Care[8]	Percent		
Improvement in Medications Management	30	48	.085
Improved in Number of Moderate ADL Disabilities	48	70	.047
Discharged to Independent Living and Stabilized in Cooking Main Meals	64	75	.052

Patient Stratum and Provider Discipline	Mean Number of Visits[2]			Mean Visits per Week[2]		
	HMO	FFS	Significance[3]	HMO	FFS	Significance[3]
Admitted From Hospital[4]						
Total	12.96	19.91	<.001	3.20	4.13	<.001
Skilled Nursing	8.43	11.23	<.001	2.15	2.48	.061
Home Health Aide	2.67	5.29	<.001	0.55	0.94	<.001
Physical Therapist	1.31	2.20	<.001	0.33	0.47	.001
No Willing and Able Caregiver at Home[5]						
Total	14.12	21.96	.001	3.30	4.54	.004
Skilled Nursing	8.47	10.79	.153	2.23	2.42	.301
Home Health Aide	4.73	7.18	.110	0.83	1.22	<.120
Social Services	0.18	0.66	.014	0.06	0.17	.016
Willing and Able Caregiver at Home[6]						
Total	13.20	19.63	<.001	3.08	3.97	<.001
Skilled Nursing	8.81	10.47	.003	2.09	2.32	.119
Home Health Aide	2.11	5.09	<.001	0.44	0.82	<.001
Social Services	0.16	0.30	.001	0.04	0.06	.002
Above Average Need for Personal Care[7]						
Total	14.24	21.27	<.001	3.19	4.35	<.001
Skilled Nursing	8.59	10.56	.009	2.07	2.35	.232
Home Health Aide	3.31	5.98	<.001	0.64	1.01	<.001
Physical Therapist	1.70	3.00	<.001	0.33	0.65	<.001
Occupational Therapist	0.28	0.81	.018	0.06	0.16	.011
Social Services	0.19	0.46	<.001	0.05	0.10	.001
Below Average Need for Personal Care[8]						
Total	11.77	18.50	<.001	2.88	3.86	<.001
Skilled Nursing	8.52	12.10	<.001	2.15	2.65	.001
Home Health Aide	1.52	4.18	<.001	0.29	0.70	<.001
Physical Therapist	1.37	1.66	.054	0.31	0.36	.063
Occupational Therapist	0.19	0.27	.275	0.07	0.08	.261
Social Services	0.11	0.26	.002	0.03	0.07	.002

[1]Terminally ill patients were excluded from these samples. The information on some variables, including not only outcomes but total visits and visits per week, may be based on lower sample sizes owing to missing data for selected patients.

[2]The mean number of visits and mean visits per week for each provider discipline are based on the period from admission until discharge or until 12 weeks, whichever occurred first. Thus, the visit intensity (visits-per-week) values for each patient are based on the total number of visits during this study interval divided by the number of weeks (or fraction thereof) during the study interval (maximum of 12). Statistics for selected provider disciplines are presented for each patient stratum in order to demonstrate certain trends or statistical patterns. The "total" row for each of the five patient strata, however, pertains to the sum of visits across all disciplines, not only those presented in this table.

[3]Significance levels are based on Fisher's exact test or its chi-square approximation for all outcome measures (except for the outcome corresponding to the number of emergent care visits, where the significance level is based on the Wilcoxon two-sample test). For the discipline-specific mean comparisons of total visits and visits per week, significance levels are based on the two-sample *t*-test with separate or pooled variance estimates, or the Wilcoxon test, whichever was appropriate in view of the underlying distribution.

[4]Random admission samples of 313 HMO and 506 FFS patients.

[5]Random admission samples of 86 HMO and 155 FFS patients.

[6]Random admission samples of 370 HMO and 502 FFS patients.

[7]Random admission samples of 290 HMO and 476 FFS patients.

[8]Random admission samples of 240 HMO and 280 FFS patients.

NOTES: HMO is health maintenance organization. FFS is fee-for-service. ADL is activity of daily living. IADL is instrumental activity of daily living.

Table 11

Mean Home Health Aide Visits, by Home Health Agency Type

Variable	HMO-Owned Patients	Mixed HMO Patients	Mixed FFS Patients	Pure-FFS Patients
Mean Home Health Aide Visits	0.59	6.01	9.00	5.64
Mean Home Health Aide Visits per Week	0.27	1.00	1.34	1.12

NOTES: HMO is health maintenance organization. FFS is fee-for-service.

SOURCE: Based on random samples of 381, 414, 308, and 529 patients from mixed HMO, mixed FFS, HMO-owned, and pure-FFS home health agencies, respectively.

Noteworthy exceptions, however, were the relatively few outcome differences between HMO and FFS patients found for patients receiving wound care and intravenous therapy, even though (as with most of the stratified analyses) FFS patients received more visits and were characterized by higher visit intensities for these two conditions. Thus, for these two conditions, the findings suggest that HMO patients may have received more cost-effective care, unlike most other conditions and circumstances where FFS patients were characterized by superior outcomes that were also accompanied by more visits and therefore higher cost.

