

Working Paper: Simple Methods of Measuring Hospital Readmission Rates

February 2012 *[revised for minor editorial corrections]*

Over the last several years, AHIP has published several policy studies of hospital readmission rates. We have presented these studies in a series of working papers and reports on AHIP's research webpage and at various academic and professional seminars.

The most recent report, "Medicare Advantage Chronic Special Needs Plan Boosted Primary Care, Reduced Hospital Use Among Diabetes Patients," by Robb Cohen and Jeff Schoenborn of XLHealth Inc., and Jeff Lemieux and Teresa Mulligan of AHIP, appears in the January 2012 issue of *Health Affairs*. Another report titled "Hospital Readmission Rates in Medicare Advantage Plans" is forthcoming in February 2012 in the *American Journal of Managed Care* (AJMC).¹

Readmission rates are being used in new, multi-year contracts between hospitals and health plans that

gradually increase the proportion of payment based on patient outcomes and population health, and reduce the proportion of reimbursement paid on a fee-for-service basis. These new contracts, sometimes called "alternative quality contracts," use benchmarks or tracking measures of readmission rates to help gauge progress in the care for patients and the health of enrolled populations.²

Likewise, reducing readmission rates has become a top priority in the Medicare program. Beginning in 2013, hospitals may be penalized for higher-than-average readmission rates under Medicare's fee-for-service reimbursement system. Medicare's Partnership for Patients initiative, which features a coalition of health systems and plans, targets a 20 percent reduction in readmission rates between 2010 and 2013.³

¹ Sennett C, Lemieux J, Wang R, Mulligan T, and Bumbaugh J, "Hospital Readmission Rates in Medicare Advantage Plans." *American Journal of Managed Care*. February 2012 (forthcoming). See also: AHIP Center for Policy and Research. *Using AHRQ's 'Revisit' Data to Estimate 30-Day Readmission Rates in Medicare Advantage and the Traditional Fee-for-Service Program*. October 2010 [revised]. Available from: http://www.ahipresearch.org/pdfs/AHRQ_revisit_readmission_rates_10-12-10.pdf. For a list of other readmissions studies from the AHIP Center for Policy and Research, see the "Readmissions Publications from the AHIP Center for Policy and Research" section at the back of this paper.

² See, for example, AHIP Center for Policy and Research, *Health Care Cost Summit: Slowing the Growth of Health Costs, How to Bend the Cost Curve* (conference overview), March 11, 2011, available at <http://www.ahipresearch.org/pdfs/March2011CostSummit.pdf>; and Michael E. Chernew, Robert E. Mechanic, Bruce E. Landon and Dana Gelb Safran "Private-Payer Innovation In Massachusetts: The 'Alternative Quality Contract'" *Health Affairs*, 30, no.1 (January 2011):51-61, available at: <http://content.healthaffairs.org/content/30/1/51.full.pdf+html>.

³ The CMS website for the Partnership for Patients initiative is <http://www.healthcare.gov/center/programs/partnership/index.html>.

However, there are many ways to measure readmission rates, some of which may be suitable for certain purposes but not others. Sometimes data limitations may restrict the types of readmission rates that can be computed.

This working paper summarizes the various methods used by AHIP for computing readmission rates. In general, we have preferred the simplest method of computing readmission rates for the purpose at hand. This makes duplication of the results easiest.

AHIP's reports typically count 30-day readmissions or same-quarter readmissions. We often compute readmission rates on both a per-admission and a per-enrollee basis. Per-enrollee comparisons are further modified by using the enrollee's risk score or the number of major diagnosis codes associated with the patient as a divisor for the readmission rates.

We usually count readmissions on an "all-cause" basis. However, sometimes we limit the types of admissions that can be counted as readmissions, such as by excluding readmissions for rehabilitation, which may be scheduled or planned in advance. Likewise, we do not narrow the scope of "initial" admissions considered. For example, CMS currently counts readmissions only after admissions for pneumonia, heart failure, and heart attack, although this list is likely to be expanded in the future.

The following sections explain some readmission counting methods used by AHIP. We compare the standard 30-day readmission counts with same-quarter counts and show per-admission vs. per-enrollee readmission rates. We also address some logical or conceptual issues that can confound efforts to count 30-day readmissions. This report may be updated from time to time as new research is added or methods are revised.

