Rates of Hospitalization for Ambulatory Care Sensitive Conditions in the Medicare+Choice Population

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This article evaluates the feasibility of developing hospitalization rates for ambulatory care sensitive conditions (ACSCs) for the Medicare+Choice (M+C) population. M+C inpatient encounter data were used to calculate 15 ACSC rates. We found the initial reporting year of M+C inpatient encounter data had no apparent volume or diagnosis-based biases and over 90 percent of M+C organizations had sufficient enrollment to produce statistically reliable rates. Further, our study results support the premise that ACSCs could be used as sentinel events for potentially vulnerable populations; the oldest old and the disabled experienced statistically significant higher rates of ACSC admissions than younger Medicare beneficiaries.

BACKGROUND

In recent years, HCFA has begun the process of transforming itself from being a passive payer for health services to being an active purchaser of health care. HCFA is also encouraging its beneficiaries to be equally as active. As part of this transformation, HCFA has broadened its consumer information mission by collecting a variety of data from Medicare managed care enrollees: health status information from the Health Outcomes Survey, satisfaction information from the Consumer Assessment of Health Plans, and health plan performance from the Health Employer Data and Information Set among other initiatives. Also as part of this transformation effort, HCFA has started making some of this information available to Medicare beneficiaries, thereby encouraging its M+C enrollees to select their M+C organizations based on comparative performance.

This article evaluates the feasibility of including annual hospitalization rates for ACSCs as part of HCFA's comparative performance information database. Over the past decade, ACSCs have become an established tool for analyzing access to care. If treated in a timely fashion with adequate primary care and managed properly on an outpatient basis, medical practitioners broadly concur that, in most instances, commonly defined ACSCs (e.g., bacterial pneumonia, diabetes mellitus, etc.) should not advance to the point where hospitalization is required. Because lack of primary care for ACSCs does, in fact, often result in hospitalization, the rate of preventable inpatient admissions provides a practical way of evaluating primary care delivery and, thereby, identifying appropriate areas for improving access and quality in the health care delivery system.

The use of ACSCs is appealing for several reasons. First, ACSC admission rates have been used extensively in analysis of access to care for patients in the fee-for-service (FFS) sector. Although revisions may be needed, the methodology for deriving the rates in managed care can build on an existing literature. Second, ACSC rates are

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constructed using enrollment and inpatient stay data. Thus, they can be constructed using data that HCFA currently collects from M+C organizations. No additional financial burden would be placed on M+C organizations, nor would special data collection efforts be necessary. Further, because hospitalization data are available relatively soon after a hospitalization, ACSC rates can be constructed on a timely basis providing early outcome feedback to M+C organizations. This information could be used by the M+C organizations to evaluate their providers' processes of care, and to develop case management strategies to reduce rates of ACSC hospitalizations.

SELECTION OF ACSCS FOR STUDY

Fifteen ACSCs were selected for evaluation following an extensive review of the literature (Pappas et al., 1997; Billings et al. 1993; Billings et al. 1996; Weissman, Gatsonis, and Epstein, 1992; Institute of Medicine 1993; Bindman et al., 1995; Krakauer et al., 1996; Culler, Parchman, and Przybylski, 1998; Blustein, Hanson, and Shea, 1998; Schreiber and Zielinski, 1997; Braverman et al., 1994; and Mitchell, 1993). Because ACSCs were developed primarily as a measure of access to care for the non-elderly population, each measure was reviewed by two clinical consultants to ensure that selected ACSCs were appropriate for the elderly population. Critical examination of the previously used specifications for identifying both the population at risk and the clinical conditions of interest was undertaken as well as an evaluation of the likely accuracy of coding of the clinical condition on hospital bills.

ACSCs tend to be relatively rare events raising questions about the statistical reliability of the ACSC rates calculated at the M+C organization level. In addition to the problem of small numerator values for individual events, reporting each rate individually may lead to an overload of information. Beneficiaries may find it difficult to interpret a dozen or more ACSC rates simultaneously. Further, individual purchasers may not necessarily care about the rates for each of the ACSCs; instead the issue of concern may be a broader one of the rates for ambulatory care as a whole. Two alternative indices were constructed: a single ACSC index that simply aggregated all ACSC diagnoses; and three ACSC indices that aggregated conditions considered acute, chronic, and preventable. The ACSCs selected for the study include: chronic (asthma/chronic obstructive pulmonary disease (COPD), congestive heart failure, seizure disorder, diabetes, and hypertension); acute (hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric and duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections); and preventable (influenza and malnutrition).

INPATIENT HOSPITAL ENCOUNTER DATA

Medicare was required by the Balanced Budget Act (BBA) of 1997 to implement a risk adjusted payment system for M+C organizations by January 1, 2000. The BBA provided authority to collect hospital inpatient encounter data, retroactive to July 1, 1997. Encounter data reflecting discharges for the period July 1997-June 1998 were used to calculate estimates of risk adjusted payments for the startup year. Risk adjustment for M+C is based on the Principal Inpatient Diagnostic Cost Group (PIP-DCG) model. The PIP-DCG model uses the principal inpatient discharge diagnosis to determine a beneficiary's predicted costs for the following 12-month period (Pope et al., 1999). Thus, M+C organiza-

tions have an incentive to submit valid principal diagnoses on the encounter forms, and these data are subject to validation.

M+C organizations could submit inpatient encounter data for the period July 1997-June 1998 using either the standard Medicare FFS data formats or an abbreviated uniform bill (UB)-92 format. The abbreviated UB-92 format was designed for use by M+C organizations and provided for the collection of the essential data elements necessary for risk adjustment, including patient and provider identifiers and the principal inpatient diagnosis. For the startup year, either the M+C organization could submit the data to HCFA or alternatively, hospitals could submit the standard Medicare FFS data formats directly to HCFA for the M+C organizations. Two-thirds of the discharge data were submitted in the abbreviated UB-92 format, while the remaining one-third were submitted in the full UB-92 format. The majority of the full UB-92 data were submitted directly to HCFA by hospitals providing inpatient services to M+C enrollees (the majority of M+C organizations submitted abbreviated data).

It should be noted that during the startup year, the focus was on the submission of data necessary for risk adjustment, and other diagnosis codes beyond the principal and all procedure codes were frequently less than complete. Thus, ACSCs were selected that could be defined based solely on the presence of the principal discharge diagnosis because the other diagnosis codes and procedure codes were not consistently reported in the encounter data. All UB-92 encounters were processed through edits similar to Medicare FFS, including diagnostic and procedure code editing. Additional algorithms were applied to the abbreviated UB-92s to remove duplicate records and interim bills and to retain only the first hospitalization bill for cases involving transfers between two acute care hospitals, thereby avoiding double counting of ACSC admissions.

