Evaluating the Functionality of the Symmetry ETG and Medstat MEG Software in Forming Episodes of Care Using Medicare Data

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Thomas MaCurdy, Ph.D.
Jason Kerwin
Jonathan Gibbs
Eugene Lin
Carolyn Cotterman
Margaret O'Brien-Strain, Ph.D.
Nick Theobald, Ph.D.

CMS Project Officer
Frederick Thomas, Ph.D.

Acumen, LLC
500 Airport Blvd., Suite 365
Burlingame, CA 94010

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The statements contained in this report are solely those of the authors and do not necessarily reflect the views or policies of the CMS. Acumen, LLC assumes responsibility for the accuracy and completeness of the information contained in this report.

EXECUTIVE SUMMARY

Medicare health care costs are rising rapidly, and to stem this increase the Centers for Medicare and Medicaid Services (CMS) has been exploring a variety of value-based purchasing (VBP) initiatives aimed at improving quality of care while avoiding unnecessary costs. One major concern involves the significant variation in practice patterns observed both across and within regions, which prominent research has argued does not improve quality of care even though these patterns entail large differences in resource utilization. To advance policymakers' understanding of the nature and extent of variation in practice patterns, CMS and other government agencies have conducted a series of projects evaluating alternative approaches for comparing relative resource use for various types of medical care. A key initial goal of these efforts consists of providing feedback and education to encourage more efficient practice by physicians and hospitals, with the potential follow-on goal being the development of pay for performance systems that could reward health care professionals for delivering cost-effective medical care. Implementing such VBP concepts requires a reliable framework for measuring the cost of care and the "value" contributed by providers. A popular candidate advocated for this framework relies on software products known as episode groupers.

Episode grouping offers the potential to create measures of resource utilization and expenditures for the treatment of different medical conditions, allowing comparisons of health-care providers across a region or a specialty to rate individual performance. This report presents an initial appraisal of two commercially available episodic grouper software packages applied to Medicare claims: the INGENIX Symmetry Episode Treatment Groups (ETG) and the Thomson Medstat Medical Episode Grouper (MEG). The specific aims of this study are to:

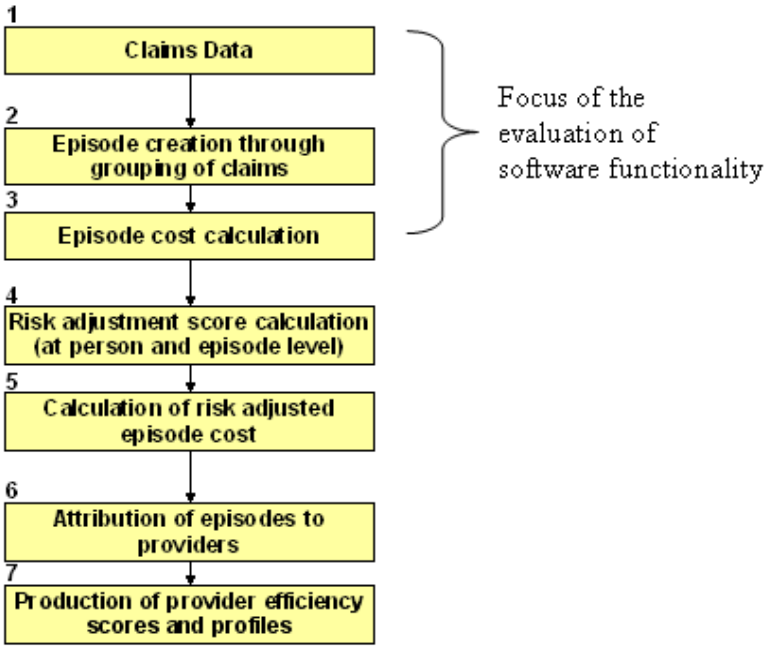
(1) Build an interface to use Medicare claims as inputs for the episodic groupers.
(2) Implement the groupers by inputting Medicare data.
(3) Document the properties of the groupers in constructing episodes of care and associated costs.
(4) Evaluate the impacts of altering the configuration options offered by the groupers in assigning Medicare claims to episodes.
(5) Compare the results of the two groupers.

This report focuses on understanding the properties of the grouper algorithms in forming episodes out of Medicare claims data and in assigning costs to these episodes. Such an analysis

provides key insights into the challenges that must be overcome to realize the potential put forth by advocates of using the groupers to evaluate Medicare providers. The study does not explore how the ETG and MEG groupers might be used to profile physicians, nor does it examine the clinical logic underlying the groupers in their allocation of claims into meaningful clinical events.

Figure 1 depicts the process for developing physician profiles using these commercial programs. As illustrated in this figure, the use of episode grouping in performance measurement starts with assigning claims data to episodes of care. The groupers seek to arrange administrative claims into episodes of medical treatment for about 600 categories of health conditions. The next steps assign costs to each episode, while incorporating risk adjustments to account for patient composition and case mix. In the last steps, episodes are attributed to particular providers, and scores are produced reflecting the providers' cost rankings among their peers.

Figure 1: Stylized Procedure for Using Episode Groupers to Evaluate Provider Efficiency



In this report, we only study steps 1-3 of this process, starting with raw Medicare claims and ending at the formation of episodes and the calculation of associated costs. The application of risk adjustment and the attribution of episodes to physicians are left for further research.

Our analysis documents the challenges encountered in applying the Symmetry and Medstat packages to Medicare data, not only due to the special configuration of Medicare claims, but also arising from inherent features of the individual groupers. This report develops protocols for translating all types of Medicare claims into input formats accepted by the ETG and MEG software, and for presenting the software outputs in a comprehensive framework that permits convenient comparisons of the outcomes produced by the two groupers. To understand the options for making use of Part A and B claims in the ETG and MEG packages, this study begins with a review of how the different types of Medicare claims report the essential information used by grouping algorithms to construct episodes of care. The latter sections of this study examine the impacts of the alternative strategies employed by the two software products, as well as the effects on each grouper's results from changing software configurations and the data elements extracted from Medicare claims.

Adapting the Groupers for Use with Medicare Data

One encounters a variety of challenges in applying the Symmetry and Medstat software in a Medicare setting to create episodes of care and in assigning costs to these episodes (the first three steps of Figure 1). To depict practice in most health care organizations, grouping algorithms essentially rely on three key assumptions:

(1) All claims relevant for treating a particular illness incident can be grouped into a distinctive episode of care.
(2) The component medical services making up any claim belong to one and only one episode.
(3) Episodes of care have clearly defined start and end dates.

The Medicare system introduces a variety of complications in the applicability of these suppositions, which in turn induces challenges in implementation. Whereas some challenges are specific to the individual software packages, others are common to both groupers. The following discussion initially describes several of the complications commonly encountered in providing medical care to Medicare beneficiaries, and it then outlines specific issues encountered in implementing the ETG and MEG groupers using Medicare data.

General Challenges in Using Groupers to Infer Episodes of Care

The medical complexity of the health status of many Medicare beneficiaries often makes the task of allocating individual medical services or claims to a single category of care or treatment a significant problem. Such a task requires distinguishing which particular health condition constitutes the ultimate cause for the provision of each service represented by a Medicare claim. Yet numerous Medicare beneficiaries have multiple co-morbidities that simultaneously affect a patient's health status and the resulting administration of care. Given the complexity of patients' health circumstances, attributing services to distinct illnesses and health conditions constitutes a serious quandary. Moreover, beneficiaries who look quite similar from the perspective of services received may have different underlying causal conditions. To complicate matters further, treatments for such illnesses can result in a large number of claims being submitted for individual beneficiaries; in a three year period, nearly 7% of beneficiaries have more than 300 claims paid on their behalf.

Moreover, the notion that episodes of care have clearly defined start and end dates is questionable in the treatment of chronic conditions. Chronic condition episodes do not have clearly defined end dates, because such conditions are progressive and, by definition, do not end. To facilitate episode creation, administrative rules are used to define the duration of chronic episodes. Without such rules, the episode would never end. Both groupers truncate chronic care into fixed 12-month intervals, with the most common time interval being a calendar year. Typically, one chronic "episode" immediately follows another. Chronic care episodes in the Medicare population account for a large percentage of costs. Each grouper defines chronic conditions differently. In ETG, chronic condition episodes constitute approximately 65% of the costs, and 43% in MEG.

Finally, to a great extent, the applicability of the groupers to Medicare data depends on how diagnoses are used by the various Medicare payment systems. Diagnoses are collected on all claims, but they are used quite differently. The essential data elements from claims used by grouping algorithms to construct episodes of care and associated costs include the following: diagnosis codes, procedure and/or revenue codes, start and end dates, service payments, and patient characteristics. The Parts A and B programs in fee-for service Medicare pay for services using seven distinct types of claims— inpatient (IP), outpatient (OP), skilled nursing facility

(SNF), hospice (HS), home health (HH), Part B or carrier (PB), and durable medical equipment (DME)—which report the above data elements in different manners and with varying degrees of consistency.

Although just one of several factors, diagnosis is the major determinant that affects the level of payment to facilities for acute hospital inpatient stays and to home health agencies. The IP DRG payment system keys off the principal diagnosis. In HH, diagnosis is one component in constructing the home health resource groups. The physician fee schedule pays based on HCPCS codes, which identify medical services, and diagnoses are sometimes used as a screen to determine whether a service should be paid. Similarly, SNF payments do not use diagnoses except to determine whether a SNF stay is a covered service. Finally, facility payments for services provided in OP departments and payments for hospice care are not based on diagnosis. Given that the groupers tend to group claims based in principal diagnoses, and the use of diagnosis codes varies by claim type, it will not always be the case that claims from various sources will go to the same episode even when, clinically, they appear related.

Specific Features of the ETG Grouper in Applications to Medicare Data

In the case of Symmetry, the following three aspects of the ETG framework govern the construction of episodes of care and associated costs from Medicare claims:

- *The ETG software inputs each claim as a set of service-level records comprised of the revenue center and procedure codes on the claim, with each record individually assigned to an episode*:
    - For institutional claims, each input record consists of a single revenue center code identifying a form of service, an accompanying procedure code if available, and diagnoses listed on the parent claim.[1] A claim has as many input records as it has revenue center codes. Whereas revenue center codes are universally reported on all institutional Medicare claims, HCPCS/CPT procedure codes—which often reveal more details about the form of service—are rarely available on IP, SNF, and HS claims (e.g., less than 9% IP claims list these codes); in contrast, these procedure codes commonly accompany revenue center codes on OP and HH claims (e.g., 99% in the case of HH claims).
    - For non-institutional services, Medicare's PB and DME claims are readily separated into line items associated with individual HCPCS or CPT codes; these claim types have no revenue center codes. Each input record constructed from a PB and DME claim consists of a single procedure code and its corresponding

[1] Symmetry's input files accept up to 4 diagnosis codes, which is fewer than are often available on Medicare's institutional claims. 82% of IP claims, 70% of SNF claims, and 38% of HH claims have more than 4 codes.

line-item diagnosis. Consequently, in addition to diagnosis information in a Medicare setting, the ETG grouper primarily relies on revenue center codes to group IP/SNF/HS claims, procedure codes to group PB and DME claims, and it can use either or both types of codes to group OP and HH claims.

- *Institutional claims are often linked to multiple episodes*: Symmetry's grouper can and often does assign the separate input records from a single parent claim to different episodes and, consequently, many institutional claims are essentially connected to more than one episode.
- *Users must devise their own procedure for allocating the cost of a multi-linked claim to its associated episodes*: When the input records of an institutional claim are assigned to two or more episodes, the ETG grouper offers no guidance for how to divide the cost of this claim across its associated episodes. While a variety of candidate rules are available, none are free of substantive criticisms.

Specific Features of the MEG Grouper in Applications to Medicare Data

Medstat takes a somewhat different approach to the same data. We highlight two main considerations important when using Medstat's software to group Medicare claims into episodes:

- *Medstat's grouping process inputs each claim as a single record, relying primarily on diagnosis information in its assignments to episodes*: Regardless of whether a Medicare claim comes from an institutional or non-institutional source, the MEG grouper accepts one input record per claim. This record distinguishes IP and PB claims from other types of Medicare claims, but it does not differentiate among the other distinct types of Medicare claims as the source of diagnoses. Switching claims from one of these types to another results in no change in constructed episodes. An input record accepts data on procedure codes appearing on the claim (not revenue center codes). This procedure information is primarily used to determine whether a claim represents an x-ray/lab event—which cannot start an episode—and in some instances to assist the grouper in deciding how to interpret secondary diagnoses on the claim.
- *Medstat's grouper does not offer the capacity to treat a claim as an aggregate of services potentially linkable to more than one episode*: Institutional Medicare claims typically cover an array of medical services, and MEG ignores the possibility that such a claim might provide treatments relevant to more than one illness. The prospective payment system used by Medicare not only compensates based on diagnoses but also on procedures and the likelihood of various co-morbidities. MEG's inability to associate the cost of claims paid under such a system with more than one episode constitutes a potential challenge in applying Medstat's grouper software to a Medicare setting.

Methods and Data

Our initial samples included all claims available in 2002-2004 for 100% of Medicare beneficiaries aged 65 and older who resided in the states of Colorado, Florida, Pennsylvania and Oregon in 2003 and who were continuously enrolled in fee-for-service (FFS) Part A and B services while alive. The groupers are run using all claims paid for beneficiaries during the years

2002-2004. Because our analyses reached equivalent conclusions for the different states, this report presents only findings for Colorado. Further, to lessen the computational burden involved in carrying out grouping for the many different specifications of the groupers considered in this study, most of our analyses rely on a randomly-selected 20% sample of the Colorado residents. We validated the results against the 100% samples of Colorado, Florida, Pennsylvania, and Oregon and found that the 20% Colorado sample was always representative of larger state samples.

To present the findings produced by the different groupers on a level playing field, we have developed a framework to output and analyze the results in common metrics.[2] This approach exploits the fact that both groupers map claims to episodes, making it possible to see, claim by claim, to which episode the claim was assigned. We use this claim-level episode assignment to construct our own matching output tables for the two groupers. Based on the claims included in the episodes, we develop common measures of episode length, cost and completeness. In this analysis, the start date refers to the earliest service date of all the claims grouped into the episode, and the end date takes the latest date of the grouped claims. We calculate an episode's cost based on its assigned claims, with the cost of a claim composed of its Medicare payments, excluding the capital payment portion of IP claims, pass-thru payments, and deductibles and copayments made by beneficiaries. The results discussed in this report come from the current versions of the ETG and MEG software (version 7 for INGENIX Symmetry and version 7.1 for Thomson Medstat).[3]

Overview of Findings

Our analysis uncovered a number of insights into the properties of episode groupers applied to Medicare claims data.

Comparisons of Grouping Results for a Medicare Population

Table 1 presents summary statistics for such a sample comprised of 20% of the Medicare beneficiaries residing in Colorado in 2003. Medicare paid $585.5 million for 5.05 million claims on behalf of these beneficiaries between 2002 and 2004. The ETG grouper creates 672,600

[2] The vendors have accepted this framework as a basis for comparison between the two packages.
[3] In particular, we used INGENIX Symmetry Episode Treatment Groups Version 7.0.1 and Thomson Medstat Medical Episode Grouper Version 7.1.0 Build 7 Patch 1. We obtained similar key findings using prior releases of both software products available over the past two years.

episodes leaving 15% of claims and 5% of costs ungrouped, whereas the MEG grouper produces 661,053 episodes with 23% of claims and 8% of costs left ungrouped. Beneficiaries experienced 6 episodes on average for both groupers; a large share of episodes last only 1 day: 45% for Symmetry and 48% for Medstat.[4] Each grouper classifies slightly more than a third of their episode categories as chronic conditions, but definitions of these chronic and acute categories differ distinctly across the groupers. Within this sample of complete episodes ending in 2003, we see that ETG chronic episodes are slightly shorter and 23% more costly on average than MEG chronic episodes. Conversely, acute episodes produced by Symmetry are 28% less costly than Medstat-produced acute episodes and are slightly shorter on average.