COUNTING READMISSIONS

The 30-day readmission rate is a common measurement in the research literature. The intuitive definition of a 30-day readmission is straightforward: Was the patient admitted to a hospital within 30 days of a hospital discharge?

However, there are many complications that arise when measuring 30-day readmission rates from various datasets. For example, transfers from one hospital to another are rarely counted as readmissions. Transfers from nursing homes are usually counted, but not always. Admissions that occur on the same day as a discharge are usually counted as readmissions as long as there was no transfer code in the discharge record.

Moreover, there are technical counting issues. For example, consider the hypothetical patient whose admission and discharge dates are shown in Table 1.

Table 1. Admission and Discharge Record for a Hypothetical Patient

Admission	Discharge	Days from Prior Discharge
10-July	15-July	-
20-July	15-August	5
26-August	28-August	11
7-September	8-September	10
15-September	22-September	7
4-October	10-October	12
10-December	12-December	61

It is not self-evident how many readmissions should be measured for this hypothetical patient. Table 2 illustrates the wide range of readmissions counts that could be derived for this patient, based on similar basic concepts.

Table 2. Illustration of the Impact of Alternative Counting Methods for the Hypothetical Patient

Method	Number of Readmissions Counted
30-day (standard method, from prior discharge)	5
Same-quarter (admits in calendar quarter less 1)	5
30-day (at least one readmit from first discharge)	1
30-day (all readmits from all discharges)	8

Standard 30-Day Readmission Counts. The standard 30-day counting method tallies admissions that followed the prior discharge by 30 days or less. Each discharge is tracked for a potential readmission and each admission can be a readmission only once, from the previous discharge. This is the method used in the most prominent research on readmissions, such as the benchmark study of readmission rates in Medicare’s fee-for-service program by Jencks et. al.⁴ and the earlier major study by Anderson and Steinberg.⁵

⁴ Jencks, S., Williams, M., and Coleman, E., “Rehospitalizations in the Medicare Fee-for-Service Program,” *New England Journal of Medicine* (April 2, 2009), available at <http://content.nejm.org/cgi/content/full/360/14/1418>.

⁵ Anderson, G.F., Steinberg, E.P., “Hospital readmissions in the Medicare population.” *New England Journal of Medicine*. 1984;311: 1349-53.

Under this standard approach, the hypothetical patient in Table 1 would be counted as having five 30-day readmissions: on July 20, August 26, September 7, September 15, and October 4 (see Figure 1).

Thirty-day readmissions can only be counted in datasets where the dates of discharge and admission are provided. However, some datasets are “limited” and do not provide such detailed data. Fortunately, AHRQ has devised a solution that allows computation of 30-day readmissions from some of their limited datasets. Some AHRQ limited datasets now provide “revisit codes” that express the length of time between admissions. These admission-to-admission spans can be combined with the reported length of hospital stays to compute the day spans between discharge and readmission, which allows measurement of 30-day readmission rates.

Same-Quarter Readmission Counts. AHIP has devised the same-quarter readmission rate as a proxy for the standard 30-day readmission count when neither actual dates of admission and discharge nor AHRQ-style revisit indicators are available. For example, the most commonly available versions of Medicare’s 5% and 100% sample claims and administrative files do not provide actual dates of service or revisit indicators, only the calendar quarter of the service.

AHIP’s same-quarter readmission rate is simply computed as the number of admissions in a quarter less one. This count is done for each calendar quarter (January-March; April-June; July-September; October-December) and then summed for the year. Figure 2 shows the method of counting same-quarter readmissions for the hypothetical patient.

Figure 1. Counting 30-Day Readmissions
(Standard Method – Jencks/Anderson/AHIP)

	Admission	Discharge	Days from Prior Discharge
1	07/10	07/15	-
2	07/20	08/15	5
3	08/26	08/28	11
4	09/07	09/08	10
5	09/15	09/22	7
	10/04	10/10	12
	12/10	12/12	61

Figure 2. Counting Same Quarter Readmissions
(AHIP)

	Admission	Discharge	Days from Prior Discharge
	07/10	07/15	-
	07/20	08/15	5
4 (5-1)	08/26	08/28	11
	09/07	09/08	10
	09/15	09/22	7
1 (2-1)	10/04	10/10	12
	12/10	12/12	61

While the same-quarter readmission count is not as clinically intuitive as a 30-day count, it has the advantage of being unambiguous to compute, and it can be computed from most publically available hospital discharge or claims datasets. Moreover, the same-quarter readmission counts and rates turn out to be fairly similar to and consistent with the 30-day rate.