STUDY POPULATION

The study cohort of managed care enrollees was identified from the full startup year M+C population. This cohort was analyzed to validate the completeness of the M+C organization encounter data and to profile the occurrence of the ACSCs for the study period July 1997-June 1998. M+C beneficiaries were eligible for inclusion in the study cohort if they met the following criteria: (1) they were continuously eligible for both Medicare Part A and Part B for a full 12 months, (2) they were enrolled in an M+C organization as of July 1997, and (3) they were continuously enrolled in the same M+C organization for the full 12-month period. One exception was made in the case of individuals who were continuously enrolled in the same M+C organization but died during the 12-month period. These individuals were also included in the cohort. Since we are estimating annual rates, we imposed the first condition to ensure that we were observing all of an enrollee's health care utilization. The second and third conditions were imposed to increase the face validity of the calculated rates by providing a reasonable timeframe in which the M+C organization would have an opportunity to influence the majority of an enrollee's ambulatory care. To adjust for partial year enrollment due to death, full-time equivalent (FTE) managed care enrollees were estimated. A total of 4.05 million FTE M+C enrollees were identified for the study cohort. It is important to note that because we required enrollees to have contracted with the same M+C organization for the full year, the number of enrollees assigned to an M+C organization may not represent actual M+C enrollment

throughout the course of the year. Further, the number of hospitalizations may not represent the actual number of discharges.

METHODS

Our evaluation efforts centered around two analytic tasks: a critical examination of the completeness of inpatient encounter data for the startup year at the M+C organization level; and a comprehensive examination of the validity and reliability of the calculated ACSC rates also at the M+C organization level. If hospitalization data are missing, then ACSC rates will be biased downward. If there is evidence that the missing data are randomly distributed (i.e., are independent of diagnosis), then the ACSC rates could be inflated to account for missing data. However, missing data might not be random, if M+C organizations were more likely to report particular types of cases, for example, those that impact the PIP-DCG model and higher payment. To examine the completeness of the encounter data, we constructed hospital admission rates for the M+C organizations across all admissions, adjusted for the age-sex distribution of the M+C organizations' enrollment to the Medicare FFS population using the direct standardization methodology (Glantz, 1981). We obtained estimates of 1997 State-level hospitalization rates for the Medicare FFS population (Health Care Financing Administration, 1999) allowing us to construct regional FFS admission rates. Comparisons of hospital admission rates were made, in total, and by geographic regions.[1] To allow for M+C organization-specific managed care comparisons with Medicare FFS, each M+C organization was assigned to the State in which the majority of their enrollees were resident. The M+C organizations' admissions were then compared with the relevant State Medicare FFS admission experience. To identify low- or high-end outliers, or those with unusually low or high rates of hospitalizations that might be indicative of data anomalies, we estimated a relative rate of managed care to FFS admissions at the M+C organization level by dividing the managed care admission rate by the FFS admission rate, thereby, controlling for known baseline FFS admission rate differences across geographic areas. Lastly, we examined the distribution of adjusted hospital discharge rates per 1,000 FTE enrollees across the M+C organizations.

To examine the validity and statistical reliability of the rate of ACSCs, rates were calculated at the national, regional, and M+C organization levels and by beneficiary characteristics, age and sex. To determine whether differences in these rates are meaningful, 95 percent confidence intervals were constructed. For face validity analyses, comparisons were made with those published in the literature. To assess whether there are any discernible patterns across the M+C organizations in the types of ACSC hospital bills submitted (i.e., missing data are not randomly distributed across diagnoses), we constructed the relative rate of ACSC index admissions to all admissions for each of the three indices, chronic, acute, and preventable, at the M+C organization level and evaluated the distribution of relative rates across the M+C organizations. This controls for underlying differences in rate of hospitalization and allows one to examine the proportion of admissions that are for acute, chronic, or preventable clinical conditions.

To assess the statistical reliability of the calculated ACSC admission rates, we examined the distributional properties of ACSC admissions across M+C organizations and the sufficiency of M+C organization

[1] Our expectation was that the managed care rates would be lower, given differences in patient health status between managed care and FFS, thus we looked for significantly lower rates as a signal of incomplete data.

Table 1

Distribution of Medicare Fee-for-Service, Managed Care, and Medicare+Choice Enrollees, by Age and Sex: July 1, 1997

Age and Sex	Enrollee Characteristics					
	Medicare Fee-for-Service		Medicare Managed Care		Study Sample	
	Number	Percent	Number	Percent	Number	Percent
Total	33,009	100.00	5,456	100.00	4,052	100.00
Age/Sex						
Under Age 65	4,498	13.63	330	6.05	261	6.45
Male	2,621	7.94	186	3.41	145	3.57
Female	1,877	5.69	144	2.64	116	2.87
65-74 Years	15,099	45.74	2,959	54.23	2,298	56.70
Male	6,763	20.49	1,324	24.27	1,030	25.42
Female	8,336	25.25	1,635	29.97	1,267	31.28
75-84 Years	9,848	29.83	1,714	31.41	1,208	29.81
Male	3,789	11.48	701	12.85	495	12.22
Female	6,059	18.36	1,013	18.57	713	17.59
85 Years and Over	3,564	10.80	453	8.30	285	7.04
Male	977	2.96	147	2.69	91	2.26
Female	2,587	7.84	306	5.61	194	4.79

NOTE: Number of beneficiaries are in thousands.

SOURCES: (Health Care Financing Administration, 1999.) Health Economics Research, Inc., analysis of study cohort's demographics from Health Care Financing Administration's July 1, 1997-June 30, 1998 enrollment database.

enrollment to support the calculation of ambulatory care sensitive conditions at the M+C organization level. We estimated the proportion of M+C organizations that would produce statistically reliable ACSC rates by applying a statistical precision criterion that required the M+C organization to have a sufficient number of FTE enrollees to produce an average ACSC admission rate that was within 10 percent of its true rate 90 percent of the time. Using this criterion, we were able to specify the minimum number of FTE enrollees that would be required in order to ensure that the M+C organization's average admission rate was reliable and valid for the 15 individual ACSCs, the 3 subgroups of ACSCs, and for all ACSCs combined. We report the average requirement across all M+C organizations and the percentage of M+C organizations that had a sufficient volume of FTE enrollees, given their admission rate for the various ACSC conditions, to produce statistically reliable estimates at the specified precision level.