DISCUSSION

Outcome Patterns

The strongest patterns of outcome differences were found by comparing outcomes for HMO patients with those found for FFS patients. Although a number of outcome measures did not yield statistically significant mean differences, an overall trend of superior case-mix-adjusted outcomes for FFS patients was apparent in terms of the relative uniformity of higher values for most outcome measures and, when statistically significant differences occurred, they nearly always indicated superior outcomes for FFS patients. A brief summary of the more important findings is presented here, followed by a discussion of selected issues.

HMO Patients Versus FFS Patients

Comparing the two types of HMO patients (contractual and HMO-owned) with the two types of FFS patients (contractual and pure-FFS) yielded superior outcomes after case-mix adjustment for FFS patients for the following outcome measures:

- An aggregate measure of improvement in the number of mild disabilities in ADLs.
- An aggregate measure of improvement in the number of moderate disabilities in ADLs.
- Improvement in eating.
- Improvement in toileting.
- Improvement in medications management.
- Improvement in ability to shop.
- Discharged to independent living and improved in eating.
- Discharged to independent living and improved in medications management.
- Stabilized in grooming.
- Stabilized in eating.
- Stabilized in toileting.
- Stabilized in transferring.
- An aggregate measure of stabilization in the number of mild disabilities in ADLs.
- An aggregate measure of stabilization in the number of moderate disabilities in ADLs.

There were no differences in mortality or utilization outcomes. None of the case-mix-adjusted outcomes were superior for HMO patients.

Patients in HMO-Owned Agencies Versus Pure-FFS Agencies

After case-mix adjustment, the following outcome measures were superior for FFS patients:

- An aggregate measure of improvement in the number of mild disabilities in ADLs.
- An aggregate measure of improvement in the number of moderate disabilities in ADLs.
- An aggregate measure of improvement in one or more ADLs, with all others stable.
- Discharged to independent living and improved in eating.
- Stabilized in grooming.
- Stabilized in eating.
- Stabilized in toileting.
- Stabilized in grade of pressure ulcers.
- An aggregate measure of stabilization in the number of mild disabilities in ADLs.
- An aggregate measure of stabilization in the number of moderate disabilities in ADLs.
- An aggregate measure of stabilization in all ADLs.

HMO patients had superior outcomes relative to FFS patients for the following measures:

- Discharged to independent living and stabilized in light meal preparation.
- Hospitalization within 12 weeks for urgent care.

HMO Versus FFS Patients Admitted to Contractual Agencies

Contractual FFS patients had superior outcomes after case-mix adjustment according to the following measures:

- An aggregate measure of improvement in the number of moderate disabilities in ADLs.
- Improvement in ability to do laundry.
- Improvement in ability to shop.
- Discharged to independent living and improved in ability to prepare light meals.
- Discharged to independent living and improved in ability to cook main meals.
- Discharged to independent living and improved in ability to do laundry.
- Stabilized in ability to transfer.
- Stabilized in ability to cook main meals.
- An aggregate measure of stabilization in the number of mild disabilities in five IADLs.
- An aggregate measure of stabilization in the number of mild disabilities in three IADLs.
- Discharged to independent living and stabilized in grooming.
- Discharged to independent living and stabilized in transferring.
- Discharged to independent living and stabilized in medication management.
- Discharged to independent living and stabilized in ability to prepare light meals.
- Discharged to independent living and stabilized in ability to cook main meals.
- Mortality (discharged due to death).
- Hospitalization within 12 weeks for urgent care.

The only outcome for which HMO patients were superior was hospitalization within 12 weeks for emergent care.

Other Comparisons

The general patterns of findings just summarized were supported by analyses of patients stratified by condition and other characteristics. In addition, although not as pronounced as the outcome differences resulting from the comparison of HMO and FFS patients, outcome differences were found for two other sets of comparisons. In particular, moderately superior outcomes were found for contractual FFS patients relative to patients admitted to pure-FFS agencies. Some superior outcomes were found for

contractual HMO patients relative to HMO patients admitted to HMO-owned agencies. Further, a relationship between utilization (number of visits, which translates into costs) and outcomes was evident, with higher utilization (higher numbers of visits) associated with better outcomes. This relationship was strongest among contractual HMO patients.

COMMENTS

The approach taken in this study to measuring and analyzing patient status outcomes was developed over the course of conducting several studies in long-term care (Shaughnessy, 1991; Shaughnessy, Kramer, and Hittle, 1990; Shaughnessy et al., 1987). In general, we have learned that it is important to examine patterns of results for several outcome measures considered simultaneously, rather than examining results for a few select measures. In this regard, the patterns of superior outcomes for FFS home health patients relative to HMO home health patients are fairly consistent. They parallel and are further validated by the utilization and RC patterns that indicate resources consumed in providing home health care to HMO patients are less than those consumed in treating FFS patients (Shaughnessy et al., 1994). Although the case-mix findings point to less disability among HMO patients admitted to home health care, the lower HMO case-mix intensity was taken into consideration in the outcome analyses by examining risk-factor-adjusted outcomes, excluding patients who could not improve (worsen) from improvement (stabilization) analyses, conducting and comparing analyses with terminal patients excluded, as well as using end-stage condition as a covariate, and examining most outcomes by patient strata, as well as through combined multivariate analyses that adjusted for case mix.