Table 1: Summary Statistics for Claims, Episodes, and Costs
All 2002-2004 claims for 20% sample of Colorado beneficiaries

Statistic	Symmetry	Medstat
Total # Claims	5,049,696	
% Ungrouped	15%	23%
Total # Episodes	672,600	661,053
% Chronic Episodes	50%	40%
% Acute Episodes	50%	60%
Average # per beneficiary	6	6
Total Cost of Claims	$585,447,839	
% Cost of Chronic Episodes	65%	43%
% Cost of Acute Episodes	30%	48%
% Cost of Ungrouped Claims	5%	8%
Chronic Episodes		
Average Cost per Episode	$1,071	$871
Average Length of Episode (days)	113	123
Acute Episodes		
Average Cost per Episode	$498	$690
Average Length of Episode (days)	22	24

As briefly noted in the above discussion of specific application issues of the groupers, whereas Medstat's algorithm always assigns each individual Medicare claim to only one episode,

[4]As noted previously, we measure an episode's length as the time between the earliest and latest dates of the claims grouped into the episode, and the averages in Table 1 merely compute the means of these lengths Both groupers can interpret episodes length differently. For example, chronic episodes are often reported as lasting for a fixed 12-month interval.

Symmetry's algorithm often links the services from a single parent claim to different episodes. In the Table 0.1 sample, the ETG grouper splits 52% of SNF claims across episodes, 23% of IP claims, 40% of HH claims, 13% of OP claims, and 15% of HS claims; each non-institutional PB and DME claim is allocated to at most one episode. In instances where services from a parent claim are grouped to multiple episodes, we allocated the cost of the claim to the episode that was assigned the plurality of the claim's service-level input records.

Illustration of Difficulties in Comparing Grouping Results for an Individual Beneficiary

Each grouper has its own system for classifying episodes into categories of medical care, but these designations are typically not comparable. Symmetry classifies each episode to a base ETG combined with a severity level, with there being essentially 679 such classifications ignoring the residual ungrouped categories. Medstat's grouper assigns each episode to a MEG (disease classifications) along with main and detailed disease stages. There are a total of 560 MEG main classifications, and 2 or more disease stages per MEG.[5] Often an ETG cannot be matched to a MEG designation, and attempting to compare groups of ETGs to groups of MEG typically yields dissimilar classifications as well.

To highlight the challenge of directly comparing outcomes from the two groupers, Tables 2 and 3 present grouping results for an individual beneficiary selected for illustrative purposes. According to Table 2, this selected beneficiary filed 133 claims accounting for $31,705 in costs during the period 2002-2004. Further, we see that Symmetry assigned the patient's claims into 24 episodes, and Medstat allocated them into 21 episodes. Symmetry grouped 98% of this individual's claim costs, and Medstat grouped 96% of these costs.

The difficulty in comparing the groupers' outputs can be seen in Table 3, which presents a detailed breakdown listing several of the ETG and MEG assignments for our illustrative beneficiary. The top set of rows in this table shows examples of "similar" episodes constructed by the groupers. These episodes have somewhat parallel clinical interpretations, and their assigned costs are close. If all grouping results looked like these, one might be indifferent about which grouper to use in allocating claims into episodes of care. However, the lower set of rows

[5] Compared to version 7.1 used in this report, in the recently released version 7.25 of the Medstat grouper there are an additional 12 MEGs for a total of 572.

Table 2: Summary Statistics for Claims, Episodes, and Costs
All 2002-2004 claims for an Example Beneficiary

Statistic	All Claims 2002-2004	
	Symmetry	Medstat
Total # Claims	133	
Total # Episodes	24	21
% Chronic Episodes	46%	29%
% Acute Episodes	54%	71%
Total Cost of Claims	$31,705	
% Cost of Ungrouped Claims	2%	4%

in Table 3 shows the examples of "dissimilar" episodes produced by the two groupers for this beneficiary. In the first of these rows, the occurrence of a bacterial lung infection ETG and a bacterial pneumonia MEG suggests an overlap in the beneficiary's assessed clinical circumstances, but Symmetry assigned a cost of $203 to this episode and Medstat allotted a cost of $14,626 which is hardly comparable. Moving to the final rows, both groupers have an episode classification for a chronic neurological condition, but only Symmetry identified this beneficiary as having Alzheimer's with a cost totaling $14,897. The only neurological condition assessed by Medstat was an acute psychosis episode, with costs totaling $266. The findings for this illustrative patient indicates that the Symmetry and Medstat software can present different pictures of the health status and medical treatment circumstances of the same person. The differences become more pronounced the greater the complications of a beneficiary's medical circumstances and the higher the costs.

Table 3: Comparison of Symmetry and Medstat Grouping Results for an Individual Beneficiary

2003 Episodes Selected to Illustrate Comparability Issues

Symmetry				Medstat			
ETG	**# of Assigned Claims**	**# of Episodes**	**Total Cost**	**MEG**	**# of Assigned Claims**	**# of Episodes**	**Total Cost**
Similar Episodes							
Closed fracture or dislocation - thigh, hip & pelvis, SL2 (ETG 713103L2 - Acute)	13	1	$9,554	**Fracture: Femur, Head or Neck (MEG 348 - Acute)**	8	1	$9,288
Hypo-functioning thyroid gland, SL1 (ETG 162200L1 - Chronic)	7	1	$138	**Hypothyroidism (MEG 55 - Chronic)**	9	1	$176
Other skin disorders, SL1 (ETG 669100L1 - Acute)	1	1	$41	**Other Inflammations and Infections of Skin and Subcutaneous Tissue (MEG 545 - Acute)**	1	1	$41
Dissimilar Episodes							
Bacterial lung infections, SL4 (ETG 437400L4 - Acute)	8	1	$203	**Pneumonia: Bacterial (MEG 510 - Acute)**	11	1	$14,626
Alzheimer's disease, SL1 (ETG 316400L1 - Chronic)	10	2	$14,897	--	--	--	--
--	--	--	--	**Other Psychoses (MEG 494 - Acute)**	4	1	$266

Episodes Exhibit Large Variation in Costs (Adjusted Medicare Payments)

The evidence in this report documents considerable variation in costs across episodes within episode types, regardless of whether one considers within individual ETG or MEG classifications. For any of the top five highest-cost acute and chronic ETGs or MEGs, the level of cost (Medicare payments, exclusive of co-pays and deductibles) demarking the most expensive 10% of episodes always exceeds the level demarking the cheapest 10% by almost 5 times, and in many instances it is more than 100 times larger. For the top-five acute ETGs, the top 5% of episodes alone account for 15% to 42% of total annual cost for the ETG, and for the top five chronic ETGs this range is 26% to 50%. For the top five acute MEGs, the top 5% of episodes alone account for 25% to 48% of total annual cost for the MEG, and for chronic MEGs this range is 35% to 64%. This level of variation in raw episode costs suggests the need to develop models of risk or severity adjustment applicable for Medicare populations prior to being able to use the episodes produced by the ETG or MEG software for profiling Medicare providers.

Effects of Altering Forms of Input Files and Software Configurations

Implementing the grouper packages requires decisions to be made in selecting the form of the input file drawn from the Medicare claims and the settings of configuration options. Our analysis compares a Baseline specification to a number of alternatives to evaluate the appropriateness of using the Baseline:

- *Influence of alternative configuration settings for Symmetry*: Varying the software and input settings for the ETG grouper produces modest differences in the share of ungrouped claims and in the number and distributional characteristics of episodes, but these settings can sometimes induce substantial shifts in the assignment of claims to particular episodes.[6] For example, excluding all secondary diagnosis codes in all input records leads to nearly a 5% decrease in the number of episodes, an increase in the share of ungrouped claims from 14.6% to 16.4%, and only minor changes in the distributional properties of chronic and acute episodes. At the same time, this reliance on only primary diagnosis induces over a 20% reassignment of claims to different episodes, representing a shift of more than 34% of costs across episodes.

[6] This generalization ignores several configuration choices that exert obvious effects on the number and distributional properties of episodes. For example, allowing episode lengths to be unlimited in the ETG software leads naturally to a 25% decrease in the number of episodes compared to the Baseline. It leaves the number of ungrouped claims essentially unchanged.

- *Influence of alternative configuration settings for Medstat*: Varying the software and input settings for the MEG grouper generally leads to modest differences in the fraction of claims grouped and in the number and distributional characteristics of episodes, but again changes in settings can cause notable shifts in the allocations of claims across episodes.[7] For example, eliminating all secondary diagnosis codes in all input records leads to virtually no changes in the amount of grouped claims, in the number or compositional breakdown of episodes into acute and chronic classifications, or in the distributional properties of episodes. Using just the primary diagnosis reassigns 2.7% of claims and 8.7% of costs to different episodes, with just over a 1% of claims being shifted to episodes with different MEGs.

- *Medstat makes little use of procedure codes*: Although Medstat allows for 15 procedure codes on an input record, these codes are, in fact, used only marginally in grouping. Unsurprisingly, altering the setting of the x-ray/lab flag (which prevents a record from starting an episode) sharply influences the number of episodes and ungrouped claims.

- *Extending the time horizon for claims coverage beyond the evaluation period can affect grouping outcomes*: We explored the impact on 2003 episodes of dropping claims from the last six months of 2004. More specifically, instead of including claims from 1/1/02-12/31/04, the horizon selected to compute Baseline results, we input claims falling in the horizon 1/1/02-6/30/04. This shortening of the period for including claims causes the Symmetry grouper to reassign 2.5% of claims and 3.5% of costs in constructing its 2003 Complete Episodes. Although this difference is small, the fact that any complete episodes are altered by adding data beyond a six month period means that the use of episodes to assess resource utilization can produce different pictures depending on how long after the fact one delays evaluating past performance. In the same test, the MEG grouper reassigns only 0.09% of claims and 0.23% of costs in its construction of 2003 Complete Episodes.

- *Altering the sort order of input records can affect constructed episodes*: Finally, while satisfying the specified sort order rules required by each grouper, we randomly reordered input records within cells and discovered that the Symmetry grouper reassigned 0.9% of claims and 1.1% of costs to different episodes, whereas the Medstat grouper reallocated 0.4% of claims and 0.6% of costs. This reassignment of costs to different episodes (and potentially to different providers) arises solely due to a user's arrangement of input records, an arrangement that is likely to differ across users.

[7] Similar to the previous footnote for Symmetry, several configuration choices for Medstat have non-surprising impacts on the number and distributional properties of episodes. For instance, increasing episode length limit to longer values considerably reduces the total number of episodes. Less obvious, the share of ungrouped claims and their associated costs also declines.

Grouping Algorithms Do Not Emulate Practice Patterns Common in the Medicare System

A challenge concerns the capability of the grouping algorithms to duplicate familiar practice patterns observed in the Medicare system. For a grouper to work well within a Medicare setting, it would be advantageous for its constructed episodes to capture existing practice protocols and payment regimens. In this way, practitioners whose cost may be profiled by a grouper would have a logical framework for interpreting results.

Medicare guides the flows of services and treatment norms through its benefit structure, which in turn directly influences patterns of care across the different claim types. In essence, Medicare already has some of its own concepts of episodes of care, with the most prominent relating IP stays to post-acute care and physician services. In the case of post-acute care, this episode concept is formally embedded in Medicare's benefit rules. Post-acute care in the form of SNF claims must follow a clinically-related IP claim with a minimum 3-day stay and must occur within 30 days of the discharge date from the hospital. Medicare always considers SNF services to be a continuation of an IP stay.

The grouper algorithms are not designed to follow all the service flows expected under Medicare's program rules, and the findings in this study reveal that episodes constructed by the groupers do not fully mirror some of the practice patterns seen in Medicare data. Under their Baseline runs, both groupers link SNF claims to the same episodes as IP stays only about half the time.

Inpatient Physician Services Often Do Not Group with Associated Hospital Stays

Moreover, neither grouper closely replicates the pattern of inpatient physician services linked to hospital stays in Medicare. Medicare pays for daily Evaluation & Management (E&M) services by a physician during a hospital admission, and the evidence strongly supports the occurrence of daily (or near-daily) PB claims in the form of E&M visits for IP stays paid for by medical DRGs. More specifically, in the Medicare data, 69% of IP stays show concurrent daily E&M hospital visits considering stays of all lengths. Under the Baseline run of the ETG

grouper, only 42% of IP stays have daily E&M visits grouped to the same episode as the IP admission, and this figure reaches only 32% for the Medstat Baseline run.[8]

This report explores several options for re-configuring the groupers to build episodes in a way that more closely mirrors Medicare treatment profiles. We consulted with both vendors in exploring such options. In the case of the ETG grouper, we revised input records for PB claims to include additional diagnoses from the header that accompanies Part B line items. This expands the clinical information beyond the single line-item diagnosis with the idea that this augmented information might enhance opportunities for matching PB diagnosis to IP diagnosis inducing a linkage of these claims to the same episodes. While this modification changes the number and composition of episode types, it does not regroup physician claims in a manner more consistent with Medicare's practice patterns.

In the case of the MEG grouper, we adapted the attributes of input records to invoke an "All Services Admissions Build" feature. This feature is effective in linking IP claims to other claims concurrent with the IP stay because it does so purely based on the timing of service dates. Although the All Services Admissions Build offers a remedy for ensuring the bundling of relevant Part B physician claims into the same episode as the hospital inpatient claims, this option represents a philosophical shift in the meaning of an episode in the sense that claims issued during an IP stay are no longer grouped according to diagnosis but are instead grouped merely on the basis of whether their dates fall within the IP admission. For this reason, while this reports summarizes the findings obtained using the All Services Admissions Build, this specification does not serve as our Baseline setting for analyzing Medstat results due to its significant impact on episode construction and, more importantly, its incomparability with Symmetry's creation of episodes.

Concluding Remarks

This report identifies challenges in applying the ETG and MEG frameworks to Medicare data. Questions arise as to how successfully the grouping algorithms capture common practice patterns used by the Medicare payment system, and the problem of assigning costs from

[8] Considering all PB claims concurrent with an IP stay, Symmetry links about 56% of these claims to the same episode as the IP claim, and Medstat associates 40% of these PB claims with the episode of the corresponding IP stay.

aggregate payments for institutional claims remains a fundamental issue in using either software package. For episode grouping of Medicare claims, the payment mechanism is a crucial distinction between institutional and non-institutional claims. The integration of combined costs in prospective payment systems – such as IP payments based on DRGs – is a central element of Medicare reimbursement policy for institutional claims. By design, these claims do not offer a clear strategy to disaggregate payments. Yet cost allocation is a vital issue for episode groupers. Because institutional claims typically have multiple diagnoses, procedures, and/or revenue center codes, it is plausible that the packages of services reflected in these codes can sometimes be assignable to more than one episode type for the patient.

This dilemma – between the Medicare prospective payment approach to aggregate costs and the need to divide payments for episode costs – is an unanswered challenge in using the episode grouper software in the Medicare setting. Medstat offers no mechanism either for carrying out such assignments or for dividing costs across services. Symmetry's routines can link a parent claim to different episodes, but the breakdown in services is entirely determined by the institutional structure of Medicare claims, and the recorded service categories by construction are not separately priced in claims. To divide aggregate prospective payments across services, CMS would need to develop an allocation mechanism that splits costs using revenue center codes, even supposing that each service signaled by a revenue center code is assignable to treatment for only one health condition.

This review of the functionality of the Symmetry and Medstat grouping algorithms leaves many important features of the ETG and MEG software packages as topics for future study. Most notably, future topics include: (1) evaluating whether the clinical logic incorporated in the grouper algorithms satisfies face validity as judged by medical practitioners; (2) appraising whether the software adequately adjusts episode costs to account for patient composition and case mix; and (3) assessing whether routines can be developed to attribute episode costs to individual providers in a way that appropriately reflects their rank in resource utilization among peers. This review does not address these topics and, therefore, reveals only part of the picture needed to understand the capabilities of the ETG and MEG systems in achieving their ultimate goal of producing reliable profiles of health-care providers and assignments of efficiency scores in a Medicare setting.

As far as informing the next steps in developing measures of resource utilization of Medicare providers, beyond the challenges noted above, the findings of this study suggest that devising a reliable method of risk or severity adjustment for episodes and beneficiary costs in Medicare settings will be required. This may require innovative approaches that are not yet available in the existing literature or software packages. With the multiple co-morbidities and the complexity of the patients, the risk and severity models developed for commercial populations are unlikely to work as effectively in the Medicare population.