RESULTS

Analysis of Completeness of Data

The study cohort was identified from the population of all M+C beneficiaries who were enrolled in an M+C organization during the period July 1997-June 1998. A total of 305 M+C organizations were identified for the continuously enrolled study cohort.[2] The number of FTE enrollees ranged from 1 to 255,520, and the number of hospital discharges ranged from 0 to 54,009 per M+C organization. Table 1 provides a demographic comparison of three populations: Medicare FFS, Medicare managed care population, and the M+C study population. The general Medicare managed care population is about 14 percent of the Medicare FFS population, and our M+C study cohort is roughly 12 percent of the Medicare FFS population. The data show that the two managed care populations

[2] It should be noted that a small number of these M+C organizations cannot be defined as true risk M+C organizations. These M+C organizations need to be examined further and excluded from future analyses.

have similar demographic profiles. However, both managed care populations have lower proportions of individuals under age 65 (i.e., the disabled) and over age 85 than observed in the FFS population. This indicates that the health status and subsequent use of hospital services may be different for the managed care and FFS populations.

An immediate concern, with regard to using the M+C encounter data for the purpose of profiling the occurrence of ACSCs, is the extent to which the encounter data are complete. Data that are incomplete would underestimate the presence of ACSCs. A series of analyses were conducted for this study to validate the completeness of the encounter data prior to proceeding with the analysis of ACSCs. The focus of the completeness analysis was on the extent to which an encounter data record had been submitted for each discharge occurring for M+C beneficiaries during the startup year. Descriptive profiles of discharge rates were generated at the national level, by census regions and divisions, and for each M+C organization in order to identify missing encounter data. The distribution of the discharge rates for managed care was examined and compared with the Medicare FFS experience. A normal distribution of the discharge rates that closely resembled the FFS environment would support the notion that M+C encounter data are sufficiently complete for our study purposes.

Table 2 compares the distribution of discharge rates for M+C with the FFS experience for the period July 1997-June 1998 at the national level, by census regions and divisions. The M+C rates are age-sex adjusted to reflect the demographic profile of the FFS population and are reported as rates per thousand. The adjusted rates are higher than the unadjusted rates. This supports the premise that the managed care population is healthier, with fewer hospitalizations, than the FFS population, and allows for a more equitable comparison of the discharge rates. A comparison of the adjusted M+C rates at the national, regional, and census division levels indicates that the FFS discharge rates are consistently higher than the M+C discharge rates, as expected. The national M+C adjusted rate is 237 per thousand enrollees, while the FFS rate is 366 per 1,000 beneficiaries. Adjusted rates for the census divisions ranged from 211 to 287 per thousand for managed care, and 320 to 416 per thousand for FFS. Similar geographic variation in admission rates is observed in both FFS and managed care.

An analysis of the ratios of relative rates of adjusted hospital discharges for the M+C to FFS populations at the national and census division level reveals that the M+C population tends to have about one-third fewer hospitalizations than the FFS population even after the age/sex adjustment. The lowest ratio was in the Pacific census division, while the highest could be found in the New England census division (0.54 and 0.78 per 1,000 enrollees/beneficiaries).

Figure 1 displays an analysis of the distribution of M+C organizations by the adjusted hospital discharge rate per 1,000 FTEs for each M+C organization. The figure shows that the distribution of rates for the M+C organizations is relatively normal. The mean is 250 discharges per 1,000 enrollees with a small cluster of M+C organizations in the lower tail of the distribution. This cluster is suggestive of some M+C organizations having abnormally low rates of discharges.[3] The analysis findings indicate that M+C organizations appear to have consistently lower rates of hospital discharges, which are normally distributed across the managed

[3] Eight M+C organizations were excluded from this distribution because they appeared to have over submitted duplicate encounter data records.

Table 2

Comparison of Medicare+Choice Study Cohort and Medicare Fee-for-Service Hospital Discharge Rates: July 1, 1997-June 30, 1998

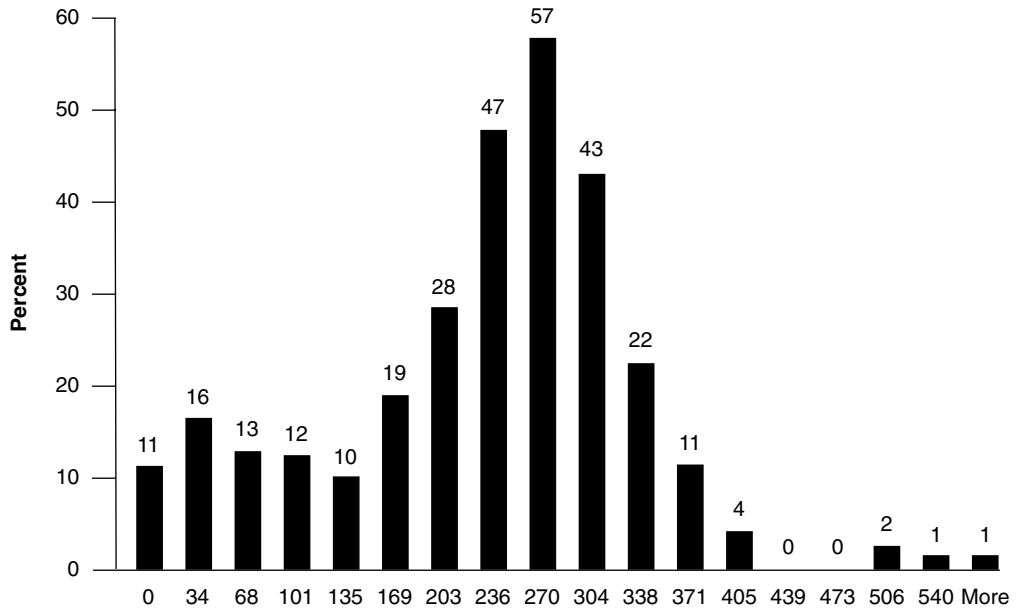
	Medicare+Choice Study Cohort						Medicare Fee-for-Service				
			Unadjusted	Adjusted	95 Percent CI					95 Percent CI	
Geographic Area	Number of Beneficiaries	Number of Discharges	Rate per 1,000	Rate per 1,000	Lower	Upper	Number of Beneficiaries	Number of Discharges	Rate per 1,000	Lower	Upper
National	4,052,454	903,685	223	237	236	237	32,602,360	11,919,085	366	365	366
Census Regions											
Northeast	955,229	239,952	251	276	275	277	6,692,840	2,495,665	373	373	373
Midwest	425,889	98,619	232	245	244	246	8,407,740	3,017,995	359	359	359
South	960,190	223,407	233	247	246	248	11,999,660	4,532,590	378	377	378
West	1,710,819	341,643	200	213	212	214	4,700,200	1,729,770	368	368	368
Census Divisions											
New England	210,239	47,833	238	259	257	261	1,820,700	607,280	334	333	334
Middle Atlantic	753,988	192,119	255	281	280	282	4,872,140	1,888,385	388	387	388
East North Central	280,556	63,599	227	241	239	243	5,839,900	2,112,400	362	361	362
West North Central	145,331	35,020	241	251	249	253	2,567,840	905,595	353	352	353
South Atlantic	626,174	148,265	237	248	247	249	6,327,820	2,272,995	359	359	360
East South Central	44,564	12,095	271	287	283	291	2,376,960	988,025	416	415	416
West South Central	289,450	63,147	218	236	234	238	3,294,880	1,271,570	386	385	386
Mountain	402,591	82,706	205	216	215	217	1,555,500	497,810	320	319	321
Pacific	1,308,226	258,937	198	211	210	212	3,144,700	1,231,960	392	391	392

NOTES: CI is confidence interval. Managed care rates are age/sex adjusted to Medicare fee-for-service demographics.