Table 3 shows 30-day and same-quarter readmission counts (and rates per admission) for a large sample of commercially insured patients (under age 65). Although there are more same-quarter readmissions than 30-day readmissions, the rates are similar, and their movements across the three years shown are consistent. We have observed this same consistency in other databases where both 30-day and same-quarter readmission rates can be computed.

Table 3. Comparing 30-Day and Same-Quarter Readmission Rates on Large Populations—Readmissions per Admission

Year	Total Admits	Number of Readmissions	
		30-Day	Same Quarter
2008	2,682,319	271,636	282,928
2009	2,701,552	275,046	285,021
2010	2,387,135	247,767	256,789
Readmissions per Admission			
2008		10.1%	10.5%
2009		10.2%	10.6%
2010		10.4%	10.8%

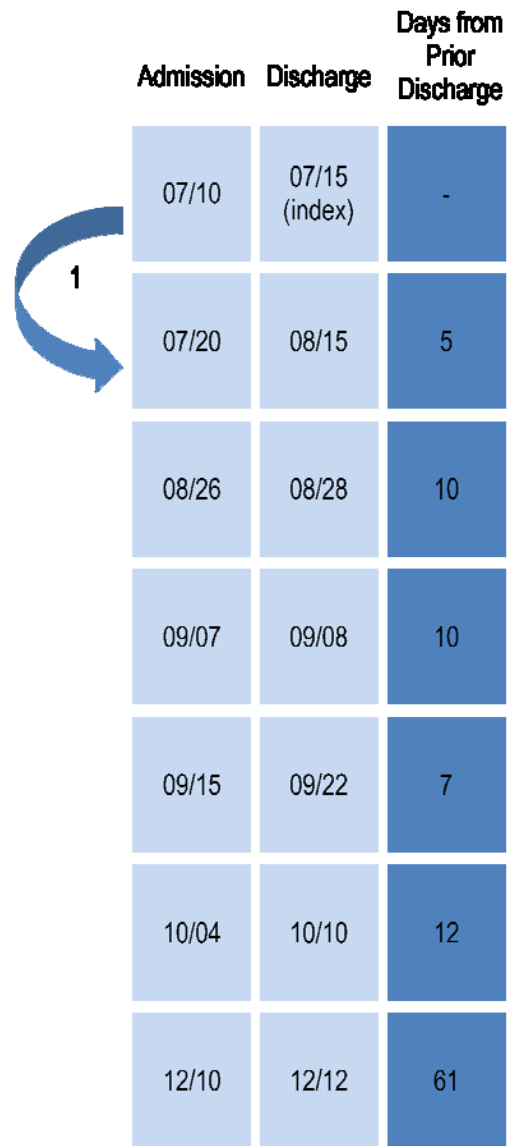
Source: AHIP Center for Policy and Research; data from Thomson Reuters MarketScan, commercially insured population under age 65.

Non-Preferred Methods—Any Readmissions

Concepts. Figure 3 shows a method of assessing whether a patient had at least one 30-day readmission. In this calculation, the answer is a simple yes or no (1 or 0), with the result “1” signifying that at least one readmission occurred within 30-days for the patient during the year, or, alternatively, that the patient’s first discharge of the year yielded a 30-day readmission. The maximum possible number of readmissions by this method is one per patient in a year.

This method could be used for questions like: “How many patients had an admission within 30-days of their first discharge of the year?” or “Did the patient have at least one readmission within 30 days of discharge within a year?” Although these questions are also not unreasonable, this approach excludes instances where admissions and readmissions occur in a rapid sequence – precisely the most problematic cascades of readmissions that can result from poor quality health care or lack of care coordination.

Figure 3. The Any-Readmissions Concept
(This method is not used by AHIP)



In general, we do not use this type of count because many readmissions occur in batches, and this counting method essentially misses those readmissions. It would substantially understate the readmission rate compared with standard published measures.

Figure 4. The All-Readmissions Concept
(This method is not used by AHIP)

	Admission	Discharge	Days from Prior Discharge
1	07/10	07/15	-
2	07/20	08/15	5
3	08/26	08/28	11
4	09/07	09/08	10
5	09/15	09/22	7
6	10/04	10/10	12
7	12/10	12/12	61

Note: 6 = Discharge 08/15, Admission 09/07; 7 = Discharge 08/28, Admission 09/15; 8 = Discharge 09/08, Admission 10/04

Non-Preferred Methods—All Readmissions Concept.