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1 INTRODUCTION

This report describes the functionality of the Symmetry ETG and Medstat MEG software packages for grouping Medicare claims data into distinct episodes of care. Episode grouping creates a common measure of resource utilization and expenditures on the treatment of medical conditions, allowing comparison across a community of health-care providers to rate individual performance. In rating individual performance, any evaluation process must, of course, also control for factors such as the quality of care, a patient's illness, disease severity, and demographic risk factors. Episode-based comparisons offer a possible framework for a payment scheme that gives incentives for providers to make efficient use of resources.

The Symmetry ETG and Medstat MEG packages seek to group administrative medical claims into episodes of medical treatment for various categories of health conditions or diagnoses. This grouping creates measures of the intensity of medical treatment for each episode, with intensity interpreted as the cost of the claims making up the episode and/or the time taken to complete treatment, among other assessments of engagement by the health care system. For a particular health condition, these constructed measures can then be compared across different care settings to assess resource utilization in each setting. The grouper products analyzed here assign claims into episodes of illness for a universe of over 500 categories of health conditions.[9]

In this report, we focus only on the first stages of applying grouper software to construct measures of resource utilization: the capacities of the Symmetry and Medstat groupers to form episodes and associated measures of resource utilization relying on information available in Medicare claims. The important questions about how to interpret episode measures as efficiency indicators are left for a future report. The contribution of the discussion here is a careful assessment of the options available for applying the Symmetry and Medstat groupers to Medicare claims.[10]

[9] Unfortunately, the disease classifications used by the two products are quite different, limiting the comparability of episodes for a disease across products.

[10] As part of this study we exchanged Medicare claims data and grouping results with both Symmetry and Medstat to ensure that we ran the groupers according to the vendor's specifications.

The body of the report is divided into seven chapters. Chapter 2 reviews the elements of claims used for episode grouping and the particular features of Medicare claims that are relevant for understanding the challenges of episode grouping for Medicare. Because the output from the two groupers is quite different in some respects, Chapter 3 develops a common empirical framework to document and compare the findings produced by the two groupers. The remainder of the report, Chapters 4 through 7, presents detailed findings and issues relevant in evaluating the functionality and performance of the individual episode groupers. Chapters 4 and 5 review the Symmetry grouper, and Chapters 6 and 7 review the Medstat grouper. Finally, Chapter 8 presents an overall summary of findings and concluding remarks.

2 APPLICATION OF MEDICARE CLAIMS DATA FOR EPISODIC GROUPERS

There are seven different types of Medicare claims to be processed by episode grouping software: inpatient (IP), outpatient (OP), skilled nursing facility (SNF), hospice (HS), home health (HH), Part B or carrier (PB), and durable medical equipment (DME). Table 2.1 shows the share of claims and share of costs from each of these seven claims types. The sample summarized in this table includes all claims available in 2002-2004 for 100% of Medicare beneficiaries aged 65 and older who resided in the state of Colorado in 2003 and who were continuously enrolled in Part A and B services while alive.[11] As seen in the table, for many of the crucial data elements for episode grouping, there are key differences in the information tracked in "institutional claims" (IP, OP, SNF, HS and HH) and "non-institutional" claims (PB and DME). Institutional claims represent just 1 in 10 claims filed in Colorado from 2002-2004 but account for nearly two-thirds of the costs of Medicare.[12]

Table 2.1: Medicare Claims and Costs by Claim Type

100% of Claims for Colorado, 2002-2004

	Claim Type	Institutional	Total # of Claims	% of Claims	Total Cost of Claims	% of Costs
IP	**Inpatient**	Y	162,499	0.65%	$1,091,422,291	37%
OP	**Outpatient**	Y	2,422,859	9.63%	$379,930,622	13%
SNF	**Skilled Nursing Facility**	Y	46,295	0.18%	$188,859,309	6%
HH	**Home Health**	Y	58,217	0.23%	$136,660,551	5%
HS	**Hospice**	Y	13,726	0.05%	$31,236,464	1%
PB	**Part B or Carrier**	N	20,440,786	81.20%	$938,071,324	32%
DME	**Durable Medical Equipment**	N	2,027,603	8.05%	$157,558,928	5%
	Total	--	25,171,985	100.00%	$2,923,739,489	100%

The Symmetry and Medstat software packages implement similar steps in grouping claims to episodes. Conceptually, episodes are meant to capture all claims for a patient for a given condition from the time of an initial diagnosis by a clinician to the end of treatment for this

[11] All the analyses carried out in this section were also done using data from the states of Florida, Pennsylvania and Oregon, and the findings for Colorado were always fully representative of these other states.

[12] Unless otherwise specified, results in this section are drawn from a 100% sample of fee-for-service Medicare claims for Colorado beneficiaries aged 65 and older for the years 2002-2004. Samples include only beneficiaries who were continuously enrolled in fee-for-service from July 2002 to June 2004; the only exception is that if a previously continuously-enrolled beneficiary died during that period they are kept in our sample. Comparable analyses were conducted for Florida, Pennsylvania and Oregon, with the same basic conclusions.

diagnosis. Thus, episodes are groups of claims for the same diagnoses that occur together in time, typically begun by a visit to a physician's office or hospital. After the first claim, all claims associated with the particular diagnosis are aggregated, until there are no additional observed claims for the same disease for a given period of time ("a clean period"). The aggregation of claims into an episode measures the time from diagnosis to last treatment, the procedures provided, and the cost of care for the disease in that episode.

Given this basic approach, the episode grouping algorithms use specific data from the claims, including:

- Diagnosis codes.
- Procedure and/or revenue center codes.
- Start and end dates.
- Costs.
- Patient characteristics.

To understand the use of the ETG and MEG packages in grouping Medicare claims, we begin with a review of how these data elements are captured in different types of Medicare claims and how this information is used by the two products. In doing so, we identify some of the challenges faced in applying episode groupers to the Medicare claims. As we note in the last part of this section, one of these challenges lies in which claims to include in the analysis. This information provides a background for the later chapters of the report, which examine the impact of the different strategies employed by the two software products, as well as the impact of changing the input of these four data types.

2.1 Diagnosis Codes

The distinction between institutional and non-institutional claims matters first in the use of diagnosis codes, which are used by the Symmetry and Medstat software packages to assign claims to episode types. Institutional claims (IP, OP, SNF, HS, and HH) have up to ten diagnosis codes (Table 2.2).

Among these diagnoses, the first diagnosis code always corresponds to the principal diagnosis code for that claim. For IP and SNF claims, there is also a diagnosis code designated as the admitting diagnosis. This code often (but not necessarily) corresponds with the first (principal) diagnosis. As Table 2.3 shows, the admitting diagnosis is not the principal diagnosis

in 43% of IP claims and 24% of SNF claims. In fact, in 34% of IP claims and 9% of SNF claims, the admitting diagnosis is not in the main list of 10 diagnoses.[13]

Table 2.2: Information on Diagnosis Codes by Medicare Claim Type

100% of Claims for Colorado, 2002-2004

		Diagnosis Codes			
	Claim Type	Maximum # of Diagnoses (Header)	% with >4 Diagnosis Codes	Line Item Diagnosis	Admitting Diagnosis
IP	**Inpatient**	10	82%		Y
OP	**Outpatient**	10	7%		
SNF	**Skilled Nursing Facility**	10	70%		Y
HH	**Home Health**	10	38%		
HS	**Hospice**	10	7%		
PB	**Part B or Carrier**	4	-	Y	
DME	**Durable Medical Equipment**	4	-	Y	

Table 2.3: Availability of Admitting and Line-Item Diagnosis Codes

100% of Claims for Colorado, 2002-2004

	% of Claims In Which Diagnosis	
	Not Principal/ First Listed	Not in Main Diagnosis List
Admitting Diagnosis		
IP Claims	43%	34%
SNF Claims	24%	9%
Line-Item Diagnosis		
PB Claims	10%	<0.2%
DME Claims	10%	8%

Non-institutional claims (PB and DME) have a header section with up to four diagnosis codes. As with institutional claims, the first listed diagnosis is considered the principal diagnosis. In addition to the header diagnoses, each non-institutional claim has line-items with an associated diagnosis for each service included on the claim; one of the header diagnoses is

[13] This may occur when the admitting diagnosis is later determined to be incorrect.

almost always associated with each line item. The vast majority of the time, the line-item diagnosis corresponds to the first diagnosis listed on the header.

We review the number of diagnosis codes by claims type because the input for each record in the Symmetry grouper accepts up to four diagnosis codes.[14] Since the majority of IP and SNF claims and a large share of HH claims have more than four diagnosis codes, and can have up to ten codes, this four code limit may lead to the loss of diagnostic information that would be relevant for grouping. We examine the effect of this limit later in the report. The Medstat grouper does not limit the number of diagnosis codes as it accepts up to ten diagnosis codes.

2.2 Procedure Codes and Revenue Center Codes

Institutional and non-institutional Medicare claims also differ in their use of revenue center and procedure codes (Table 2.4). All institutional claims report a set of service items identified by revenue center codes. Depending on the type of Medicare claim, the individual data elements listing a revenue code can have an accompanying HCPCS or CPT procedure code, which varies significantly by claim type.[15] Medicare pays for an institutional claim as an aggregate payment, not broken down by service item. IP claims are paid according to the primary diagnoses and ICD-9 procedure codes listed on the claim, which are again reported for the entire claim and not linked to individual service items.

Medicare payment rules dictate which types of procedure codes will be present on different institutional claim types. As Medicare does not use procedure codes for payment of HS and SNF claims, these claims rarely list procedure codes. IP claims rarely list HCPCS/CPT codes, but it is common for ICD-9 procedure codes to be present on IP claims as DRGs are often classified by these codes. Nearly all OP and HH claims, however, list either HCPCS or CPT codes as OP claim payments are based from CPT codes and HH payments are dictated by HCPCS codes. The number of revenue center and HPCPS/CPT codes on an institutional claim is practically unlimited; the maximum number of revenue center codes on a claim in our sample if

[14] "Record" is Symmetry's term for each claim observation input into the software. A record is usually one claim. However, as we see below, one claim is sometimes broken into multiple records.
[15] 88% of HH service items list a HCPCS/CPT procedure code, as do 72% of OP service items. In contrast, only 7% of SN service items have a procedure code, as do 6% of HS service items and just 2% of IP service items.

383 and the maximum number of HCPCS/CPT codes observed on a single claim is 370. The maximum number of ICD-9 procedure codes in the claims that use them (IP, OP and SNF) is six.

In contrast, non-institutional claims have only procedure codes and do not have revenue center codes. Line items in PB claims usually list CPT codes, but may list HCPCS instead. DME claims almost exclusively list HCPCS codes, with less than 0.1% of claims containing a CPT code.

Symmetry and Medstat differ in the information they use from revenue center and procedure codes. Symmetry preferentially relies on revenue center codes to determine record types, and whether or not a procedure represents a clinical interaction, such as an office visit, surgery or specific therapy. Only claims with such clinical interactions are allowed to open an episode; Symmetry calls these claims "anchor records." Revenue center and procedure codes are also used by Symmetry in the grouping assignment.

Table 2.4: Distribution of Revenue Center and Procedure Codes by Medicare Claim Type
100% of Claims for Colorado, 2002-2004

		Revenue Center Codes		Procedure Codes			
				% of Claims with Any:			
	Claim Type	Revenue Ctr Codes Available	% of Claims with Only Revenue Ctr Codes	CPT	HCPCS	ICD-9	% with 2+ Types
IP	**Inpatient**	Y	39%	2%	7%	55%	3%
OP	**Outpatient**	Y	3%	94%	34%	5%	35%
SNF	**Skilled Nursing Facility**	Y	78%	18%	1%	3%	1%
HH	**Home Health**	Y	1%	<0.1%	99%	-	<0.1%
HS	**Hospice**	Y	93%	7%	<0.1%	-	0%
PB	**Part B or Carrier**		-	87%	13%	-	0%
DME	**Durable Medical Equipment**		-	<0.1%	100%	-	0%

The Medstat episode grouper does not accept revenue center codes in its input. However, it does accept up to 15 procedure codes, but only of a single type. That is, for each claim, Medstat accepts only ICD-9 procedure codes, only HCPCS procedure codes, or only CPT procedure codes. As shown in Table 2.4 this strategy works well for HH and DME claims, but less well for PB (which uses both CPT and HCPCS) and OP (which often has multiple procedure code types), and even less well for IP, SNF and HS, which commonly have only revenue center

codes. However, Medstat relies primarily on diagnoses for grouping, using procedure codes only to choose among multiple diagnoses for a given claim that determine episode assignment. Any potential information loss from the limitations on procedure codes will therefore have at most a marginal effect on a claim's episode assignment.

2.3 Start and End Dates

Grouper software uses dates to assign claims to episodes. Every episode type has a clean period assigned to it, an interval used to establish a temporal boundary between episodes of the same type. Relevant services that fall within the clean period for an episode are included in the episode; relevant services that fall outside of an episode's clean period are not included in the episode.

Medicare data often contain several different types of dates, such as the date of admission or the date the claim was made, requiring the user to decide which dates should be used as a claim's start or end date in the grouping process. Table 2.5 outlines for the purposes of this study the start and end dates used for the different Medicare claim types.

Table 2.5: Start and End Date Used in Grouper Input

		Key Claim Dates	
	Claim Type	**Start Dates**	**End Dates**
IP	**Inpatient**	Claim admission date	NCH beneficiary discharge date
OP	**Outpatient**	Claim from date	Claim through date
SNF	**Skilled Nursing Facility**	Claim admission date	NCH beneficiary discharge date
HH	**Home Health**	Home health start date	NCH beneficiary discharge date
HS	**Hospice**	Hospice start date	NCH beneficiary discharge date
PB	**Part B or Carrier**	First line expense date	Last line expense date
DME	**Durable Medical Equipment**	First line expense date	Last line expense date

2.4 Cost of Claims

Perhaps the most critical reason to distinguish between Medicare claims types is the effect the Medicare payment system is likely to have on information used by the grouper software. This payment system determines the cost information that is captured in the claims data, as well as practices that govern patterns of care.

As shown in Table 2.6, institutional claims are paid as aggregate payments, with IP, OP

and HH claims paid using a prospective payment system (PPS), and SNF and HS claims paid per diem. The basis for aggregate PPS payments varies by claim type. IP claim payments are based on Diagnostic Related Groups (DRGs), which draw on diagnosis and procedure information. We subtract capital PPS payments from IP claim payments.[16] OP payments are based on Ambulatory Payment Classifications (APCs), while HH payments are made for 60-day intervals. Institutional claims, then, have one payment regardless of how many procedures are listed on the claim.

Table 2.6: Medicare Payment Basis by Claim Type

		Medicare Reimbursement			
	Claim Type	Payment Type	Based On	Can Split Costs by Service Item	Input Payment Amount
IP	**Inpatient**	PPS	DRGs	No	Aggregate payment minus capital PPS costs
OP	**Outpatient**	PPS	APCs	No	Aggregate payment
SNF	**Skilled Nursing Facility**	Per Diem	-	No	Aggregate payment
HH	**Home Health**	PPS	Intervals	No	Aggregate payment
HS	**Hospice**	Per Diem	-	No	Aggregate payment
PB	**Part B or Carrier**	Service Item	Procedure code fee schedule	Yes	Line-item payment
DME	**Durable Medical Equipment**	Service Item	Procedure code fee schedule	Yes	Line-item payment

Non-institutional claims have separate payments for each procedure, based on a procedure code fee schedule. These individual line-items constitute the record inputs for both groupers. In our assignments of payment amounts for claims, we excluded pass-thru sums and beneficiary-paid amounts, such as deductibles and coinsurance payments.

[16] We subtract the capital payment portion of IP reimbursements to remove adjustments for indirect medical education (IME) and disproportionate shares (DSH), as these costs do not reflect episode resource use. However, these adjustments still remain in operating payment portion of the reimbursement. As the Medicare Standard Analytical Files (SAF) do not provide a way to separate these adjustments from the operating portion of the payment, they cannot be readily removed from inpatient costs.