SOURCES: Health Economics Research, Inc., analysis of Medicare+Care 1997/1998 inpatient hospital encounter data. (Health Care Financing Administration, 1999.)

Figure 1

Hospital Discharge Rate per 1,000 Enrollees Across Medicare+Choice Organizations



NOTE: Hospital discharge rates are age/sex adjusted and reported based on 1,000 full-time equivalent enrollees.

SOURCE: Health Economics Research, Inc. analysis of July 1997-June1998 Medicare+Choice inpatient hospital encounter data.

care population. The lower rates of hospital discharges for managed care in comparison to FFS may be explained by both better management of patient conditions and healthier M+C enrollees, and does not necessarily reflect missing hospital bills. Rather, we believe the normal distribution of adjusted hospital discharge rate per 1,000 FTEs across the M+C organizations provides evidence that the data are sufficiently complete for the first reporting year for the conduct of this study.

Analysis of ACSC Rates

Validity

To examine the validity and statistical reliability of the rate of ACSCs, hospitalization rates were calculated at the national, regional, and M+C organization levels and by beneficiary characteristics, age and sex. Table 3 displays the rate of ACSCs for M+C enrollees during the 12-month period, July 1, 1997-June 30, 1998. ACSC rates are displayed for each of the 15 individual ACSCs, all 15 ACSCs combined, and three indices of combined conditions: acute, chronic, and preventable. Unadjusted and adjusted rates per thousand are displayed, as are 95 percent confidence intervals for the adjusted rates.[4] Our sample contained just over 4 million full year equivalent M+C enrollees who experienced 191,323 hospitalizations for ambulatory care sensitive conditions. This produced an unadjusted rate of 47.2 admissions per thousand M+C enrollees and an adjusted rate of 51.5 admissions per thousand

[4] All M+C rates have been adjusted to the age/sex distribution of the Medicare FFS population.

Table 3

Admissions per 1,000 Medicare+Choice Full Time Equivalent Enrollees, by Rate of Ambulatory Care Sensitive Conditions (ACSCs): July 1,1997-June 30, 1998

ACSC	Total ACSC Admissions		Unadjusted	Adjusted[1]	95 Percent CI	
	Number	Percent	Rate per 1,000	Rate per 1,000	Lower	Upper
Total	191,323	100	47.22	51.46	51.25	51.67
Acute Conditions[2]	82,818	43.3	20.44	22.39	22.25	22.53
Chronic Conditions[3]	107,608	56.2	26.56	28.83	28.67	28.99
Preventable Conditions[4]	897	0.5	0.22	0.24	0.23	0.25
Asthma/COPD	34,031	17.8	8.40	8.89	8.80	8.98
Congestive Heart Failure	57,487	30.0	14.19	15.49	15.37	15.61
Seizure Disorder	3,997	2.1	0.99	1.14	1.11	1.17
Diabetes Mellitus	6,783	3.5	1.67	1.89	1.85	1.93
Hypertension	5,310	2.8	1.31	1.41	1.37	1.45
Gastric or Duodenal Ulcer	6,398	3.3	1.58	1.65	1.61	1.69
Hypoglycemia	320	0.2	0.08	0.09	0.08	0.10
Urinary Tract Infections	12,956	6.8	3.20	3.59	3.53	3.65
Cellulitis	8,119	4.2	2.00	2.27	2.22	2.32
Dehydration	10,768	5.6	2.66	2.94	2.89	2.99
Hypokalemia	777	0.4	0.19	0.21	0.20	0.22
Pneumonia	43,384	22.7	10.71	11.62	11.52	11.72
Severe Ear/Nose/Throat Infections	96	0.1	0.02	0.03	0.02	0.04
Influenza	431	0.2	0.11	0.11	0.10	0.12
Malnutrition	466	0.2	0.12	0.13	0.12	0.14

[1] Adjusted to the 1997 age/sex distribution of Medicare fee-for-service beneficiaries.

[2] Acute conditions are hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric or duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections.

[3] Chronic conditions are asthma/COPD, congestive heart failure, seizure disorder, diabetes mellitus, and hypertension.

[4] Preventable conditions are influenza and malnutrition.

NOTES: CI is confidence interval. COPD is chronic obstructive pulmonary disease.

SOURCE: Health Economics Research, Inc., analysis of 1997/1998 Medicare+Choice inpatient hospital encounter data.

M+C enrollees. Chronic conditions accounted for 56 percent of ACSC admissions, or 28.83 admissions per thousand; acute conditions accounted for 43 percent of admissions, or 22.39 per thousand; and the two preventable conditions combined accounted for less than 1 percent of all ACSC admissions, or 0.24 per thousand. Over 70 percent of all ACSC admissions were for the three clinical conditions: congestive heart failure, 15.49 per thousand; pneumonia, 11.62 per thousand; and asthma/COPD, 8.89 per thousand.[5] Several conditions had extremely low admission rates, such as, severe ear/nose/throat infections (0.03 per thousand), hypoglycemia (0.09 per thousand), influenza (0.11 per thousand), and malnutrition (0.13 per thousand).

One of the primary goals of this project was an assessment of whether there were systematic biases in the submission of hospital encounter data in the first year of data that would produce erroneous estimates of ACSC admissions. To examine whether the submitted hospitalization data are biased based on diagnosis, we constructed relative ACSC admission rates for the three clinical condition-specific indices by dividing each ACSC admission rate by the rate of admissions for all hospitalizations for each M+C organization. The all-hospitalization rate controls for baseline utilization differences among the M+C organizations. Relative rates for the condition-specific indices that are way above or way below the average across all M+C organizations could signal the possibility of biased hospitalization data submissions. The distribution of relative rates across the

[5] Because the denominator was defined as the number of FTE beneficiaries enrolled in the M+C organization for the full 12-month period for all ACSCs, the admission rate per thousand mirrors the calculated percentage of admissions.