Another readmissions counting method includes all admissions that followed ANY discharge within 30 days (see Figure 4). Thus an admission could be a readmission for more than one prior discharge. We believe this type of calculation, while not illogical, is impractical. It would count more readmissions than admissions for some patients. In our example, this

method would count eight readmissions and seven admissions!

SCOPE OF READMISSION CALCULATIONS

There are two major questions to answer when setting the scope for counting readmissions. First, are all types of admissions considered as potential readmissions, or is the universe of admissions that could be considered a readmission narrowed to some degree? Second, are all types of initial admissions considered as eligible for readmissions, or are certain types of admissions – such as admissions for pneumonia, heart failure, or heart attack – the only admissions that are tracked?

All-Cause, Same-Cause, or “Most-Cause” Readmissions? Most readmission rates are measured as “all-cause” or “any-DRG” readmission rates. (DRG is the abbreviation for the “diagnosis related group” assigned for Medicare admissions and adopted for coding virtually all hospital admissions in research databases.)

The first AHIP studies used a much narrower “same-DRG” readmission rate, which counts only readmissions for precisely the same hospital service. Later studies used the all-cause concept (any DRG), and a modified all-cause approach (any DRG except for rehabilitation). A forthcoming AHIP study of readmission rates by community excluded not only the DRG for rehabilitation, but also the other DRGs identified by Jencks et. al. as potentially associated with planned or scheduled readmissions.

Rehabilitation and Exclusions of Other DRGs.

Jencks excluded readmissions with the DRG for rehabilitation in his tabulation of readmission rates in Medicare’s fee-for-service program. In order to

Table 4. Diagnosis Related Group (DRG and MS-DRG) Codes for Hospital Admissions Often Associated with Planned Readmissions

DRG Description	Jencks DRG v22	DRG v23 and v24	MS-DRG v25 and v26
Craniotomy Age >17 w CC	001	001	025
Major Chest Procedures	075	075	163 164 165
Cardiac Valve & Other Major Cardiothoracic Procedures w/o Cardiac Catheterization	105	105	219 220 221
Coronary Bypass w/o Cardiac Catheterization	109	549 550	235 236
Major Cardiovascular Procedures w CC	110	110	237
Amputation For Circulatory System Disorders Except Upper Limb & Toe	113	113	239 240 241
Other Circulatory System O.R. Procedures	120	120	264
Major Joint & Limb Reattachment Procedures of Lower Extremity	209	544	469 470
Skin Graft &/Or Debridement For Skin Ulcer Or Cellulitis w CC	263	263	573
Other Kidney & Urinary Tract Procedures	315	315	673 674 675
Transurethral Prostatectomy w CC	336	336	713
Chemotherapy w/o Acute Leukemia As Secondary Diagnosis	410	410	846 847 848
Rehabilitation	462	462	945 946
Aftercare w/o History of Malignancy As Secondary Diagnosis	466	466	950
Other Vascular Procedures w CC	478	553	253
Cardiac Defibrillator Implant w/o Cardiac Catheterization	515	515	226 227
Percutaneous Cardiovascular Procedures w Non-Drug Eluting Stent w/o AMI	517	556	249
Percutaneous Cardiovascular Procedures w/o Coronary Artery Stent or AMI	518	518	250 251
Percutaneous Cardiovascular Procedures w Drug-Eluting Stent w/o AMI	527	558	247
Extracranial Procedures w CC	533	533	037

Source: Information on DRG crosswalk changes is from CMS; published annually in the Federal Register. For illustration of MS-DRG v25 to v26 see Federal Register / Vol. 72, No. 162 / Wednesday, August 22, 2007 / Rules and Regulations ppg 47156 to 47157; Information on DRGs likely associated with "planned readmissions" is from Jencks, Williams, Coleman: *NEJM* 2009;360:1418-28, supplemental appendix.
Note: CC = complications and comorbidities; AMI = acute myocardial infarction.

compare readmission rates with those computed by Jencks, we excluded admissions for rehabilitation in the forthcoming *AJMC* paper.