The use of aggregate payments, such as IP payments based on DRGs, is a central element of Medicare reimbursement policy. By design, the claims data do not offer a clear strategy to disaggregate these payments.[17] Yet cost allocation is a fundamental issue for episode groupers because episode groupers use cost as the measure of resource use associated with each episode. If it were appropriate to allocate each procedure within an aggregated claim to the same episode, the presence of aggregated payment amounts for institutional claims would not matter. However, because institutional claims typically have multiple diagnoses and procedures, a user can encounter situations whereby these services become assigned to multiple episodes, which leads to the problem of how to divide a single parent claim's cost across its linked episodes.

Symmetry requires that an input record represent a single medical service. The user must decide, then, whether to treat an institutional claim as a single service by choosing just one service from the claim, or instead to split the institutional claim into a set of service-level inputs. We chose the latter option and create what we refer to as "pseudo-claims." Each pseudo-claim represents a single service on an institutional claim, identified by a revenue center code and accompanying procedure code when available. This construction permits investigation of claims going to multiple episode assignments. However, one also encounters the problem of how to assign the aggregated payment for the parent claim across its pseudo-claims. We address this question in more detail in Section 4.3 in our discussion of the implementation of the Symmetry grouper.

Medstat uses claim-level inputs, and evaluates all services on a claim when assigning claims to episodes. Whereas Symmetry requires the use of a single procedure code on an input, Medstat accepts up to 15 procedure codes for a single input. Medstat uses procedure codes to prioritize the secondary diagnoses code listed on the claim in its episode grouping, and assigns a claim, regardless of the number of services associated listed on a claim, to a single episode. As a

[17] Hospitals do provide revenue center level charge information for IP claims. The total charges created from the sum of revenue center charges have historically been used by CMS to weight DRGs. But whether revenue center charges should be used to allocate payments across episodes is questionable due to lack of specificity associated with these charges. Although charge data might provide the basis for identifying the relative share of resources allocable to revenue centers, the non-disease-specific nature of many revenue center codes seems to preclude straightforward algorithms that could sensibly allocate a revenue center's share of resources to more than a single episode. For example there are 55 revenue center codes that refer to different types of room and board services (e.g. All inclusive rate-room and board plus ancillary (0100); All inclusive rate-room and board (0101); Private medical or general-general classification (0110); Private medical or general-medical/surgical/GYN (0111)), which are typically a large share of each IP claim.

result, the total cost of the claim is always attributed to the episode to which an institutional claim is assigned.

2.5 Final Action Claims

Regarding the original source of Medicare claims data, this analysis included all final action claims. For institutional claims, the final action claims are claims that Medicare has reimbursed and thus have an associated Medicare payment. However, non-institutional claims may include denied line items, representing services not reimbursed by Medicare for a variety of reasons (e.g., billing for a medically unnecessary service, billing for a service not covered by Medicare, or submitting a duplicate line-item). Table 2.7 summarizes the non-institutional line items, both those denied for any reason and those denied because they were duplicates.

Table 2.7: Distribution of Denied and Duplicate Line Items

100% of Claims for Colorado, 2002-2004

	PB		DME	
Category of Claim	**#**	**%**	**#**	**%**
All Claims	20,849,091	100.0%	2,041,197	100.0%
Excluding All Denials	18,594,767	89.2%	1,789,502	87.7%
Excluding Duplicates	20,440,786	98.0%	2,027,603	99.3%

Even though denied line items have zero costs, the presence of these claims may change the way episodes group and, thus, indirectly affect episode costs. For the purpose of the grouper analysis, we exclude all duplicate line items but keep those that are denied for other reasons. We exclude duplicate line items because they merely represent a previous encounter in the data.[18] The denied non-duplicate line items, on the other hand, represent an encounter with a healthcare professional which potentially provides clinical information useful in grouping.

2.6 Expected Patterns of Care in Medicare

Finally, beyond stipulating the form of payments made for the claims types described above, the Medicare system also guides the flows of services and treatment norms that influence patterns of care across the different claim types. In essence, Medicare has its own concepts of episodes of care in several important circumstances, most notably ones that relate IP stays to

[18] Excluding duplicated claims produces virtually identical grouping results compared to using all claims. However, excluding all denied claims introduces noteworthy changes in the grouping results. These results can be supplied upon request.

post-acute care and physician services. For post-acute care, this concept is formally embedded in Medicare payment rules. For physician services, the episode concept is supported by a common but non-mandated payment practice. For any grouper to work well within a Medicare setting, it would be advantageous for its constructed episodes to emulate expected practice patterns. In this way, practitioners, whose costs may be profiled by a grouper, would have a logical framework for interpreting results.

Within Medicare, SNF and HH services are provided as post-acute care. Care in a SNF is considered a continuation of care from an IP stay. To be paid, each SNF claim must be clinically related to an IP claim with a minimum 3-day stay and start within 30 days of the IP discharge date. Similarly, HH services are intended to provide post-acute-care services in the home, rather than in a SNF or hospital. Although HH services do not have to follow an IP claim, they are intended as follow up treatment for a specific diagnosis, such as a joint replacement or congestive heart disease. As such, the HH services would be expected to be linked to an earlier claim. An HH claim covers services for a set period, typically 60 days. If a beneficiary is still eligible for HH services at the end of a given period, another period can begin, and the care is considered part of the same treatment plan.

In the case of physician services during hospital admissions, it is expected that doctors will monitor beneficiaries during IP stays (e.g., daily visits). Given this expectation, Medicare pays for evaluation and management (E&M) services by a physician during an IP admission for a medical condition (i.e., an IP claim paid for by medical DRGs). These visits often show up as PB claims representing E&M services provided in the hospital; and a common form of these services list CPT codes denoting specific types of E&M visits, including hospital visits (99221-99239), hospital consult codes (99251-99255), and critical care services (99291-99292). For hospital admissions to perform surgery (i.e., IP claims paid for by surgical DRGs), Medicare pays for PB services but not necessarily in the form of E&M claims, and some associated PB claims may precede or follow the patient's time spent in the hospital. In any case, the flow of services in Medicare invariably provides for treatment linkages between IP and PB claims.

Daily PB visits are, in fact, the norm for IP stays in Medicare, as shown in Table 2.8. This table considers all IP claims paid for by medical DRGs. For these IP claims, we investigate the pattern of PB claims that are concurrent with that claim, in order to identify daily or near

daily visits. The columns distinguish IP claims by the number of days spent in the hospital, with a one-day stay occurring when the beneficiary is discharged on the same day as the admission date and a two-day stay when the beneficiary is discharged on the day after admission. For each stay length, the table reports the frequency of PB claims that are concurrent with that claim. The top panel of the table looks at the frequency of all types of PB claims submitted during the stay. For example, the first number in the table shows that, among one-day claims, 95% have at least one concurrent PB claim. For 7-day admissions in the same row, 92% of IP stays show an average of one or more PB claims per day submitted during the admission. If we look at the "Overall" column in the first row, which summarizes frequencies for all lengths, we see that 93% of IP stays show an average of at least one concurrent PB claim for each day of the IP admission. The general pattern in this row reveals that the fraction of IP stays with an average of at least one PB claim per day slowly falls as admissions lengthen. To allow for near daily visits for the longer stays, the second and third rows of Table 2.8 show the share of IP stays reaching the one-per-day average allowing for one and two days to be missed during the stay. For reference, the fourth row lists the percentages of stays with at least one PB submission. The middle panel of rows in the table presents comparable statistics considering only E&M PB claims, and the bottom panel further focuses on E&M PB claims with HCPCS codes designating hospital visits directly associated with the inpatient stay.

The profiles in Table 2.8 mirror the flow of physician services supported by Medicare's payment structure for PB claims during IP stays. The findings reveal that virtually all IP stays have at least one concurrent PB claim, and those that do not meet the one-per-day standard often come close, as shown in the second and third rows of Table 2.8. Among the longest IP stays, 68% of stays have PB claims for all but two out of the 22+ days in the stay. Of course, these PB claims may not all represent E&M claims. The middle panel shows that daily claims are very much the norm counting only E&M PB claims, and the bottom panel further shows that the near daily norm also applies for E&M PB claims with HCPCS codes directly associated with the inpatient stay. Out of 20,957 inpatient stays with a medical DRG, 69% have daily hospital E&M claims, and 88% have nearly daily E&M visits.

Table 2.8: IP Claims with Concurrent "Daily" PB and E&M Claims

All PB Claims During IP Claims with Medical DRGs

Concurrent PB Claims		Length of Inpatient Claim (Days)										Overall Match Rate
Claim Type	Occurrence During IP Claim	1	2	3	4	5	6	7	8-14	15-21	22+	
All PB Claims	At least one per day	95%	98%	97%	97%	95%	93%	92%	84%	71%	64%	93%
	At least one per day, except 1 day		99%	99%	98%	98%	97%	95%	88%	75%	65%	95%
	At least one per day, except 2 days			99%	99%	99%	98%	97%	91%	78%	68%	96%
	At least one	95%	99%	99%	100%	99%	100%	100%	99%	99%	95%	99%
All E&M PB Claims	At least one per day	87%	90%	90%	85%	79%	75%	72%	68%	57%	49%	81%
	At least one per day, except 1 day		97%	95%	94%	91%	86%	81%	73%	60%	52%	88%
	At least one per day, except 2 days			98%	97%	96%	94%	89%	79%	64%	54%	91%
	At least one	87%	97%	98%	99%	99%	99%	98%	98%	98%	93%	98%
"Hospital" E&M PB Claims	At least one per day	77%	75%	78%	70%	67%	66%	64%	62%	54%	48%	69%
	At least one per day, except 1 day		90%	92%	90%	84%	80%	75%	70%	58%	49%	83%
	At least one per day, except 2 days			96%	95%	94%	89%	82%	75%	62%	52%	88%
	At least one	77%	90%	96%	97%	98%	98%	98%	98%	98%	91%	95%
Number of IP claims		409	3,358	3,995	3,733	2,567	1,683	1,250	2,914	633	415	20,957

3 FRAMEWORK FOR UNDERSTANDING AND COMPARING GROUPER RESULTS

To understand and compare the results from the two groupers, we need a common framework for the output. Unfortunately, the summary output files produced by the Symmetry and Medstat groupers use different approaches for assigning costs, lengths and types to episodes. While these output differences do not necessarily reflect on the functionality of the groupers, they do make it difficult to compare the results.

As a framework to compare the two groupers, we develop a common set of measures for the two packages that rely on the fact that the groupers map claims to episodes. In other words, it is possible to see, claim by claim, to which episode each claim is assigned. Using the claim-episode mapping output from each grouper, we calculate episode length, cost and completeness. Because the concept of completeness applies primarily to acute episodes, we also identify episode types as either acute or chronic using each grouper's classification. Drawing on these common measures, we construct matching output tables for the two groupers.

In this section, we review our decision rules for calculating measures from the underlying mapping of claims to episodes produced by the groupers. We then describe the output tables that we use in the subsequent analyses of each software package. The main area in which the output tables do not match across the two groupers is in the reporting of episode categories. As noted, the two groupers have different disease classifications, which limits the direct comparability of the output.

3.1 Characteristics of Episodes

Each grouper has its own episode classification system. For Symmetry, its software assigns each episode to an ETG. At its most elaborate, an ETG designation consists of a 9 digit code with the first 6 digits representing a disease classification—referred to as the Base ETG—and the last three digits identifying complications, comorbidities and treatments. There are a total of 524 Base ETG classes, of which 68 are categorized as "Ungroupable." Symmetry also distinguishes Base ETGs by up to 4 severity levels. Of the 456 Base ETGs that are assignable to episodes, 129 have multiple severity levels which lead to a total of 679 Base ETG-Severity level categories. For the purpose of attributing episodes to health-care providers using the current version of its software, Symmetry recommends interpreting Base ETG plus its assessed severity

level as the episode categories for comparing cost outcomes. Consequently, when we use the term ETG in this report, we interpret this designation of an episode type to be a Base ETG plus an associated severity level.

Medstat's grouper assigns each episode to a MEG (disease classifications) along with a main disease stage and detailed disease stages. There are a total of 560 MEG classifications, 1883 combinations of MEGs and main disease stages, and 4727 combinations of MEGs and detailed disease stages.[19] Medstat recommends classifying episodes into MEGs as the relevant categories for attributing incidents of care to providers. A primary use of disease stages arises in adjusting episode costs within MEGs for risk factors, a topic not covered in this report. So, when we use the term MEG in the subsequent discussion, we interpret this designation of an episode type to be a simple MEG without distinguishing disease stages.

For the purpose of comparing the two groupers, we have established a common approach for calculating key measures for the episodes and in identifying the sample of episodes to use for analysis. We briefly review these concepts below.

3.2 Approach for Determining Episode Length and Cost

Using Symmetry's and Medstat's assignment of claims to episodes, we have developed common measures of episode length and costs. These measures are not necessarily superior to measures produced by the ETG and MEG software, but provide a reasonable basis for comparison, as well as offering a strategy to understand the effects of different algorithms used by the two packages. The strategies for calculating episode length and costs are straightforward.

Episode length: Because Symmetry and Medstat use different methods for calculating start and end dates when calculating episode lengths, for purposes of comparison, we apply a single rule to compute episode lengths. In this analysis, the start date is the earliest start date of all the claims grouped into the episode, and the end date is the latest end date of all the claims grouped into the episode.[20] Neither Symmetry nor Medstat uses this method.

[19] These figures reflect the number of MEGs in version 7.1 of the Medstat grouper. The recently released version 7.25 adds 12 additional MEGs, for a total of 572.

[20] Symmetry inputs institutional claims as a set of "pseudo-claims", one for each of the procedure codes or revenue center codes from the parent claim. These pseudo-claims are often grouped to multiple episodes. For the purposes of calculating episode dates for Symmetry, we consider all the dates on any record grouped to an episode, including all institutional pseudo-claims and non-institutional line items.

Episode cost: We also recalculate episode costs for both Symmetry and Medstat to ensure that our costs were consistent across groupers. In our analysis, we compute an episode's costs by summing the payments of all the claims allocated to the episode. In the case of Symmetry, for which we split institutional claims into multiple records (pseudo-claims) that can be linked to more than one episode, we assign the entire cost of the institutional claim to whichever episode was assigned the most records (i.e., pseudo-claims) from the original Medicare claim.[21] In the case of Medstat, which assigns whole claims to episodes, our method precisely assesses the cost of each episode. This means our comparisons accurately capture the costs for the claims in the episodes, based on each grouper's assignment of claims to episodes.

3.2.1 Categories of Episodes for Analysis

Our analysis is divided in a number of key ways: based on the type of episode (acute versus chronic) and based on which data are included in a particular examination of the episode groupings:

Acute vs. chronic episode types: We distinguish acute episode types from chronic episode types, using the categories defined by the groupers. For Medstat, the grouper documentation lists which MEGs are chronic and which are acute.[22] With its most recent release, Symmetry now also classifies its episode types (ETGs) as either acute or chronic. The distinction between acute and chronic types becomes most relevant when we examine only complete episodes.

All Claims: All our analyses are based on claims from 2002 to 2004 for a sample of continuously-enrolled fee-for-service (FFS) beneficiaries aged 65 and older with a residence in Colorado. Our analyses primarily focus on a randomly-selected subsample of 20% of those beneficiaries. When we refer to "All Claims" in this report, we mean all claims for those beneficiaries.

[21] If more than one episode is tied for having the greatest share of pseudo-claims for a claim, the claim's cost is divided equally among the tied episodes. See Section 4.3 for more discussion of our plurality rule.
[22] Medstat has five categories of MEGs: acute, chronic acute flare-up, chronic maintenance, chronic non-stratified, and well care. As chronic acute flare-ups represent a distinct episode from the underlying chronic condition, and have defined clean periods (unlike the 999 day clean period for other chronic episodes), we treat these episodes as acute. Chronic maintenance, chronic non-stratified, and well care (i.e., preventive care) are all treated as chronic episodes by Mestat, so we include them in our chronic episode statistics.