While there are various methods to conduct cost-effectiveness analyses to determine whether the lower costs for HMO patients offset inferior outcomes relative to the higher costs and superior outcomes for FFS patients, we concluded that such methods would overstep the natural boundaries of this study's data. Such approaches require placing a value or weight on each of the many different types of outcome measures used—so that such values could be compared in dollar terms or in some other units that are meaningful in assessing the cost-outcome tradeoffs. Although there are ways to assign such values to outcomes, we elected not to do so, because we believe they allow too much room for subjectivity in this application.

In general, relative to the FFS sector, it appears that HMOs tend to approach some aspects of home health care with more of a "maintenance" philosophy than a rehabilitative or restorative philosophy. Fewer visits are provided, less personal care services are given, and a stronger orientation toward a medical approach (as opposed to a combined "medical-social-rehabilitation-personal care" approach) characterizes home health services provided to HMO patients. This may be due to a philosophy that home health care is to be avoided in the same general manner as hospital care. It may also be due to a lack of awareness by at least some (if not most) physicians in HMO environments as to the potential value of home health care in terms of service integration, patient preference, quality of life, and patient benefits in terms of functioning.

The superiority of outcomes for FFS patients who typically receive more home health visits by discipline (with varying degrees of discipline-specific differences) suggests that most HMO patients are underserved in terms of the number of home health visits. Conversely, the lack of HMO versus FFS outcome differences for some types of patients (wound patients and patients receiving intravenous therapy)

suggests room for greater efficiency in selected areas in the FFS sector because the absence of outcome differences is accompanied by lower service intensity for HMO patients.

The volume-outcome relationship between utilization and RC and patient outcomes has several ramifications. First, the fact that HMO patients who receive home health care in HMO-owned agencies are characterized by both the lowest cost and the least adequate case-mix-adjusted outcomes is important for HMO providers to take into consideration. It appears that HMOs that own HHAs generally provide fewer nursing, therapy, and personal care services than is the case for both contractual HMO patients and FFS patients. However, HMO-owned agencies tend to provide proportionately more social services, and on the basis of our visits to such agencies, appear to more closely monitor and manage the provision of home health care through social workers (and discharge planners). A reevaluation of the potential value of home health care, emphasizing improvement in restoration of functioning and physiologic condition (as opposed to maintenance of condition), would appear to be warranted on the part of such agencies.

Second, the finding that the volume-outcome relationship is most pronounced among contractual HMO patients is important. Many HMOs that contract for home health care provide relatively stringent guidelines to HHAs in terms of the number of visits or length of time until discharge. An overly stringent or unduly rigid approach to utilization control of this nature apparently works to the detriment of a number of HMO patients who receive home health care under contractual arrangements.

Third, on the basis of the findings from this study, it is not possible to discern precisely whether there are utilization or RC thresholds beyond which relatively few gains in patient outcomes would accrue. Intuitively, it seems apparent that such a threshold would exist. Further research on this issue may prove fruitful from the perspective of establishing standards for the volume of home health care by patient type.

The purpose of this analysis was to examine outcomes of home health care. For this reason, the most important time interval over which outcomes were analyzed was from start of home health care until discharge or 12 weeks, whichever occurred first. Efforts were made to control for case mix and variations in LOSs among the different modalities of care. Additional case-mix variables, risk factors, or environmental covariates might further reduce some of the outcome differences found in this study. However, in view of the pervasiveness of the differences, it seems unlikely that they would be totally eliminated through further covariate adjustment. It is plausible, however, that if longer time intervals were used so that the longer run effects of physician care, hospital care, nursing home care, rehabilitation care, and even additional home care were all taken into consideration, then HMO patients might ultimately attain the same outcomes as FFS patients (or possibly even superior outcomes). This is also an issue that could be researched further. However, our goal was to assess the more direct impacts of home health care, and thus a study interval was chosen during which most home health patients would be discharged, so that outcomes could be directly assessed over the episode of home health care.[3] The findings

[3]The results for hospitalization within 12 weeks reflected no clear pattern of difference between FFS and HMO patients. If the HMO hospitalization rates had been uniformly higher, adding further support to the inferior functional outcome for HMO patients, short-run cost implications would then be a clear accompaniment of other outcome differences. Given the established tendencies of HMOs to avoid hospitalizations, however, the lack of discernable patterns of differences in hospitalization rates suggests a similarity between FFS and HMO patient use of hospital care that would not be expected in view of higher hospitalization rates in the FFS sector in general. Whether longer run hospitalization or utilization implications of these findings exist could be examined through further research, as previously noted.

that have emerged suggest that we should be more attentive to both outcome-based quality assurance and managed care practices that may be overly restrictive in terms of the use of home health care services.

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