Jencks associated several other DRGs in addition to rehabilitation with possible periodicity in their admission patterns. That is, the admission data for these DRGs showed spikes in probability at certain intervals, as if these admissions might be associated with scheduled readmissions for follow-up treatment, such as recurring treatments for cancer. Table 4 shows the mapping over time of the original DRGs identified by Jencks to the newer-version DRGs excluded by AHIP in the forthcoming study.

All “Initial” Discharges or Certain Conditions Only? CMS currently computes 30-day readmission rates for three discharge conditions: pneumonia, heart failure, and heart attack. By contrast, AHIP’s readmissions data use readmissions based on any reason for initial admission.

CALCULATING READMISSION RATES

Per-Enrollee or Per-Admission? Readmission rates are usually reported on a per-admission basis. That is, the readmission rate for a group of people is the number of readmissions counted (by any method) divided by the total number of admissions.

However, for performance benchmarking and tracking, it is also useful to measure readmissions on a per-person or (for insured populations) a per-enrollee basis. After all, the simplest way to reduce the risk of readmission in a population is to reduce the need for patients to be admitted to a hospital in the first place.

Furthermore, it is mathematically possible for health plans and hospitals to reduce the overall number of readmissions in their populations, and to yet have an increase in their measured readmission rate on a per-admission basis. This could occur if a health plan or hospital system substantially reduced its overall admission rate.

Per-enrollee readmission rates are computed as the number of readmissions divided by the number of enrollees. A per-enrollee rate will almost always be lower than a per-admission rate because most enrollees in a health plan are not admitted to a hospital during a year. Table 5 shows per-admission and per-enrollee readmission rates for the Medicare fee-for-service population.

Table 5. Same Quarter Readmissions (AHIP)
Comparing Readmissions Rates per Admission
and per Enrollee

Year	Same-Quarter Readmissions	Admissions	Readmissions per Admission
2004	112,259	519,065	21.6%
2005	111,689	519,837	21.5%
2006	106,455	498,670	21.3%
2007	100,652	478,845	21.0%
2008	99,372	469,032	21.2%
		Enrollees	Readmissions per Enrollee
2004	112,259	1,452,896	7.7%
2005	111,689	1,479,408	7.5%
2006	106,455	1,452,896	7.3%
2007	100,652	1,426,062	7.1%
2008	99,372	1,413,423	7.0%

Source: AHIP Center for Policy and Research; data from Medicare fee-for-service 5% sample claims and administrative files.

Note: Does not include admissions for rehabilitation. Beneficiaries aged 65 and older.

Dropping Late-Year Discharges from the Readmission Rate. For comparability with other research, we have sometimes limited the period from which index admissions were tracked. For example, the forthcoming *AJMC* study of readmission rates in Medicare Advantage used the method devised by Jencks et. al. in their analysis of readmission rates in the fee-for-service Medicare program. For the Jencks method, we tracked “index” discharges in the final quarter of the year and counted readmissions within that quarter and also during the whole subsequent year. For another set of calculations, which was devised by Gerard Anderson, we tracked index discharges in the first nine months of the year, with an allowance for “flow out” of readmissions for 30, 60, and 90 days thereafter during the same year.

However, in most of the AHIP-published readmission studies that used 30-day readmission rates, we did not drop December admissions from the denominator. This added complication was not necessary, because we were not attempting to create benchmark readmission rates for comparison with other published research. Instead, we were comparing readmission rates among cohorts of data, and we needed only to be internally consistent.

However, this method does compute slightly lower readmission rates than some other prominent methods in the research literature. For example, by counting all admissions in the year as “index” admissions, including those at the end of the year, we may “miss” some readmissions that occurred within 30 days. For example, using only data for a calendar year, an index admission in late December could have a 30-day readmission the following January that would not be tracked.

SUMMARY

At AHIP, we count 30-day readmissions in a manner that most closely fits the intuitive sense of the problem: “In how many instances did an admission follow the prior discharge within 30 days?” We often use same-quarter readmission rates as a proxy where data restrictions do not allow computation of 30-day rates.

For comparability with other published research, we usually display readmissions on a per-admission basis. However, we often show per-enrollee readmission rates – which frequently are more meaningful analytically – where such comparability is not required. For simplicity, we prefer to not exclude admissions occurring late in the year from either readmission or admission counts, regardless of whether there was “enough time” left in the year to fully count some readmissions. However, for comparability with other research, we have sometimes used methods that do exclude latter parts of a year from the admission and (some) readmission counts.