2003 Touching Episodes: Our analysis draws on data from 2002 to 2004 to understand episodes in 2003. Our primary definition of episodes in 2003 is "2003 Touching Episodes." These are episodes that "touch" 2003 in that their start and end dates of the episodes occur in the 2002-2004 observation period, with at least one day of 2003 between. This includes episodes that start in 2002 and end in 2003, episodes that both start and end in 2003, episodes that start in 2003 and end in 2004, and episodes that start in 2002 and end in 2004.[23]

2003 Complete Episodes: Although this report focuses largely on episodes that touch 2003, a narrower focus is appropriate when one turns to the issue of physician attribution. To use the groupers to attribute episodes to physicians and especially to use them to attribute costs, it is critical to concentrate on completed episodes. By using complete episodes we can be certain that the attribution of an episode to a given provider will not change when more claims are added to the data. In addition, the length and the final cost of episode can both only be determined for complete episodes.

Conceptually, episodes are determined to be complete if we observe an appropriate "clean period" ahead of the initial date on the claims and also observe an appropriate clean period after the final date on the claims. Clean periods, or intervals during which there are no claims associated with a given episode type, are used by the grouper packages to determine whether two claims are close enough together in time to be considered part of the same episode. Each episode type (ETG for Symmetry and MEG for Medstat) has an associated clean period that is set by the groupers on consultation with physicians. These clean periods range from 0 days to 999 days. Acute episode types have shorter clean periods; chronic episode types have longer clean periods.

With a three-year window of data, it is not possible to determine whether we are missing claims for episodes near the beginning or end of the time period covered by our data. In other words, episodes with start dates close to January 1, 2002 or with end dates close to December 31, 2004 could have claims that would have been counted in the episode if our data cover a longer period. Episodes with claims not included because of the time cutoffs are not complete in the clinical sense, or administratively, in that they do not include all clinical and cost information.

[23] In a few extremely rare cases, our data includes episodes with that start before 2002 or end after 2004. We do not include these episodes in the 2003 Touching sample unless they either start or end in 2003.

Therefore, for inclusion in the sample of 2003 Complete Episodes, we require acute episodes to begin at least a full clean period after January 1, 2002 and end at least a full clean period before December 31, 2004.

This focus on clean periods does not fit well with the concept of a chronic disease. With a three year window of data, it is extremely difficult for chronic episodes to be deemed complete (since they need clean periods of 180 to 365 days[24]). Recognizing this, it is common when using episode groupers to set annual measures for chronic diseases, rather than limit the analysis to episodes that are complete using definitions based on clean periods. Following this convention, we rely on calendar year measures of chronic episodes.

To develop a sample of episodes that comprises a representative composition of medical treatments that have run their course for any designated time horizon, one must go beyond the notion of complete episodes as defined by the grouping algorithms which only signals that treatment has been finalized. In addition to being complete from a grouper perspective, one must also select episodes in a way to avoid oversampling systematically long and costly episodes. We create such as a sample by requiring grouper-complete episodes also to satisfy the following two conditions:

- Episodes must have started beyond a clean period after January 1, 2002, with the clean period varying with an episode's assigned illness classification. This criterion ensures each episode has a well defined start within our 2002-04 sample horizon.
- Episodes must end during 2003.

We term the sample of episodes meeting these conditions as the group of 2003 Complete Episodes. This sample provides a collection of finalized episodes of care that is representative of the cost and duration of treatment in the year 2003. Sections 5.2 and 7.2 discuss the properties of 2003 Complete Episodes further and elaborate the advantages of using this sample to carry out of attribution exercises.

[24] For Medstat, all chronic episode types have an associated clean period of 999 days. Such diseases effectively have a 365-day clean period, because Medstat uses an annual cutoff for chronic episodes. Thus, claims occurring one year apart should always be grouped to different episodes. For this reason, and to make completeness statistics of chronic episode types more comparable between the two groupers, we use 365-day clean periods for these MEGs.

3.3 Tables Summarizing Characteristics of Episodes for Baseline Runs

Using the framework above, we develop eight core tables as a basis for comparisons of the abilities of the respective groupers in grouping claims into episodes. We complete each of these tables for a "Baseline" run of each grouper package.[25] The discussion of the Baseline findings is presented in Sections 5.1 (for Symmetry) and 7.1 (for Medstat). These findings are organized into eight key tables that provide the following information:

General statistics on grouping**:** The first tables for each grouper (Table 5.1 for Symmetry and 7.1 for Medstat) give general statistics about the degree to which claims get grouped into episodes. They cite the total number and cost of all claims input and the total number of episodes output. The tables also report the fraction of episodes that are chronic and acute as well as the fraction of costs represented by episodes of each type of disease, and the fraction of ungrouped claims. When we reference claims in our descriptions of grouping outcomes, we mean either parent institutional claims (IP, OP, SNF, HS or HH) or the line items of non-institutional claims (PB and DME).[26] As noted previously, in our analysis of the Symmetry grouper we create "pseudo-claims" from service-level items reported in institutional claims, but we do not summarize grouping outcomes in terms of these pseudo-claims. Table Shell 3.1 shows the format of the general statistics tables for grouping outcomes.

Table Shell 3.1: Summary Statistics for Claims, Episodes and Costs

All Claims

			Fraction of All Episodes			Fraction of all 2002-2004 Claims Costs		
Total # Claims	**% Ungrouped Claims**	**Total # Episodes**	**% Chronic Episodes**	**% Acute Episodes**	**Total Cost in 2002-2004**	**% of Costs in Chronic Episodes**	**% of Costs in Acute Episodes**	**% of Costs in Ungrouped Claims**

[25] The Baseline adopted for each grouper consists of the settings that seemed to best fit Medicare data, choosing default settings wherever reasonable.

[26] Non-Institutional claims are submitted as a list of services, with each item showing a procedure code for a service specific to a condition identified by a diagnosis code; however, these items are not necessarily related, and each item does not affect the payment of the other.

General statistics for 2003 Touching Episodes**:** The core of our analysis focuses on episodes that fall at least partially in 2003, our analysis year. We refer to such episodes as "2003 Touching."

The second table for each grouper (Table 5.2 for Symmetry and 7.2 for Medstat) gives summary information on all episodes that touch 2003, as well as for acute episodes we deem complete (see Section 3.1.2 above). They list the total number of episodes that touch 2003, and fraction of for Touching acute and chronic episodes along with shares of Complete acute episodes. The tables also give the share costs represented by each of these categories. Table Shell 3.2 demonstrates the format of these tables.

Table Shell 3.2: Summary Statistics Episodes and Costs

2003 Touching Episodes

	Fraction of All 2003 Touching Episodes				Fraction of All 2003 Touching Episode Costs		
Total # 2003 Touching Episodes	**% Chronic Episodes**	**% Acute Episodes**	**% 2003 Complete Acute Episodes**	**Total Cost of 2003 Touching Episodes**	**% of Costs in Chronic Episodes**	**% of Costs in Acute Episodes**	**% of Costs in 2003 Complete Acute Episodes**

Distribution of each type of episode by cost and length**:** Tables 5.3 for Symmetry and 7.3 for Medstat give the distribution of chronic, acute, and complete acute episodes both by cost and length of episode, still focusing on 2003 Touching Episodes. The tables break the statistics into percentiles (10, 25, 50, 75, 90, 95, and 98) as well as specify the mean and standard deviation (Std Dev) for the cost and length of episodes. Table Shell 3.3 shows the format of these tables.

Table Shell 3.3: Episode Cost and Length Percentiles

2003 Touching Episodes

		Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Chronic	Cost per Episode ($)									
	Length per Episode (days)									
Acute	Cost per Episode ($)									
	Length per Episode (days)									
2003 Complete Acute	Cost per Episode ($)									
	Length per Episode (days)									

Number and cost of each type of episode per person**:** The fourth set of tables (Table 5.4 for Symmetry and 7.4 for Medstat) provide a summary of the number and costs of chronic, acute and complete acute episodes per person. The tables give the distribution at the 10, 25, 50, 75, 90, 95, and 98 percentiles as well as provide the mean and standard deviation for the total number and cost per person for chronic, acute and complete acute episodes. Table Shell 3.4 shows the format of these tables.

Table Shell 3.4: Episodes and Total Costs per Person

All Beneficiaries with at Least One 2003 Touching Episode

	Summary Statistics								
Type of Episode	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
# of Episodes per Person:									
Chronic									
Acute									
2003 Complete Acute									
Total Cost per Person									

Breakdown of Episodes by Disease Type**:** The next table shell (Table 5.5 for Symmetry and 7.5 for Medstat) provides a summary of general disease types. For each disease type, the fraction of chronic, complete acute, incomplete acute and total episodes is given. For Symmetry, general disease types are the "Major Practice Categories" (MPCs) specified in the software documentation. The MPCs are general categories that can be further split into episode treatment groups (ETGs). Although Medstat also groups its episode types into general categories, its categories are more specific than Symmetry's MPCs. For comparison purposes, Acumen further groups Medstat's categories so that they correspond to the 25 Major Diagnostic Categories or MDCs.[27] Although Symmetry's MPCs and Medstat's MDCs are similar, they do not have a one-to-one correspondence and are therefore not necessarily comparable. Table Shell 3.5 provides the format of these tables – the rows differ between the two software packages, according to the MPC/MDC differences.

Table Shell 3.5: Major Practice Category Classifications

2003 Touching Episodes (Symmetry Example)

Major Practice Category	% Chronic Episodes	% 2003 Complete Acute Episodes	% Incomplete Acute Episodes	% All Episodes
Orthopedics & Rheumatology				
Cardiology				
TOTAL				100%

Episode Costs and Other Characteristics by Disease Types: Two tables look at specific episode types (i.e. an ETG for Symmetry and a MEG for Medstat) and give statistics for chronic and acute episodes of those types that touch 2003. These tables correspond to Tables 5.6 and 5.7 for Symmetry and Tables 7.6 and 7.7 for Medstat. For Tables 5.6 and 7.6, each row summarizes a specific episode type's cost data, indicating the rank in cost for that episode type and the rank in standard deviation of cost. Information on the distribution of costs per episode for that episode type include costs by percentiles (10, 50, 90, and 98), along with the mean and standard

[27] These categories are commonly used diagnostic categories and usually correspond to either a single organ system or a medical specialty. The specific mapping from Medstat's episode groups to MDCs is available upon request. More information regarding these categories can be found at health.utah.gov/opha/IBIShelp/codes/MDC.htm.

deviation. We also distinguish the total episode cost from the total cost of claims occurring in 2003 (where the episode cost may include costs in earlier or later periods).[28]

The second table by episode type (equivalent to Tables 5.7 and 7.7) gives additional data for the episode types, including the number of claims for each episode type, the total number of episodes and the average length of episodes. The tables also show the percentage of ETGs/MEGs that start in 2002 and end in 2003, the number of episodes that start in 2003 and end in 2004 and the number of episodes that begin in 2002 and end in 2004.

As suggested in Table Shells 3.6 and 3.7, the rows of tables 5.6 and 7.6 differ for the two groupers, as do the rows of tables 5.7 and 7.7, reflecting their different episode classification systems. Due to the number of episode types, these tables are condensed to include only selected focal diseases.

[28] Other cost statistics, including the coefficient of variation, are available upon request.

Table Shell 3.6: Cost Statistics for Individual Focal Disease ETGs

2003 Touching Episodes (Symmetry Example)

ETG: Description	Rank		Cost per Episode Touching 2003							Total Cost of 2003 Claims
	Rank in Total Cost	Rank in Std Dev of Cost	10%	50%	90%	98%	Average Cost	Std Dev of Cost	Total Episode Cost	
163000L1: Diabetes, SL1										
713103L1: Closed Fracture or Dislocation - thigh, hip & pelvis, SL1										

Table Shell 3.7: Number, Length, and Timing of Episodes by Focal Disease MEG

2003 Touching Episodes (Medstat Example)

MEG: Description	Number, Length, and Timing of Episodes Touching 2003										
	Rank		# of Episodes	Percentiles			Average (days)	Std Dev (days)	% Start and End in Different Years		
	Rank in # of Claims	Rank in # of Episodes		20%	50%	80%			Start 2002 End 2003	Start 2003 End 2004	Start 2002 End 2004
9: Congestive Heart Failure											
500: Chronic Obstructive Pulmonary Disease											

Ungrouped claims**:** Finally, the last table common to both groupers (corresponding to Table 5.8 for Symmetry and 7.8 for Medstat) provides a distribution of ungrouped claims by the seven claim types. It gives the number of ungrouped claims for each claim type and the fraction of ungrouped claims within each claim type.

Table Shell 3.8: Ungrouped Claims by Claim Type

All Claims

Claim Type	# of Claims Ungrouped	% of Claims Ungrouped
IP		
OP		
SNF		
HH		
HS		
PB		
DME		

All of the tables are presented for the Baseline runs. However, we do not replicate in this report all of the tables for all of the runs associated with varying the input and configuration settings. In particular, we include the tables by MPC/MDC and episode type only for the Baseline runs. Versions of these tables for subsequent runs are available upon request.

4 SPECIFICATION OF BASELINE APPLICATION OF SYMMETRY GROUPER TO MEDICARE DATA

For the purpose of this analysis as well as future work using grouper software for Medicare, we have developed a specification of input file characteristics and software configuration settings that represent our "Baseline." This Baseline reflects our determination of the input file and configuration options that best suit the Medicare claims data, within the normal settings of the software. This chapter describes the Baseline application of the Symmetry grouper to Medicare claims. The Baseline specification details the structure of the input file, the software configuration, and the structure of the output file. The following chapter presents the findings from the Baseline run using these settings, as well as comparisons using alternative specifications.

4.1 Structure of Symmetry Input File for "Baseline" Run

Using all Medicare claims between 2002 and 2004 filed for a 20% sample of all FFS Colorado Medicare beneficiaries in 2003, we create an input file for the Symmetry software.[29] This construction requires decisions on the use of diagnosis codes, procedure and revenue center codes. Table 4.1 displays the use of diagnosis and procedure codes in our construction of the Baseline input file. We review these choices below.

Table 4.1: Data Inputs Used in Baseline Symmetry Run

Claim Type	Diagnosis Codes	Use of Revenue Center/HCPCS/CPT Codes
IP	First four listed diagnosis codes	One input record created for each medical service, which is identified by a revenue center code and, when available, the corresponding HCPCS/CPT code.
OP		
SNF		
HH		
HS		
PB	Line-item diagnosis code	Line items input using the single HCPCS/CPT procedure code on each line item.
DME		

[29] We restrict our main analysis sample to be a randomly-selected 20% of Colorado residents to lessen the computational burden involved in carrying out grouping for the many different specifications of the ETG and MEG groupers considered in this report. In many instances, we validate results against the 100% samples of Colorado, Florida, Pennsylvania and Oregon and always find that the 20% Colorado sample produces representative findings.

Symmetry offers the ability to disaggregate institutional claims into individual service-level inputs. This allows the different services listed on an institutional claim to be grouped to distinct episodes as appropriate. We create service-level input records, which we term "pseudo-claims," following Symmetry's recommendation to use information on revenue center codes and corresponding HCPCS or CPT procedure codes. Services are always identified on an institutional claim by a revenue center code, and if there are HCPCS/CPT codes on a claim, each always corresponds to single revenue center code. So in creating pseudo-claims, we use a single revenue center code as the principal designator of the service. All pseudo-claims constructed from Medicare institutional claims, then, have a single revenue center code, but not all pseudo-claims have an accompanying HCPCS/CPT code. Of pseudo-claims built from IP claims, 2% have a HCPCS or CPT code; 7% of pseudo-claims from SNF claims have a HCPCS/CPT code; 6% of input records from HS claims have a procedure code; and 72% of pseudo-claims from OP claims and 88% from HH claims have a HCPCS/CPT code.

Turning to non-institutional Medicare claims, PB and DME claims separate into individual line items, each of which has a single associated diagnosis and HCPCS or CPT code. As such, line items from PB and DME claims conform to Symmetry's service-level standard for inputs as they have a single HCPCS/CPT code.

Symmetry allows for up to four diagnosis codes for each input record. For pseudo-claims constructed from institutional claims, our Baseline implementation uses the first four diagnoses codes listed on the claim. Medicare institutional claims, particularly IP, SNF, and HH claims, often have more than four diagnosis codes (see Table 2.2). However, since Symmetry does not allow for more than four diagnoses codes per input record, the user must choose which four codes to use. As there is no mapping between diagnoses codes and revenue center or procedure codes on institutional claims, each pseudo-claim from a parent institutional claim receives the same four diagnoses codes. So, if 20 pseudo-claims are constructed from a single institutional claim, each of the 20 pseudo-claims will have the same four diagnoses codes. For PB and DME claims, we use the single line-item diagnosis code instead of the header diagnosis list because it corresponds directly to the procedure performed for non-institutional claims.