M+C organizations for total ACSCs, acute ACSCs, and chronic ACSCs were calculated.[6] For all three indices, we observe a significant clustering of relative rates within a narrow range. For the total ACSC index, two-thirds of the M+C organizations reported relative rates between 0.18 and 0.24, and another 18 percent of M+C organizations reported relative rates between 0.24 and 0.29. For the acute and chronic ACSC indices, roughly 85 percent of M+C organizations reported relative rates within the narrow range of 0.12 and 0.18. The tightness of the ranges and the similarity in the distributions between the chronic and acute indices reveal no obvious source of bias based on principal diagnosis.

Previous research has shown considerable geographic variation in the rate of hospitalization for the Medicare FFS population. Not unexpectedly, we observe statistically significant differences in the rate of ACSC admissions across the four census regions and across the nine census divisions for the M+C population (Table 4). This variation mirrors the pattern for all hospitalizations that we observed in our M+C cohort and in Medicare FFS (Table 1). The Northeast region has the highest rate of total ACSC admissions, 60 per thousand. The West region has a 14-percentage point lower average rate of ACSC admissions, or 46 per thousand. Further stratification into the nine census divisions reveals even greater geographic variation. The East North Central division has an ACSC admission rate almost twice the observed rate in the Pacific division, 84 per thousand versus 46 per thousand. The four census region pattern tends to hold across the three condition-specific indices as well. There is less of a discernible pattern at the nine census division level for the three indices.

[6] Due to a small number of preventable ACSC admissions, this index was excluded was from this analysis.

Examination of ACSC admission rates by sex revealed little variation. Across all 15 ACSC conditions, males had an admission rate of 55 per thousand and females had an admission rate of 47 per thousand ($p<0.05$), after controlling for age. This likely reflects the combination of the selected conditions as there were no statistically significant differences between the two sexes for the three subcategories of ambulatory care sensitive conditions, nor were there differences for most of the individual ACSCs. There were only two exceptions to this rule: females experienced a higher rate of admission than males for hypokalemia (0.27 per thousand versus 0.14 per thousand); and males experienced a higher rate of admission for pneumonia (13 per thousand versus 10 per thousand).

Examination of the differences in admission rate by age reveals that the oldest-old, age 85 or over, experience statistically significant higher rates of ACSC admissions than the other three age groups, when evaluating the 15 ACSC conditions jointly or across the three subgroups of ACSCs (Table 5). Enrollees under age 65, i.e., the disabled, and those age 75-84 appear to experience similar rates of admission for ACSC conditions, in the aggregate, although the disabled are more likely to have a higher rate of admission for chronic conditions and a lower rate of admission for acute conditions than enrollees age 75-84. When analyzing the individual chronic conditions (not displayed), the disabled have statistically higher rates of admission for asthma/COPD and seizure disorders than all other age groups. They also have the highest rate of admission for diabetes. In contrast, the oldest old have the highest admission rates for congestive heart failure, and generally the highest rates for the individual acute and preventable conditions, although statistical significance at the 95 percent confidence level is not

Table 4

Comparison of Medicare+Choice ACSC Rates of Admission Across Geographic Areas

Geographic Area	Number of Beneficiaries	Number of Discharges	Rate of Admission			
			Unadjusted Rate per 1,000	Adjusted[1] Rate per 1,000	95 Percent CI Lower	95 Percent CI Upper
Total ACSCs						
National	4,052,454	191,323	47.22	51.46	51.25	51.67
Census Regions						
Northeast	955,229	49,906	52.26	60.43	59.95	60.91
Midwest	425,889	22,185	52.08	56.37	55.68	57.06
South	960,190	46,999	48.91	53.07	52.62	53.52
West	1,710,819	72,322	42.32	45.95	45.64	46.26
Census Divisions						
New England	210,239	9,915	49.27	56.04	55.06	57.02
Middle Atlantic	753,988	39,991	53.04	61.77	61.23	62.31
East North Central	280,556	19,242	68.59	84.31	83.28	85.34
West North Central	145,331	7,610	52.36	56.16	54.98	57.34
South Atlantic	626,174	31,533	50.36	53.55	52.99	54.11
East South Central	44,564	2,548	57.18	62.80	60.56	65.04
West South Central	289,450	12,828	44.32	49.79	49.00	50.58
Mountain	402,591	17,648	43.84	46.99	46.34	47.64
Pacific	1,308,226	54,674	41.79	45.70	45.34	46.06
Acute ACSCs[2]						
National	4,052,454	82,818	20.44	22.39	22.25	22.53
Census Regions						
Northeast	955,229	20,225	21.18	25.00	24.69	25.31
Midwest	425,889	9,426	22.13	24.20	23.74	24.66
South	960,190	18,791	19.59	21.32	21.03	21.61
West	1,710,819	34,376	20.11	21.82	21.60	22.04
Census Divisions						
New England	210,239	4,379	21.76	25.28	24.61	25.95
Middle Atlantic	753,988	15,846	21.02	25.01	24.66	25.36
East North Central	280,556	5,957	21.23	23.36	22.80	23.92
West North Central	145,331	3,469	23.87	25.68	24.87	26.49
South Atlantic	626,174	12,337	19.70	20.97	20.62	21.32
East South Central	44,564	1,052	23.61	26.48	25.00	27.96
West South Central	289,450	5,402	18.66	21.30	20.78	21.82
Mountain	402,591	8,047	19.99	21.63	21.18	22.08
Pacific	1,308,226	26,329	20.13	21.91	21.66	22.16
Chronic ACSCs[3]						
National	4,052,454	107,608	26.56	28.83	28.67	28.99
Census Regions						
Northeast	955,229	29,462	30.85	35.17	34.80	35.53
Midwest	425,889	12,627	29.64	31.81	31.29	32.34
South	960,190	27,937	29.13	31.55	31.20	31.90
West	1,710,819	37,582	21.99	23.90	23.67	24.13
Census Divisions						
New England	210,239	5,480	27.23	30.46	29.73	31.20
Middle Atlantic	753,988	23,982	31.81	36.50	36.08	36.93
East North Central	280,556	8,541	30.44	32.69	32.03	33.34
West North Central	145,331	4,086	28.12	30.07	29.19	30.94
South Atlantic	626,174	19,094	30.49	32.42	31.98	32.86
East South Central	44,564	1,478	33.17	35.87	34.15	37.58
West South Central	289,450	7,365	25.44	28.26	27.66	28.87
Mountain	402,591	9,518	23.64	25.14	24.66	25.62
Pacific	1,308,226	28,064	21.45	23.56	23.30	23.82

See footnotes at end of table.