Going forward, many health plans may choose to use simple methods of computing readmission rates, especially if the purpose is to monitor changes over time. In these cases, a less-complex computation, performed consistently from year to year, will produce the most accessible trend data.

ACKNOWLEDGEMENTS

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READMISSIONS PUBLICATIONS FROM THE AHIP CENTER FOR POLICY AND RESEARCH

Hospital Readmission Rates in Medicare Advantage Plans

Jeff Lemieux, Cary Sennett, Ray Wang, Teresa Mulligan, and Jon Bumbaugh
American Journal of Managed Care (February 2012, forthcoming)

Source Data. MedAssurant MORE² Registry; Medicare fee-for-service 5 percent sample files.

Types of Readmission Rates Computed. Jencks-style (30-60-90 day and 1 year; 4th quarter study period with 1 year run out) Anderson-style (30-60-90 day; study period is first three quarters with 90 day run out); per admission with and without risk adjustment; all cause (without rehabilitation).

Medicare Advantage Chronic Special Needs Plan Boosted Primary Care, Reduced Hospital Use Among Diabetes Patients

Robb Cohen, Jeff Lemieux, Jeff Schoenborn, Teresa Mulligan
Health Affairs (January 2012)

Source Data. Proprietary data from XLHealth Inc.; Medicare fee-for-service 5 percent sample files.

Types of Readmission Rates Computed. Same-quarter; per-enrollee; per-admission; per risk-score value; all cause.

Link. <http://content.healthaffairs.org/content/31/1/110.full.pdf+html?ijkey=U/VKTJysX7YzE&keytype=ref&siteid=healthaff>

Using AHRQ's 'Revisit' Data to Estimate 30-Day Readmission Rates in Medicare Advantage and the Traditional Fee-for-Service Program.

AHIP Center for Policy and Research
AHIPResearch.org (October 2010)

Source Data. AHRQ HCUP SID in several states.

Types of Readmission Rates Computed. 30-day and same-quarter; per enrollee, per-HCC, per risk-score value; all cause.

Link. http://www.ahipresearch.org/pdfs/AHRQ_revisit_readmission_rates_10-12-10.pdf

Working Paper: Using State Hospital Discharge Data to Compare Readmission Rates in Medicare Advantage and Medicare's Traditional Fee-for-Service Program

AHIP Center for Policy and Research
AHIPResearch.org (May 2010)

Source Data. AHRQ HCUP SID in several states; hospital discharge data from Texas and Pennsylvania

Types of Readmission Rates Computed. Same-quarter, 30-day (Texas only); per-enrollee; per-admission; per patient with an admission; per-HCC; per risk score value; all cause and same DRG.

Link. <http://www.ahipresearch.org/pdfs/9State-Readmits.pdf>

Working Paper: Comparisons of Utilization in Two Large Multi-State Medicare Advantage HMOs and Medicare Fee-for-Service in the Same Service Areas

AHIP Center for Policy and Research

AHIPResearch.org (December 2009)

Source Data. Proprietary data from two health plans; Medicare FFS 5 percent sample files.

Types of Readmission Rates Computed. Same-quarter; per-enrollee; per-HCC; per risk score value; same DRG.

Link. <http://www.ahipresearch.org/pdfs/MAvsFFS-CO9and10.pdf>

Reductions in Hospital Days, Re-Admissions, and Potentially Avoidable Admissions Among Medicare Advantage Enrollees in California and Nevada, 2006

AHIP Center for Policy and Research

AHIPResearch.org (October 2009)

Source Data. AHRQ HCUP SID

Types of Readmission Rates Computed. Same-quarter; per-enrollee; per-admission; per patient with an admission; per risk score value; any hospital/same hospital; all cause and same DRG.

Link. <http://www.ahipresearch.org/pdfs/CAvsNV.pdf>

Working Paper: A Preliminary Comparison of Utilization Measures Among Diabetes and Heart Disease Patients in Eight Regional Medicare Advantage Plans and Medicare Fee-for-Service in the Same Service Areas

AHIP Center for Policy and Research

AHIPResearch.org (September 2009)

Source Data. Proprietary data from eight health plans; Medicare FFS 5 percent sample files.

Types of Readmission Rates Computed. Same-quarter; per-enrollee; per-HCC; per risk score value, same DRG.

Link. <http://www.ahipresearch.org/pdfs/MAvsFFS.pdf>