ICD-9 procedure codes are commonly present on IP claims because they are used in constructing the DRGs used for determining payments, and Symmetry allows for up to 4 ICD-9

procedure codes on each input record. However, Symmetry's algorithm does not use these codes for the purpose of grouping. Instead, fields for ICD-9 codes and other codes, such as payments, are provided so these variables can be used for post-grouping analysis. We tested the effect of not using ICD-9 procedure codes as input for creating ETGs and, consistent with Symmetry documentation, we found that these codes did not affect grouping.

In addition to diagnoses and procedure code information, date, cost and beneficiary information is included as input. Start and end date information is used for grouping (see Chapter 2), and beneficiary information (age and gender) is used by Symmetry to establish severity level. Cost information is not used for grouping, but instead is included as input for the purpose of post-grouping analysis.

4.2 Structure of Symmetry Configuration File for "Baseline" Run

In addition to using input files, the user can influence grouping outcomes through a configuration file. Table 4.2 lists the options and our settings for the Baseline configuration. We select "NO" for unlimited episode length, primary diagnosis indicator and alternate pregnancy provider following the recommendations of Symmetry's documentation and/or sample configuration files. Similarly, we use Symmetry's defaults for clean periods. Selecting "track patient comorbidity = NO" ensures that patients with episodes with comorbidities are not flagged, nor will the grouper assume a prior history for runs. While Symmetry's documentation suggests setting this option to YES, we want to have a clean slate for each run for comparability. Setting "link facility records = YES" connects claims associated with hospital stays into "confinements."[30] We set this value to YES since Medicare IP claims are not necessarily separate admissions. Regarding the "summarize complete episodes only" indicator, the documentation suggests using caution in setting this to NO because using incomplete episodes in analysis may give unpredictable results. However, we set this to NO because we want to analyze both incomplete and complete episodes. This setting also allows us to recalculate episode completeness as we discuss in Section 3.1.2.

[30] "Facility records" are designated by a flag on the input records given to Symmetry. A confinement is a group of facility records with the same beneficiary, provider and bed type that make up a single "stay" or confinement.

Table 4.2: Symmetry Configuration for Baseline Run

Option	Role	Baseline Setting	Varied in Runs
Unlimited Episode Length	Allows the user to specify if chronic illnesses should be limited to one year or can be unlimited in length	NO	YES
First-Listed Diagnosis is Primary	Software uses *only* the first diagnosis in assigning claims to new or existing episodes; other diagnoses are still used, but only to create phantom episodes	NO	YES
Track Patient Comorbidity	Allows the software to remember if a patient had an episode with comorbidity from a previous run	NO	YES
Custom Clean Periods	Does not change the actual clean periods used in grouping episodes. Rather, it changes whether or not Symmetry designates an episode as "complete"	Symmetry defaults	YES
Link Facility Records	Software creates "confinements" from "facility" records. The option allows the user to specify the maximum number of days between these records before a new confinement is created	YES – maximum of 1 day between facility records	YES
Summarize Complete Episodes Only	Permits formation of episodes designated as both complete and incomplete by Symmetry	NO	NO
Alternate Pregnancy Provider	Impacts the assignment of the responsible provider for each episode	NO	NO
Annual Episode Start Month	Which month begins the year for assigning chronic episodes (1-12)	1	NO

We vary most of these settings in alternative runs to the Baseline. However, we do not vary two of the options across the runs. First, we keep "Summarize Complete Episodes Only=NO" for all the runs, as we use our own definition of completeness (see Section 3.1.2) and perform data analysis on both complete and incomplete episodes. Second, we keep "Alternative Pregnancy Provider=NO" because this report only looks at variations in grouping and does not analyze the differences in assigned providers, and because we are examining an elderly population.

4.3 Structure of Symmetry Output Files

The Symmetry software produces ten output files, of which two are the most relevant for this analysis. The first output file links each record (claims or pseudo-claims) to a particular episode. The second file details each episode's cost, its start and end date, and its assigned ETG classification. We compare this second file to the episode length and cost measures that we

calculate using our framework to gain a better understanding of how the Symmetry grouper functions.

Our calculation of episode length differs substantially from Symmetry's calculations. As described in previous sections, we use the start date of the first claim associated with an episode as the start date and the end date of the last claim as the end date, whereas Symmetry has two distinct methods for assigning episode dates depending on whether the episode is for a chronic or acute ETG. For chronic ailments, Symmetry breaks up care into episodes on an annual basis, and assigns episode durations based on the start and end dates of the designated annual period, and not based on the dates of assigned claims. As we set chronic episodes to begin on January 1, every chronic episode has a start date of January 1. For acute episodes, Symmetry counts dates from the first claim with an engaged clinician – during an office visit, a surgery, or other specific treatment or therapy – to the last claim with an engaged clinician. In this way, it is grouping claims into episodes defined by active treatment. Thus, Symmetry assigns acute episode start and end dates based on first and last "anchor" records, which often differ from the actual first and last records grouped into the episode. Symmetry determines whether or not a claim is an anchor record by evaluating the revenue center and procedure codes present on the claim. For Symmetry, then, "opening an episode" does not mean that the claim necessarily has the earliest start date for the episode; rather, it means that other claims can be grouped with the anchor record to form an episode.

Figure 4.1a illustrates how the use of anchor records creates a different episode length calculation. The solid line represents the episode length as calculated by Symmetry, and the dotted line shows a linked claim that does not figure into Symmetry's date assignment for an episode. In this figure, there are six claims for a given patient: three with a diagnosis code for femur fracture and three with a diagnosis code for nutritional deficiency (evidenced by anemia, for example). For the femur fracture episode, Acumen's and Symmetry's calculation approaches would both result in a start date of 5/1/2006 and an end date of 6/21/2006. However, a blood test (Claim A3) conducted at the same time as the fracture may reveal a nutritional deficiency. For Symmetry, an episode for nutritional deficiency cannot start until there is an associated anchor record, such as the office visit in claim A4. Claim A3 would be grouped with this episode, but the start date would be that of the anchor claim. Therefore, Symmetry would assign a start date

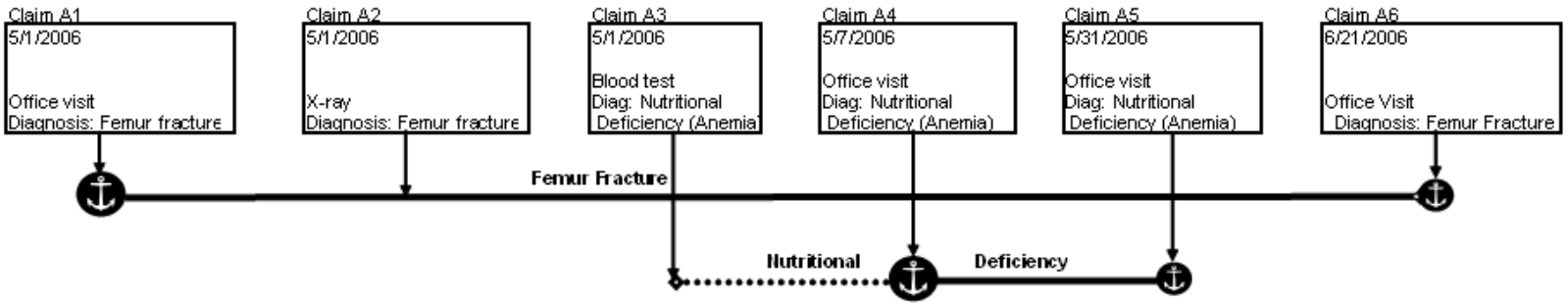
of 5/7/2006 (the date of the anchor record), but Acumen would assign a start date of 5/1/2006 (the date of the first claim).

Because of Symmetry's use of what is termed as "phantom records", episodes might also have a start or end date that comes from records grouped to a different episode. Phantom records occur when an anchor claim has multiple unrelated diagnosis codes. Diagnosis codes that do not match the revenue/procedure code are deemed phantom records and start "phantom clusters." A phantom cluster contains clinical information that can be used to start episodes. Phantom clusters that do not gather claims become phantom episodes; these are episodes without any associated claims, and simply represent a set of related diagnoses drawn from other claims.

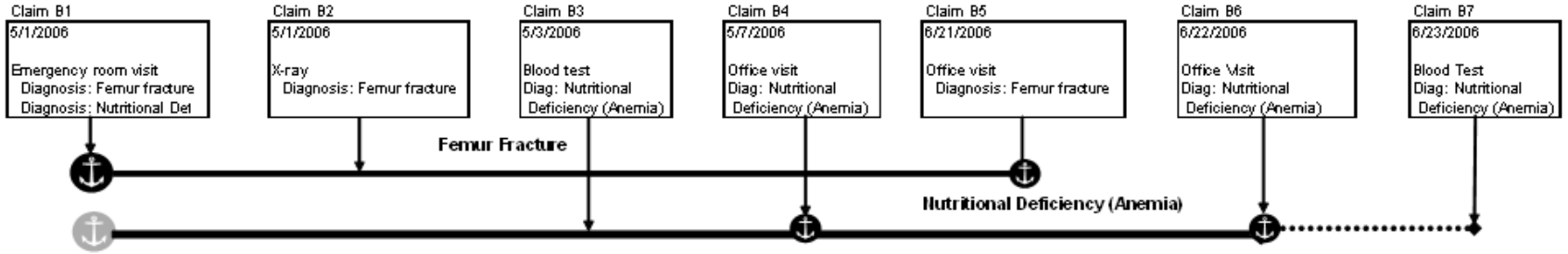
Figure 4.1b shows another set of hypothetical claims, and how a phantom record can start an episode and how Symmetry uses the phantom record to define an episode's start date. As an anchor record, Claim B1 starts, and is grouped to, the femur fracture episode; however it also starts a phantom cluster for nutritional deficiency. If any other claims (including x-ray/lab records) are identified with a nutritional deficiency condition, a new episode is created that does not include Claim B1. In the example, the phantom record from Claim B1 would create an episode for nutritional deficiency from Claim B3, even though Claim B3 is for lab work. And although Claim B4 is the first anchor claim grouped to the nutritional deficiency episode, it is our understanding of this feature in the Symmetry grouper that Claim B1 would provide the start date of 5/1/2006 for the nutritional deficiency episode while being grouped to the femur fracture episode. However, since Claim B1 is grouped to another episode, our method of assigning episode dates would not define the start date with this claim, instead we would assign a start date of 5/3/2006 using Claim B3. In this example, our end date would also differ from the date assigned by Symmetry, as Symmetry would define an end date of 6/22/2006 using claim B6 since it is an anchor claim, but we would define an end date of 6/23/2006 from claim B7.

Figure 4.1: Role of Anchor Records in ETG Episode Dates

a. Claims that Precede Anchor Record



b. Claims After Phantom Record



Because Symmetry assigns episode dates to acute episodes based on anchor records, including phantom records, the beginning and end dates of these episodes as recorded by Symmetry can differ from the dates of first and last claims (as counted by Acumen) in either direction. As shown in Table 4.3, the Acumen and Symmetry dates are the same for almost 80% of acute episodes. Because Symmetry documents its selection of these dates, we do not interpret the differences in Table 4.3 to represent errors. Instead, they indicate a key difference in approach that is worth recognizing when working with this software.

Table 4.3: Comparison Acute Episode of Start and End Dates

All Acute Episodes, Symmetry

Compared to Acumen Calculation:			
Symmetry Start Date is	**Symmetry End Date is**	**# of Episodes**	**% of Episodes**
Earlier	Earlier	3,323	1.00%
	Same	3,730	1.12%
	Later	1,319	0.40%
Same	Earlier	29,624	8.89%
	Same	259,643	77.91%
	Later	3,960	1.19%
Later	Earlier	9,034	2.71%
	Same	19,776	5.93%
	Later	2,868	0.86%

Symmetry's method for assigning dates to chronic episodes also differs from the approach used in this report. The grouper truncates chronic care into episodes on an annual basis, with five options for defining the start or end of the annual period. We choose the option that defines the start month/day and sets chronic episodes to begin on the first day of a calendar year. Symmetry's chronic episode date assignment does not use claim dates, but instead uses the start and end points of the annual period, so the episode length calculated by Symmetry for chronic episodes is always one calendar year in length. Since our approach for calculating an episode's length uses the earliest-claim start date and latest-claim end date, our measures of chronic episode lengths cannot be shorter than those reported by the Symmetry grouper. Table 4.4 shows that virtually every chronic episode has Symmetry-calculated start and end dates that are respectively earlier and later than Acumen's calculations.

Table 4.4: Comparison of Chronic Episode Start and End Dates

All Chronic Episodes, Symmetry

Compared to Acumen Calculation:			
Symmetry Start Date is	**Symmetry End Date is**	**# of Episodes**	**% of Episodes**
Earlier	Earlier	0	0.00%
	Same	5,332	1.57%
	Later	330,742	97.47%
Same	Earlier	0	0.00%
	Same	263	0.08%
	Later	945	0.28%
Later	Earlier	0	0.00%
	Same	113	0.03%
	Later	1,928	0.57%

Finally, as noted earlier, the construction of "pseudo-claims" presents a challenge in evaluating the output results from the grouper software. In particular, there is no basis for splitting the aggregated payments on Medicare's institutional claims across the different pseudo-claims to the associated revenue center and /or procedure codes.

In our analysis, we decompose each institutional claim into its corresponding pseudo-claims and assign the entire cost of the parent claim to that episode which obtains the most grouped pseudo-claims from the original Medicare claim. [31] We refer to this as the "plurality rule." Episodes earning some grouped pseudo-claim from a parent claim but less than a plurality receive zero cost contribution from the parent claim in our approach. For example, if a claim has ten pseudo-claims, and six of these pseudo-claims are assigned to one episode, while four are linked to another, then the first episode is allocated the entire cost of the original claim—the second episode receives nothing. In the case of ties (e.g., a parent claim with ten pseudo-claims has five pseudo-claims grouped to one episode and five to another), we evenly divide the cost of the parent claim across those episodes tied with the highest assignments.[32] Since it is reasonable to believe that each pseudo-claim has a cost reflected in the aggregate payment for a Medicare claim, our plurality rule for allocating a claim's cost to episodes can be expected to inflate costs

[31] In discussions with Symmetry, they confirmed Acumen's approach as being a reasonable method for calculating episode cost and dates.

[32] If the plurality of pseudo-claims from an institutional claim is not grouped, then the claim cost is not assigned to any episode.

for some episodes and mitigate costs for others when an institutional claim is grouped to multiple episodes.

We explored several other methods for allocating costs across episodes in cases where pseudo-claims from a single institutional claim were assigned to multiple episodes. These included: (1) using shares of revenue center charges to distribute an institutional claim payment to its multiple grouped episodes; (2) distributing the claim payment proportional to the number of pseudo-claims from the institutional claim assigned to an episode; and (3) allocating all the costs to the episode to which the room and board (R&B) revenue code was assigned. In the case of IP and SNF claims, cost allocation using rule (3) based on R&B revenue codes yielded essentially the same allotments as our plurality rule in those instances when these claims had R&B codes.[33] However, this R&B rule cannot be implemented for some IP and SNF claims because not all have room and board codes.[34] Moreover, the absence of R&B revenue codes on OP, HH and HS claims means that rule (3) cannot be used to allocate the cost of these types of institutional claims. As expected, the implementation of cost allocation rules (1) and (2) spreads expenses of a parent claim more evenly across associated episodes, but none of the main findings presented below were materially affected.

[33] There is a 99.7% match rate between the R&B rule and our plurality rule for IP claims with R&B codes, and a 97.1% match rate for SNF claims with R&B codes. While nearly all SNF claims have a R&B code, almost 10% of IP claims do not.