Table 4—Continued

Comparison of Medicare+Choice ACSC Rates of Admission Across Geographic Areas

Geographic Area	Number of Beneficiaries	Number of Discharges	Rate of Admission			
			Unadjusted Rate per 1,000	Adjusted[1] Rate per 1,000	95 Percent CI	
					Lower	Upper
Preventable ACSCs[4]						
National	4,052,454	897	0.22	0.24	0.23	0.25
Census Regions						
Northeast	955,229	219	0.23	0.26	0.23	0.30
Midwest	425,889	133	0.31	0.36	0.30	0.41
South	960,190	181	0.19	0.20	0.17	0.23
West	1,710,819	364	0.21	0.23	0.21	0.25
Census Divisions						
New England	210,239	56	0.28	0.30	0.23	0.37
Middle Atlantic	753,988	163	0.22	0.26	0.22	0.29
East North Central	280,556	78	0.28	0.33	0.26	0.39
West North Central	145,331	55	0.38	0.41	0.31	0.51
South Atlantic	626,174	102	0.16	0.17	0.13	0.20
East South Central	44,564	18	0.40	0.45	0.27	0.64
West South Central	289,450	61	0.21	0.23	0.18	0.28
Mountain	402,591	83	0.21	0.23	0.18	0.27
Pacific	1,308,226	281	0.21	0.24	0.21	0.27

[1] Adjusted to the 1997 age/sex distribution of Medicare fee-for-service beneficiaries.

[2] Acute conditions are hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric or duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections.

[3] Chronic conditions are asthma/chronic obstructive pulmonary disease, congestive heart failure, seizure disorder, diabetes mellitus, and hypertension.

[4] Preventable conditions are influenza and malnutrition.

SOURCE: Health Economics Research analysis of 1997/1998 Medicare+Choice inpatient hospital encounter data

always achieved. Enrollees age 65-75 consistently experience the lowest rate of ACSC admissions.

The oldest old are also the most likely to die during an ACSC admission. Across all conditions, 7 percent of the age 85 or over enrollees admitted for an ambulatory care sensitive condition die during that hospitalization (Table 5). This is in contrast to a 2.5 percent death rate for the age group 65 and under, 3.6 percent for the age group 65-74, and 4.9 percent for the age group 75-84. Although the number of ACSC deaths is about evenly split between acute and chronic ACSC admissions, the average rate of death is considerably higher for acute ACSC admissions than for chronic admissions (5.6 percent versus 3.7 percent). For both of these subgroups of conditions, the death rate increases with age. The in-hospital death rate is surprisingly high for preventable ACSC admissions, 5.2 percent, with the 65 and under age group experiencing the highest death rate, 9.3 percent. This is most likely a reflection of the small number of admissions within this category of ACSCs. For example, 33 beneficiaries under age 65 were admitted for malnutrition and 4 died, yielding a death rate of 12.1 percent. It is likely with a much larger sample, the actual percentage would decline.

Statistical Reliability

To assess the statistical reliability of the calculated ACSC admission rates, we examined the distributional properties of ACSC admissions across M+C organizations and the sufficiency of M+C FTE enrollment to support the calculation of ACSC rates. These comparisons allow us to examine whether a minimum FTE enrollee requirement or a minimum volume of ACSC admissions should be imposed at the M+C organization level. Table 6 displays the distribution of the ACSC admissions across the 305 M+C

Table 5

Rate of 1997/1998 Medicare+Choice (M+C) ACSC Admissions and Deaths per 1,000 Full-Time Equivalent Enrollees, by Age

Age	Rate of ACSC Admissions					Deaths During ASCS Admissions	
	Number of Admissions	Unadjusted Rate per 1,000	Adjusted[1] Rate per 1,000	95 Percent CI Lower	95 Percent CI Upper	Number	Percent
Total							
Under 65	15,085	57.80	57.84	56.84	58.84	384	2.5
65-74 Years	75,003	32.65	32.65	31.74	33.56	2,696	3.6
75-84 Years	71,271	59.00	58.60	56.79	60.41	3,487	4.9
85 Years and Over	29,964	104.77	103.35	99.20	107.50	2,094	7.0
Acute ACSCs[2]							
Under 65	5,276	2.53	2.53	1.76	3.30	157	3.0
65-74 Years	29,662	1.61	1.61	1.33	1.89	1,342	4.5
75-84 Years	32,114	3.32	3.30	2.88	3.71	1,848	5.8
85 Years and Over	15,766	6.89	6.78	5.87	7.69	1,282	8.1
Chronic ACSCs[3]							
Under 65	9,755	7.48	7.48	6.14	8.82	222	2.3
65-74 Years	45,045	3.92	3.92	3.48	4.36	1,342	3.0
75-84 Years	38,784	6.42	6.38	5.81	6.96	1,624	4.2
85 Years and Over	14,024	9.81	9.70	8.61	10.79	797	5.7
Preventable ACSCs[4]							
Under 65	54	0.10	0.10	0.10	0.11	5	9.3
Age 65-74	296	0.06	0.06	0.06	0.07	12	4.1
Age 75-84	373	0.15	0.15	0.15	0.16	15	4.0
85 Years and Over	174	0.30	0.30	0.30	0.31	15	8.6

[1] Adjusted to the 1997 age/sex distribution of Medicare fee-for-service beneficiaries.

[2] Acute conditions are hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric or duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections.

[3] Chronic conditions are asthma/chronic obstructive pulmonary disease, congestive heart failure, seizure disorder, diabetes mellitus, and hypertension.

[4] Preventable conditions are influenza and malnutrition.

NOTES: ACSC is ambulatory care sensitive condition. CI is confidence interval.

SOURCE: Health Economics Research, Inc., analysis of 1997/1998 M+C inpatient hospital encounter data.

organizations included in this study. A total of 41 or 13 percent had no ACSC admissions during the study year: 6 percent had no chronic ACSC admissions, 7 percent had no acute ACSC admissions, and 45 percent had no preventable ACSC hospitalizations. There was significant variation in percentage of M+C organizations with no admissions across the individual ACSCs. Over 80 percent had no admissions for the ACSC, severe ear/nose/throat infections. Over 60 percent had no admissions for the two clinical conditions, hypoglycemia and influenza. And, over 50 percent had no admissions for malnutrition and hypokalemia. At least two-thirds had admissions for the remaining ambulatory care sensitive conditions; and about 80 percent of M+C organizations or better had admissions for congestive heart failure, pneumonia, asthma/COPD, and urinary tract infections.