[34] A further variant of rule (3) for resolving the cost allocation issue is to input each IP and SNF institutional claim as a single record, with an R&B code listed as the lone service record. This approach was used by MedPAC in several of their evaluations of groupers (MedPAC Report to Congress, June 2006); this approach was implemented because MedPAC used MedPAR as the data source of IP and SNF stays which does not report revenue codes. In addition to not all the original IP and SNF claims not having R&B codes, many other have multiple R&B codes which leaves open the question of which one to include on the single input record representing the claim; in our Colorado data, we find up to 24 R&B codes on a single IP claim, and up to 3 R&B codes on a single SNF claim.

5 ASSESSMENT OF RESULTS FOR SYMMETRY GROUPER USING MEDICARE DATA

This section documents the construction of episodes from Medicare claims using the Symmetry grouper. The first section presents the grouping results for the Baseline specification, with a particular focus on 2003 Touching Episodes. Essentially, these results are the grouped episodes achieved using the Symmetry grouper to characterize episodes in 2003. For resource utilization, a more appropriate focus may be completed episodes, which are presented in Section 5.2. We examine the sensitivity of the Baseline findings to changes in Symmetry's input and configuration files in Section 5.3. In evaluating these sensitivities, we assess the impact of altering the sets of diagnoses and procedures incorporated in input records and of varying the parameters of Symmetry's configuration file. Section 5.4 covers a number of practical issues that arise when applying the Symmetry grouper to Medicare data. We conclude the chapter with an overview of our findings and the shortcomings of applying the Symmetry grouper to Medicare data. Because of the technical nature of the findings presented in this section, readers may wish to move directly to this summary in Section 5.5.

5.1 Reference Results from Symmetry Baseline Run

Our Medicare claims for a 20% sample of Colorado beneficiaries include 5,049,696 Medicare claims between 2002 and 2004, with a total claims value of $585,447,839. As Table 5.1 reveals, the 5 million claims grouped into 672,600 episodes in the Baseline run of the Symmetry grouper, with 50.5% of these episodes classified as chronic episodes and 49.6% of these episodes classified as acute episodes given the three years of the data.[35] The chronic episodes are relatively more expensive than the acute episodes, accounting for 65.0% of the total claims costs during the period. More than 1 in 7 claims did not group, but the ungrouped claims are typically low cost, with the 14.6% of claims left ungrouped accounting for only 5.3% of the total claims costs.

[35] Percentages occasionally do not sum to 100% due to rounding.

Table 5.1: Summary Statistics for Claims, Episodes and Costs

All Claims, Symmetry Baseline Run

			Fraction of All Episodes			Fraction of all 2002-2004 Claims Costs		
Total # Claims	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	Total Cost in 2002-2004	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in Ungrouped Claims
5,049,696	14.6%	672,600	50.5%	49.6%	$585,447,839	65.0%	29.6%	5.3%

The focal year for our analysis is 2003. In Table 5.2, we provide summary statistics for episodes that meet our criteria for 2003 Touching Episodes. The 231,226 episodes that touch 2003 for the Symmetry grouper are split into 50.4% chronic episodes and 49.6% acute episodes. Of the 2003 Touching episodes, 46.5% are 2003 Complete acute. Because the sample in Table 5.2 includes only grouped episodes, the division of costs is somewhat different than for all claims, but the split of costs between chronic and acute episodes is more proportionate.

Table 5.2: Summary Statistics for Episodes and Costs

2003 Touching Episodes, Symmetry Baseline Run

	Fraction of All 2003 Touching Episodes				Fraction of All 2003 Touching Episode Costs		
Total # 2003 Touching Episodes	% Chronic Episodes	% Acute Episodes	% 2003 Complete Acute Episodes	Total Cost of 2003 Touching Episodes	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in 2003 Complete Acute Episodes
231,226	50.4%	49.6%	46.5%	$201,963,072	65.0%	35.0%	26.5%

Table 5.3 presents summary statistics on the costs and lengths of 2003 chronic episodes, along with corresponding information on acute episodes making up both Touching and Complete samples. As grouped by Symmetry, the average chronic episode in 2003 cost Medicare $1,127, while the average complete acute episode cost $498. Whereas the average length of chronic episodes equaled 116 days with 2% of these episodes lasting longer than 352 days, the average length of complete acute episodes was 22 days with 2% of these episodes going beyond 184 days. 2003 Complete Episodes are a strict subset of 2003 Touching Episodes, with the 2003 Complete group missing those episodes that started in 2002 or 2003 and lasted into 2004, and

episodes that started within a clean period of January 1, 2002. Because excluded episodes started earlier in 2002 or are long enough to extend into 2004, they tend to be longer on average than those kept in the Complete group. Consequently, it is not unexpected to see that the average length of episodes in the acute 2003 Touching group exceeding those in the 2003 Complete sample by 10 days, nor is it unexpected to see that the average episode cost in the Touching sample surpassed the average of the Complete sample by about 24%.[36]

Table 5.3: Episode Cost and Length Percentiles
2003 Touching Episodes, Symmetry Baseline Run

Type of Episode	Cost and Length per Episode	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Chronic	Cost per Episode ($)	$22	$60	$141	$488	$2,061	$4,824	$12,823	$1,127	$4,165
	Length per Episode (days)	1	1	63	223	310	337	352	116	124
Acute	Cost per Episode ($)	$9	$40	$75	$227	$793	$2,478	$6,484	$616	$2,798
	Length per Episode (days)	1	1	1	29	91	168	326	32	69
2003 Complete Acute	Cost per Episode ($)	$5	$38	$71	$187	$641	$1,753	$5,239	$498	$2,299
	Length per Episode (days)	1	1	1	21	63	107	184	22	48

Table 5.4 reports episodes and costs per beneficiary for those who had at least one 2003 Touching episode (94.7% of Colorado sample). During the analysis year, the average beneficiary experiences 6 episodes. A notable range in the number of episodes experienced per beneficiary exists in this period, with a median of 5 episodes and up to 13 episodes at the 95th percentile. Across all 2003 Touching episodes in the period, the mean Medicare cost per beneficiary is $5,223. Costs can go much higher, however, with the 98th percentile at $41,049. This large amount of cost variation suggests that devising a reliable method of risk adjustment for episodes

[36] 6% of acute 2003 Touching Episodes do not qualify for being in the 2003 Complete group. Most of these episodes began in 2003 but lasted too long to end in 2003. This 6% had a mean length of 180 days, and an average cost of $2368.

and beneficiary costs necessary for profiling providers in Medicare settings requires approaches not yet available in the existing ETG software.[37]

Table 5.4: Episodes and Total Costs per Person

All Beneficiaries with at Least One 2003 Touching Episode, Symmetry Baseline Run

# of Episodes and Cost per Person	Summary Statistics								
	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
# of Episodes per Person:	2	3	5	8	11	13	16	6	4
Chronic	1	1	3	4	6	7	8	3	2
Acute	0	1	2	4	6	8	10	3	3
2003 Complete Acute	0	1	2	4	6	7	9	3	2
Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,492

Symmetry episodes are classified by major practice categories, and in further detail by individual focal diseases. Table 5.5 presents findings for the groupings of episodes by Symmetry major practice categories. In the Baseline run, episodes classified as Orthopedics & Rheumatology account for the highest number of all episodes at 15.5%; episodes classified as Cardiology also account for 15.5% of all episodes, and account for the largest fraction of chronic episodes at 13.4%. Dermatology comprises the greatest percentage of complete acute episodes at 9.2%. Ophthalmology also accounts for a significant percentage of total episodes both chronic and complete acute.

Tables 5.6 and 5.7 present findings describing the distributional properties of episode costs broken down by focal disease classifications. For episode types with multiple severity levels, these tables show summary statistics by severity level along with the overall statistics for the base ETG which combine all severity levels into a single episode category. Inspection of these tables reveals substantial wide variation in average costs across the severity levels within a base ETG, and substantially wider variation in episode costs within severity levels. For example,

[37] Symmetry recommends that users implement outlier logic prior to physician profiling. More specifically, in correspondence, Symmetry suggested that many users would exclude episodes falling into the bottom 5% percent of costs and cap the cost of the top 5% of episodes at the level corresponding to the 95% percentile. In a Medicare setting, such an approach can lead to dropping a significant share of Medicare payments. For example, if one were to apply this outlier logic in the case of the top five episode types presented in Table 5,12 below, this would result in eliminating up to 33% of total cost assessed for a particular episode type. When applied to all ETGs, implementation of this outlier approach drops nearly 20% of total grouped Medicare costs.

depending on severity level, diabetes episodes at the 90th percentile cost between 3 to 8 times as much as the median diabetes episode. Furthermore, acute episodes among the focal diseases (closed and open hip and thigh fractures) commonly cross year boundaries, with nearly half of all SL1 open hip fracture/dislocations (ETG 712903L1) episodes either straddling 2002-2003 or 2003-2004 boundaries. But by construction, chronic episodes rarely cross year boundaries, and those that do may be a result of our measure of episode dates.

Table 5.5: Major Practice Category Classifications

2003 Touching Episodes, Symmetry Baseline Run

Major Practice Category	% Chronic Episodes	%2003 Complete Acute Episodes	% Incomplete Acute Episodes	% All Episodes
Cardiology	13.4	1.9	0.3	15.5
Orthopedics & Rheumatology	7.7	6.8	1.0	15.5
Ophthalmology	8.4	3.9	0.1	12.5
Dermatology	2.0	9.2	0.2	11.4
Endocrinology	7.8	0.7	0.1	8.7
Gastroenterology	0.5	5.7	0.5	6.6
Otolaryngology	1.1	4.3	0.2	5.7
Urology	2.2	2.6	0.1	4.9
Pulmonology	2.1	2.4	0.3	4.8
Neurology	2.3	1.4	0.1	3.7
Preventive & Administrative	0.0	2.4	0.0	2.5
Gynecology	0.5	1.5	0.1	2.1
Psychiatry	1.3	0.2	0.0	1.5
Hematology	0.3	0.8	0.2	1.3
Isolated Signs & Symptoms	.	1.3	0.0	1.3
Infectious Diseases	0.0	0.6	0.0	0.6
Nephrology	0.3	0.2	0.0	0.5
Hepatology	0.1	0.3	0.0	0.5
Late effects, Environmental Trauma and Poisonings	.	0.3	0.0	0.3
Chemical Dependency	0.2	0.0	.	0.2
Neonatology	0.0	0.0	0.0	0.0
Obstetrics	.	0.0	0.0	0.0
TOTAL	50.4	46.5	3.2	100.0

Table 5.6: Cost Statistics for Individual Focal Disease ETGs

2003 Touching Episodes, Symmetry Baseline Run

ETG: Description	Rank		Cost per Episode							Total Cost of 2003 Claims
	Rank in Total Cost	Rank in Std Dev of Cost	10%	50%	90%	98%	Avg Cost	Std Dev of Cost	Total Episode Cost	
163000L1: Diabetes, SL1	19	333	$47	$252	$824	$2,900	$488	$1,389	$2,075,336	$1,969,809
163000L2: Diabetes, SL2	46	272	$63	$389	$1,576	$5,240	$875	$2,109	$1,091,179	$1,045,281
163000L3: Diabetes, SL3	168	233	$86	$487	$1,973	$13,677	$1,261	$2,784	$288,674	$312,951
163000L4: Diabetes, SL4	77	118	$121	$701	$5,808	$17,551	$2,530	$6,031	$637,497	$573,559
163000: Diabetes, base	--	--	$53	$291	$1,044	$4,904	$685	$2,077	$4,092,686	$3,901,599
316000L1: Cerebral vascular accident, SL1	54	167	$34	$319	$6,106	$15,303	$1,852	$4,169	$963,139	$941,887
316000L2: Cerebral vascular accident, SL2	3	81	$40	$525	$9,200	$29,891	$3,442	$7,781	$5,203,582	$4,671,760
316000L3: Cerebral vascular accident, SL3	27	25	$67	$1,641	$20,028	$46,593	$7,491	$15,264	$1,722,885	$1,628,245
316000: Cerebral vascular accident, base	--	--	$40	$493	$9,200	$29,009	$3,488	$8,385	$7,889,607	$7,241,892
386800L1: Congestive heart failure, SL1	32	180	$17	$201	$3,063	$13,350	$1,365	$3,820	$1,545,140	$1,245,885
386800L2: Congestive heart failure, SL2	11	139	$34	$414	$5,014	$18,997	$2,210	$5,268	$2,596,885	$2,062,227
386800L3: Congestive heart failure, SL3	20	128	$44	$707	$7,823	$22,537	$2,975	$5,687	$1,936,481	$1,787,204
386800L4: Congestive heart failure, SL4	57	75	$62	$1,463	$14,925	$35,739	$5,387	$8,266	$910,377	$794,510
386800: Congestive heart failure, base	--	--	$28	$370	$5,691	$19,581	$2,235	$5,199	$6,988,883	$5,889,825

Table 5.6: Cost Statistics for Individual Focal Disease ETGs (continued)

2003 Touching Episodes, Symmetry Baseline Run

ETG: Description		Rank		Cost per Episode							Total Cost of 2003 Claims
		Rank in Total Cost	Rank in Std Dev of Cost	10%	50%	90%	98%	Avg Cost	Std Dev of Cost	Total Episode Cost	
439300L1:	**Chronic obstructive pulmonary disease, SL1**	45	302	$17	$278	$3,023	$6,105	$1,179	$1,678	$1,094,243	$1,087,982
439300L2:	**Chronic obstructive pulmonary disease, SL2**	39	250	$32	$635	$4,076	$8,924	$1,589	$2,420	$1,262,964	$1,255,375
439300L3:	**Chronic obstructive pulmonary disease, SL3**	47	204	$49	$812	$4,720	$10,212	$2,023	$3,261	$1,061,855	$963,444
439300L4:	**Chronic obstructive pulmonary disease, SL4**	10	41	$63	$1,701	$10,918	$27,090	$4,862	$11,590	$2,688,610	$2,470,433
439300:	**Chronic obstructive pulmonary disease, overall**	--	--	$31	$658	$5,078	$13,731	$2,181	$5,738	$6,107,672	$5,777,234
588200L1:	**Malignant neoplasm of prostate, SL1**	17	170	$32	$210	$5,799	$16,870	$2,102	$4,046	$2,097,415	$2,081,910
588200L2:	**Malignant neoplasm of prostate, SL2**	44	142	$69	$418	$8,395	$19,121	$2,879	$5,109	$1,111,365	$1,089,702
588200L3:	**Malignant neoplasm of prostate, SL3**	145	127	$74	$886	$7,416	$31,155	$3,366	$5,688	$333,270	$323,727
588200:	**Malignant neoplasm of prostate, overall**	--	--	$41	$284	$6,808	$17,868	$2,388	$4,485	$3,542,050	$3,495,339
712903L1:	**Open fracture or dislocation - thigh, hip & pelvis, SL1 (no other SLs)**	50	20	$127	$20,844	$40,909	$66,413	$21,463	$16,731	$1,008,779	$736,622
713103L1:	**Closed fracture or dislocation - thigh, hip & pelvis, SL1**	51	59	$63	$4,754	$23,498	$31,303	$8,267	$9,246	$992,045	$751,674
713103L2:	**Closed fracture or dislocation - thigh, hip & pelvis, SL2**	6	40	$66	$11,826	$27,479	$42,912	$12,804	$11,883	$3,969,283	$2,700,894
713103L3:	**Closed fracture or dislocation - thigh, hip & pelvis, SL3**	12	37	$568	$16,159	$32,947	$54,549	$17,052	$13,090	$2,523,633	$1,709,958
713103:	**Closed fracture or dislocation - thigh, hip & pelvis, overall**	--	--	$78	$11,512	$28,874	$43,630	$12,950	$12,074	$7,484,962	$5,162,527