The average number of admissions across M+C organizations for all ACSCs combined was 627 cases. The median, however, was only 183 admissions revealing a right-skewed distribution. As expected, the distribution of chronic and acute ACSCs resembles the total distribution, with average and median values of 353 and 104 for acute conditions, and 272 and 82 for chronic conditions, respectively. M+C organizations, on average, had in excess of 100 admissions for the three most commonly occurring ACSCs; however, the medians were significantly less: asthma/COPD (average 112,

Table 6

Distribution of 1997/1998 ACSC Admissions Across 305 Medicare+Choice (M+C) Organizations

ACSC	Number of ACSC Admissions	M+C Organizations with no ACSC Admissions	ACSC Admissions			Quartile			
			Mean	Standard Deviation	Median	1st	2nd	3rd	4th
Total	191,323	41	627	1,324	183	28	183	681	11,281
Acute[1]	107,608	21	353	479	104	14	104	381	6,903
Chronic[2]	82,818	17	272	576	82	14	82	269	4,634
Preventable[3]	897	136	1	0	1	0	1	3	74
Asthma/COPD	34,031	63	112	232	36	5	36	121	2,037
Congestive Heart Failure	57,487	45	188	402	52	7	52	198	3,747
Seizure Disorder	3,997	110	13	31	3	0	3	13	304
Diabetes Mellitus	6,783	90	22	52	6	0	6	20	451
Hypertension	5,310	90	17	40	5	0	5	17	364
Ulcer	6,398	83	21	48	6	1	6	19	452
Hypoglycemia	320	209	1	3	0	0	0	1	23
Urinary Tract Infection	12,956	65	42	95	12	2	12	42	809
Cellulitis	8,119	79	27	56	7	1	7	27	408
Dehydration	10,768	66	35	73	9	2	9	37	602
Hypokalemia	777	157	3	6	0	0	0	2	48
Pneumonia	43,384	57	142	304	41	7	41	138	2,654
Severe Ear/Nose/Throat Infections	96	251	0	1	0	0	0	0	9
Influenza	431	185	1	4	0	0	0	1	57
Malnutrition	466	166	2	3	0	0	0	2	29

[1] Acute conditions are hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric or duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections.

[2] Chronic conditions are asthma/COPD, congestive heart failure, seizure disorder, diabetes mellitus, and hypertension.

[3] Preventable conditions are influenza and malnutrition.

NOTES: ACSC is ambulatory care sensitive condition. COPD is chronic obstructive pulmonary disease.

SOURCE: Health Economics Research, Inc., analysis of 1997/1998 M+C inpatient hospital encounter data.

Table 7

Average Minimum Plan Size and Percent of Medicare+Choice (M+C) Organizations that Meet Full-Time Equivalent (FTE) Enrollment Criteria

	Statistical Precision Criterion			
	Minimum M+C Organizations' FTE Enrollee Size[1]			Percent M+C Organizations at or Above Minimum
ACSC	Mean	Standard Deviation	Median	
Total	178	143	151	92
Acute Conditions[2]	236	171	204	87
Chronic Conditions[3]	249	185	230	85
Preventable Conditions[4]	1,172	1,187	1,334	53
Asthma/COPD	1,538	3,166	378	82
Congestive Heart Failure	1,165	2,783	293	86
Seizure Disorder	4,102	4,314	1,334	52
Diabetes Mellitus	3,341	4,174	964	69
Hypertension	3,519	4,182	1,064	70
Gastric or Duodenal Ulcer	3,112	4,049	911	70
Hypoglycemia	8,109	3,489	10,435	37
Urinary Tract Infection	2,276	3,671	612	76
Cellulitis	2,845	3,965	809	73
Dehydration	2,210	3,568	678	78
Hypokalemia	6,335	4,156	10,435	50
Pneumonia	1,355	3,011	332	84
Severe Ear/Nose/Throat Infections	9,316	2,493	10,435	35
Influenza	7,430	3,772	10,435	44
Malnutrition	6,872	3,941	10,435	47

[1] Number of M+C organizations out of 305 reporting M+C organizations.

[2] Acute conditions are hypoglycemia, urinary tract infections, cellulitis, dehydration, hypokalemia, gastric or duodenal ulcer, bacterial pneumonia, and severe ear/nose/throat infections.

[3] Chronic conditions are asthma/COPD, congestive heart failure, seizure disorder, diabetes mellitus, and hypertension.

[4] Preventable conditions are influenza and malnutrition.

NOTES: ACSC is ambulatory care sensitive condition. COPD is chronic obstructive pulmonary disease.

SOURCE: Health Economics Research, Inc., analysis of 1997/1998 M+C inpatient hospital encounter data.

median 36), congestive heart failure (average 188, median 52), and pneumonia (average 142, median 41). The median value across M+C organizations was generally less than 10 for the remaining 12 ACSCs.

Lastly, we examined the sufficiency of the M+C organizations' FTE M+C enrollment to support statistically reliable reporting of an M+C organization's performance (Table 7). We estimated the proportion of M+C organizations that would produce statistically reliable ACSC rates by applying a statistical precision criterion that required the M+C organization to have a sufficient number of FTE enrollees to produce ACSC admission rates that were within 10 percent of its true rate 90 percent of the time. The statistical precision criterion was used to generate minimum M+C FTE enrollee requirements for each of the 15 individual ACSCs, the three subgroups of ACSCs, and for all ACSCs combined. We report the average requirement across all M+C organizations and the percentage of M+C organizations that had sufficient volume of M+C FTE enrollees, given their admission rate for the various ACSCs, to produce statistically reliable estimates with the specified precision level.

The average minimum number of M+C FTE enrollees that are required to produce statistically reliable estimates of total combined ACSC rates is 178. Ninety-two percent of M+C organizations had enrollment that meet or exceed their respective individual M+C organization-level minimum estimate. Calculation of the acute and chronic ACSC indices require, on average,

236 and 249 enrollees, respectively; and the vast majority of M+C organizations meet or exceed the minimum requirements. In contrast, over 1,000 FTE enrollees are required, on average, to produce statistically reliable estimates for the preventable condition ACSC index. And, only about one-half of the M+C organizations meet the specific volume requirements.

Not surprisingly, the mean minimum number of required FTE enrollees for the individual ambulatory care sensitive conditions is highly influenced by the rate of admissions observed in this cohort population. The top three volume ACSCs, congestive heart failure, pneumonia, and asthma/COPD, have the lowest average minimum FTE enrollee requirements and standard deviations around the mean. Excluding conditions for which we observed fewer than 1,000 admissions during the 12-month period, the average FTE enrollee requirement was under 5,000, and more than one-half of all M+C organizations met the minimum sample size requirement. M+C organizations with few ACSC admissions generally produced minimum FTE enrollee requirements of just over 10,000 enrollees. Between one-third and one-half of all M+C organizations had FTE enrollees in excess of this requirement.

DISCUSSION

The use of ACSCs has become an established tool for analyzing access to care. If treated in a timely fashion with adequate primary care and managed properly on an outpatient basis, medical practitioners broadly concur that in most instances commonly defined ACSCs should not advance to the point where hospitalization is required. Because lack of primary care for ACSCs does, in fact, often result in hospitalizations, the rate of preventable inpatient admissions provides a practical way of evaluating primary care delivery and, thereby, identifying appropriate areas for improving access and quality in the health care delivery system.

Our study results support the premise that ACSCs could be used as sentinel events to focus attention on improving the adequacy of primary care for potentially vulnerable populations. Examination of the differences in admission rate by age reveals that the oldest-old, age 85 or over, experience statistically significant higher rates of ACSC admissions than younger Medicare beneficiaries. They have the highest admission rates for congestive heart failure, and generally the highest rates for the individual acute and preventable conditions. The under age 65 population also experience statistically higher rates of admission for selected chronic conditions. The oldest old are also the most likely to die during an ACSC admission. Across all conditions, 7 percent of the age group 85 or over admitted for an ACSC died during that hospitalization. This is in contrast to a 3.6 percent ACSC death rate for the age group 65-74. When analyzing the individual chronic conditions, the disabled have statistically higher rates of admission for asthma/COPD and seizure disorders than all other age groups. They also have the highest rate of admission for diabetes. Similar age-related findings were reported by Mitchell et al. (1994) in their study of 1991 ACSC admission rates for a national sample of 2.7 million Medicare FFS beneficiaries.

The use of ACSCs to monitor the provision of ambulatory care in M+C requires three factors: (1) completeness of hospital encounter data, (2) face validity of the selected conditions and generated ACSC rates, and (3) statistical reliability of the calculated rates for the majority of M+C organizations. One of the primary goals of this project was the assessment of whether

there were systematic biases in the submission of M+C inpatient hospital encounter data in the startup year of data submission that would produce erroneous estimates of ACSC admissions. As expected, we observed lower overall rates of hospitalization in the M+C population than observed in the Medicare FFS population, even after adjusting for age-sex distribution differences between the two populations. On average, M+C adjusted hospitalization rates were about one-third lower than comparable FFS rates. Marked geographic variation in both the FFS and M+C populations were also observed. Previous managed care and FFS comparisons have not been made as national-level M+C data have not been available. The rates of hospital discharges for M+C in comparison to FFS could be explained by better management of patient conditions, utilization controls, or healthier M+C enrollees. There was no evidence, however, that there were systematic gaps in the volume of submitted encounter data. An array of adjusted hospital discharge rates per 1,000 enrollees across the M+C organizations approximated a normal distribution. Low- and high-rate outliers were observed, but they comprised a fairly small proportion of total M+C organizations and, in general, had very small enrollee populations.

But more importantly is the issue of bias. To examine whether the submitted hospitalization data are biased based on diagnosis, we constructed relative ACSC admission rates for the three indices of conditions by dividing each ACSC admission rate by the relative rate of admission for all hospitalizations. For all three indices, we observe a significant clustering of relative rates within a narrow range. The tightness of the ranges and the similarity in distribution between the chronic and acute indices reveal no obvious source of bias based on principal diagnosis.

For face validation, comparisons of our generated ACSC rates were made with those in the published literature. Previous researchers who have evaluated sets of ACSCs similar to ours and in the Medicare population have found that congestive heart failure, pneumonia, asthma, and kidney and urinary tract infections are the most commonly occurring ACSCs, as we found in this study (Culler, Parchman, and Przybylski, 1998; Bluestein, Hannon, and Shea, 1998; Pappas et al. 1997; Silver, Babitz, and Magill, 1997; Mitchell, 1994; Dayhoff, Rosenbach, and Walsh, 1998; Shulka and Pestian, 1996). Further, the observed rate of admissions for the three most prevalent conditions compare quite favorably with Medicare ACSC rates in the published literature, although the populations tend to be very limited, e.g., a particular State, the time periods distant, and the insured population in FFS, rather than managed care. However, it is important to note that some ACSC admissions early in the study period may not reflect care delivered by a particular M+C organization prior to the beginning of the study period if the beneficiary had recently joined the M+C organization. This could affect face validity.

To assess the statistical reliability of the calculated ACSC admission rates, we examined the distributional properties of ACSC admissions across M+C organizations and the sufficiency of M+C FTE enrollment to support the calculation of ACSCs. A total of 41 or 13 percent had no ACSC admissions during the study year. And, there was significant variation in percentage of M+C organizations with no admissions across a number of the individual ACSCs. We estimated that the average minimum number of FTE enrollees per M+C organization that would be required to produce statistically reliable estimates of total ACSC rates is 178 enrollees. Ninety-two percent of M+C organizations have FTE enrollment that meet or

exceed their respective individual M+C organization-level minimum estimate. Calculation of the acute and chronic ACSC indices require, on average, 236 and 249 FTE enrollees, respectively; and the vast majority of M+C organizations meet or exceed the minimum requirements. In contrast, over 1,000 FTE enrollees are required, on average, to produce statistically reliable estimates for the preventable condition ACSC index. And, only about one-half of the M+C organizations meet the M+C organization-specific volume requirements for this index. Further research should be conducted to assess the minimum enrollment requirements when full-year enrollment is not imposed as a condition.

Combined, these findings suggest that the initial reporting year of M+C hospital encounter data have no apparent volume or diagnosis-based biases that would preclude using these data for further evaluation of the use of ACSCs for monitoring the provision of care in the Medicare managed care sector. The results also suggest that further exploration should be directed at developing indices of ACSC rates, or limiting the scope of conditions to the most frequently occurring in the Medicare population, e.g., congestive heart failure, pneumonia, and asthma/COPD. Many of the other conditions evaluated in this study do not occur with sufficient frequency to produce statistically reliable estimates at the M+C organization level for the majority of M+C organizations. The development of ACSC indices is appealing from a statistical power sense; however, the results may be less actionable by the M+C organizations. Summarizing rates of admissions reduces the M+C organizations' ability to identify the clinical condition(s) to which they should direct their attention. In contrast, use of sentinel events based on a single clinical condition allows M+C organizations to focus their attention, but evaluation of effectiveness of intervention may be limited due to small sample sizes. An intermediate solution of indices based on small families of clinically-related conditions should be considered.

The preliminary results are encouraging, however further research is necessary, especially in the area of health status and case-mix adjustment. Previous research has shown that health status is an important predictor of an increased likelihood of admission for ambulatory care sensitive conditions. Income level and rural locations are also positive predictors of ACSC admissions. This study did not examine the effect of these factors on the observed rates of ACSC admissions in the M+C population. Nor did this study examine the feasibility of using ACSCs to monitor the adequacy of primary care provision in the Medicare FFS sector. Given that roughly 85 percent of the Medicare population remain in the traditional Medicare FFS plan, it seems reasonable and prudent to expand the focus to this important population ensuring the development of performance measures that are applicable to all systems of care.

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