Table 5.7: Number, Length, and Timing of Episodes by Focal Disease ETG

2003 Touching Episodes, Symmetry Baseline Run

ETG: Description		Number, Length, and Timing of 2003 Touching Episodes										
		Rank			Percentiles					% Start and End in Different Years		
		Rank in # of Claims	Rank in # of Episodes	# of Episodes	20%	50%	80%	Avg (days)	Std Dev (days)	Start 2002 End 2003	Start 2003 End 2004	Start 2002 End 2004
163000L1:	Diabetes, SL1	1	6	4,251	77	253	324	216	125	3.2%	8.9%	0.1%
163000L2:	Diabetes, SL2	15	37	1,247	149	282	343	248	115	4.3%	11.5%	0.0%
163000L3:	Diabetes, SL3	110	199	229	188	299	343	265	111	4.4%	9.2%	0.0%
163000L4:	Diabetes, SL4	80	188	252	185	300	345	274	117	4.4%	9.9%	0.8%
163000:	Diabetes, overall	--	--	5,979	96	268	331	227	124	3.5%	9.5%	0.1%
316000L1:	Cerebral vascular accident, SL1	87	100	520	1	39	218	99	118	0.8%	0.8%	0.2%
316000L2:	Cerebral vascular accident, SL2	17	33	1,512	3	70	252	121	124	1.9%	4.0%	0.1%
316000L3:	Cerebral vascular accident, SL3	102	198	230	15	109	284	137	123	2.6%	5.2%	0.0%
316000:	Cerebral vascular accident, overall	--	--	2,262	3	64	246	118	123	1.7%	3.4%	0.1%
386800L1:	Congestive heart failure, SL1	30	49	1,132	1	97	300	140	134	1.0%	1.8%	0.1%
386800L2:	Congestive heart failure, SL2	19	46	1,175	10	163	329	169	137	1.6%	2.2%	0.1%
386800L3:	Congestive heart failure, SL3	29	87	651	25	191	326	180	135	0.9%	2.8%	0.2%
386800L4:	Congestive heart failure, SL4	92	240	169	48	218	335	210	142	4.1%	1.2%	0.6%
386800:	Congestive heart failure, overall	--	--	3,127	7	150	319	163	137	1.4%	2.1%	0.1%

Table 5.7: Number, Length, and Timing of Episodes by Focal Disease ETG (continued)

2003 Touching Episodes, Symmetry Baseline Run

ETG: Description	Number, Length, and Timing of 2003 Touching Episodes										
	Rank			Percentiles					% Start and End in Different Years		
	Rank in # of Claims	Rank in # of Episodes	# of Episodes	20%	50%	80%	Avg (days)	Std Dev (days)	Start 2002 End 2003	Start 2003 End 2004	Start 2002 End 2004
439300L1: Chronic obstructive pulmonary disease, SL1	23	62	928	1	153	335	164	144	0.0%	0.2%	0.0%
439300L2: Chronic obstructive pulmonary disease, SL2	24	72	795	15	212	335	188	137	0.3%	0.8%	0.0%
439300L3: Chronic obstructive pulmonary disease, SL3	31	98	525	26	245	336	203	135	0.0%	1.7%	0.0%
439300L4: Chronic obstructive pulmonary disease, SL4	22	96	553	60	263	338	220	133	1.4%	2.4%	0.2%
439300: Chronic obstructive pulmonary disease, overall	--	--	2,801	10	214	335	189	139	0.4%	1.1%	0.0%
588200L1: Malignant neoplasm of prostate, SL1	27	59	998	8	192	285	171	119	0.0%	0.1%	0.0%
588200L2: Malignant neoplasm of prostate, SL2	61	141	386	44	215	295	192	114	0.3%	0.3%	0.0%
588200L3: Malignant neoplasm of prostate, SL3	158	307	99	162	254	328	235	103	2.0%	0.0%	0.0%
588200: Malignant neoplasm of prostate, overall	--	--	1,483	19	201	292	180	118	0.2%	0.1%	0.0%
712903L1: Open fracture or dislocation - thigh, hip & pelvis, SL1 (no other SLs)	197	404	47	69	109	256	154	114	19.1%	38.3%	0.0%
713103L1: Closed fracture or dislocation - thigh, hip & pelvis, SL1	192	283	120	13	72	116	83	80	16.7%	15.8%	0.0%
713103L2: Closed fracture or dislocation - thigh, hip & pelvis, SL2	55	161	310	27	80	143	93	83	18.7%	19.4%	0.3%
713103L3: Closed fracture or dislocation - thigh, hip & pelvis, SL3	89	256	148	59	109	235	138	97	24.3%	33.1%	0.7%
713103: Closed fracture or dislocation - thigh, hip & pelvis, overall	--	--	578	35	85	152	103	89	19.7%	22.1%	0.3%

Finally, Table 5.8 reports the extent to which Symmetry groups Medicare claims, distinguishing by claim type. IP and SNF claims are almost always grouped (with 0.4% of IP claims and 2.2% of SNF claims ungrouped). In contrast, HS and DME claims are commonly ungrouped (23.1% and 25.4% ungrouped respectively). Between 8% and 14% of HH, PB, and OP claims are ungrouped.

Table 5.8: Ungrouped Claims by Claim Type

All Claims, Symmetry Baseline Run

Claim Type	# of Claims Ungrouped	% of Claims Ungrouped
IP	122	0.4%
OP	68,665	14.2%
SNF	205	2.2%
HH	982	8.3%
HS	711	23.1%
PB	561,489	13.7%
DME	103,979	25.4%

Ungrouped claims occur due to two reasons. First, only claims that are designated as anchor claims can start episodes, so if a non-anchor claim cannot be grouped to an already present episode, it will be assigned as ungrouped. Many times, ungrouped claims of this type represent diagnostic procedures that do not indicate the presence of a disease, and thus should not belong to an episode. Second, claims may have a series of nonsensical or invalid diagnoses or procedure codes, which may also lead to the claim being ungrouped.

5.2 Specification of Complete Episodes

Because this report focuses primarily on studying how the software groups Medicare claims into episodes, most of our samples consist of either all claims with dates in a particular period (e.g., all claims in the 2002-04 period), or all claims grouped into the 2003 Touching Episodes. In analyses of physician attribution, most studies include only episodes identified to be complete by the grouping software, for these categories of episodes represent fulfilled medical treatment for the illness designated by the ETG classification. Most episodes in the 2003 Touching sample are complete as designated by the ETG grouper. In addition to being in the 2003 Touching sample and being marked as complete by the grouping software, our sample of 2003 Complete Episodes also requires two additional conditions: (1) included acute episodes

must have started longer than a clean period after January 1, 2002 and must have ended in 2003; and (2) chronic episodes must have ended in 2003. Consequently, our sample of 2003 Complete Episodes eliminates episodes that do not have a well defined start and episodes that start in 2002 or 2003 and do not end until 2004; most of these eliminated episodes become members of the 2004 Complete sample. As discussed further below, the group of 2003 Complete Episodes provides a sample that is representative of the cost of finalized medical treatments for the year 2003.

Table 5.9 demonstrates the role of the clean periods in defining the share of 2003 Touching Episodes that we include in 2003 Complete Episodes. The top half of Table 5.9 presents summary statistics on the top 10 acute ETGs by cost. The first column lists the rank by cost considering all episode types, and the second column shows the number of episodes for each ETG in the 2003 Touching sample. The next column presents the fraction of 2003 Touching episodes that start within a clean period of January 1st, 2002—the length of the relevant clean period varies by ETG—and shows that only a small share of 2003 Touching episodes are dropped by this requirement for defining our formulation of Complete episodes. Nine of the top 10 ETGs by cost have 3% or fewer of their episodes with a start date within a clean period of January 1st, 2002. The exception is pulmonary embolism episodes, of which nearly 13% do not meet either Symmetry's or our definition of complete. The fourth column presents statistics on the fraction of episodes that are separated from other episodes of the same type by less than a clean period for the respective ETG, and the fifth column gives the number of episodes of the same ETG that overlap in time. Using the service dates of claims included in an episode to determine its start and finish, we do find episodes starting within a clean period of another episode of the same ETG.[38] Depending on the type of acute ETG considered in the table, between 0.6% and 35.4% of the same-type episodes occur within clean periods. In some rare instances, these episodes can even overlap, meaning that the start date we identify for an episode occurs before an end date for an episode of the same ETG.

The lower half of Table 5.9 presents equivalent statistics for chronic episodes. It is clear from the statistics in the fourth column that the concept of clean periods is not applicable for

[38] The start and end dates of an ETG episode assigned by the Symmetry grouper can be defined by anchor claims that are not assigned to the episode. So the starts and ends as measured by Symmetry need not violate the clean period when our dating measure documents a violation.

Table 5.9: Clean Period Statistics by ETG

2003 Touching Episodes, Symmetry

ETG: Description	Rank in Total Cost: All ETGs	# of Episodes	% Within a Clean Period of January 1, 2002	% Within a Clean Period of Another Episode of Same ETG	# of Overlapping Episodes
Top Ten Acute ETGs by Costs					
713103L2: Closed fracture or dislocation - thigh, hip & pelvis, SL2	6	310	1.0%	15.5%	7
713103L3: Closed fracture or dislocation - thigh, hip & pelvis, SL3	12	148	1.4%	13.5%	3
437400L4: Bacterial lung infections, SL4	14	514	0.4%	4.7%	0
316500L3: Spinal trauma, SL3	16	355	1.7%	10.4%	7
475600L1: Non-malignant neoplasm of intestines & abdomen, SL1	29	1,536	0.7%	0.6%	0
208900L1: Other hematologic diseases, SL1	31	1,724	3.1%	23.7%	31
476300L1: Bowel obstruction, SL1	35	327	0.0%	0.9%	0
441000L1: Pulmonary embolism, SL1	37	271	12.5%	35.4%	9
130400L2: Septicemia, SL2	40	239	0.0%	1.3%	0
437400L3: Bacterial lung infections, SL3	42	445	0.2%	2.2%	2
Top Ten Chronic ETGs by Costs					
386500L2: Ischemic heart disease, SL2	1	2,068	1.0%	78.7%	29
386500L1: Ischemic heart disease, SL1	2	3,595	0.3%	81.3%	16
316000L2: Cerebral vascular accident, SL2	3	1,512	0.2%	46.0%	102
386500L3: Ischemic heart disease, SL3	4	461	2.6%	35.1%	16
351700L1: Cataract, SL1	5	11,954	0.0%	44.4%	5
712208L2: Joint degeneration, localized - back, SL2	7	1,194	0.1%	38.9%	18
386500L4: Ischemic heart disease, SL4	8	187	1.1%	18.2%	3
712202L3: Joint degeneration, localized - knee & lower leg, SL3	9	687	0.0%	48.2%	12
439300L4: Chronic obstructive pulmonary disease, SL4	10	553	0.0%	57.3%	21
386800L2: Congestive heart failure, SL2	11	1,175	1.7%	72.5%	49

chronic episodes.[39] For the vast majority of afflicted individuals, one chronic episode immediately follows another. Among the top ten highest-cost chronic ETGs, chronic episodes of the same ETG run as continuous events for individuals between 18% and 81% of the time depending on the type of chronic condition. The observation of overlapping episodes, as well as episodes starting less than one year after January 1, 2002 (since the clean periods are at most 365 days in Symmetry), is likely related to our calculation of dates. Among chronic ETG episodes that have a significant share of their costs in 2003, only a tiny fraction of claims occur outside of 2003 by our dates. For example, among chronic episodes with at least 90% of their claim costs in 2003, less than 0.5% of claims have dates in 2002 or 2004.

Drawing upon theorems in the statistical literature on duration analysis, one can interpret the sample of 2003 Complete Episodes, for any individual or combination of ETGs, as being representative of the composition of finalized incidents of medical treatments for the year 2003. When faced with episodic data, an analyst can construct a representative sample by selecting either all those episodes that start within a specified period or all those that end in this period. If one instead considers all episodes that overlap a period, then it is well known that the resulting sample will disproportionately include longer and more costly episodes, for these episodes have an exaggerated likelihood of being included in the sample.[40] The group of Touching Episodes is such a sample, and for this reason it is not surprising to see its statistics overestimate costs and lengths of episodes.[41]

For each ETG, the costs of 2003 Complete Episodes closely approximate the annual cost of claims in 2003 that were grouped to the corresponding ETG. Table 5.10 supports this finding for chronic episodes, and Table 5.11 presents analogous support for acute episodes. As discussed previously, the claims linked to chronic episodes ending in 2003 are nearly equivalent to the annual claims grouped to these chronic illnesses in 2003, so it is hardly surprising in Table 5.10 to see that annual and Complete episode costs closely mirror one another.[42] Although one observes some variation by ETG, the costs in 2003 Complete Episodes totals to 99% of the

[39] Although Symmetry truncates chronic episodes on an annual basis and does not use clean periods to separate chronic diseases into episodes of care, the Symmetry documentation does provide clean period information for chronic ETGs. We used the provided clean period from Symmetry's documentation in creating this table.
[40] In the statistical duration literature, this problem is known as length-biased sampling.
[41] Footnote 36 and Tables 5.10 and 5.11 illustrate the degree to which the Touching Episodes sample overestimates per episode costs of medical treatment overall and for particular ETGs.
[42] 2003 annual claims are defined by start date on claim.

annual claims costs. The costs of Touching episodes always exceeds annual costs since it includes episodes that extend both into 2002 and 2004 as defined by our episode date calculations.

Referring to Table 5.11, we see that the costs of 2003 Complete Episodes also closely proxy the 2003 annual claims costs for acute ETGs as well. Although 2003 Complete Episodes for acute ETGs include a substantial share of claims in 2002, these costs are offset by costs for episodes that started in 2003 and did not end until 2004 or later. For the most expensive ten acute episode types, we see that the 2003 Complete Episode costs are sometimes higher and sometimes lower than 2003 annual costs for the corresponding ETG; the costs of Touching Episodes are substantially higher than either Complete or annual costs due to the inclusion of episodes that overlap both 2002 and 2004. Combining costs for all acute ETGs, we see at the bottom of the table that the cost in 2003 Complete Episodes is slightly lower than the 2003 annual costs, but still represents over 93% of 2003 expenditures.

Table 5.12 presents statistics depicting the distribution of per episode costs for the top-5-cost acute ETGs, the top-5 chronic ETGs, and for all ETGs combined reported at the bottom of the table. These statistics show the mean and standard deviation for the sample of 2003 Complete episodes, along with several percentiles of the distributions to convey the extent of variation in costs across episodes within ETG classifications. The distributions exhibit substantial dispersion in costs across episodes within each ETG. For each of the top five highest-cost acute and chronic ETGs, the level of cost demarking the most expensive 10% of episodes (i.e., the 90th percentile) always exceeds the level demarking the cheapest 10% (i.e., the 10th percentile) by more than a factor of four, and in most instances more than two orders of magnitude larger. The table further reveals that the highest-cost episodes account for large shares of total ETG costs. The top 5% of episodes in these acute ETGs account for 15.4% to 41.7% of all costs in that ETG. The distribution is even wider for the most expensive chronic ETGs, where the top 10% of episodes cost at least 100 times the cost of the cheapest 10%. For these chronic ETGs, the top 5% of episodes account for 26% to 50% of the costs of that ETG. Considering the total costs across all ETGs, the last row and column shows that 67.4% of these costs are incurred by the most expensive 5% of episodes. Overall, Table 5.12 demonstrates that considerable variation exists in the costs of individual episodes within an ETG.

Table 5.10: Comparison of 2003 Touching and 2003 Complete Samples for Chronic ETGs

Symmetry Baseline Run

ETG: Description	2003 Touching Episodes			2003 Complete Episodes			Grouped Claims in 2003
	Rank in Total Cost: Chronic ETGs	Total Episode Costs	# of 2003 Touching Episodes	Rank in Total Cost: Chronic ETGs	Total Episode Costs	# of 2003 Complete Episodes	Total Cost of 2003 Claims
386500L2: Ischemic heart disease, SL2	1	$7,318,904	2,068	1	$7,118,883	2,044	$7,141,300
386500L1: Ischemic heart disease, SL1	2	$6,250,085	3,595	2	$6,099,264	3,579	$6,129,996
316000L2: Cerebral vascular accident, SL2	3	$5,203,582	1,512	5	$4,433,199	1,450	$4,611,490
386500L3: Ischemic heart disease, SL3	4	$5,178,067	461	3	$5,102,354	451	$5,068,160
351700L1: Cataract, SL1	5	$5,082,557	11,954	4	$5,082,086	11,951	$5,072,579
712208L2: Joint degeneration, localized - back, SL2	6	$3,493,835	1,194	6	$3,404,475	1,182	$3,423,885
386500L4: Ischemic heart disease, SL4	7	$3,408,934	187	7	$3,303,181	183	$3,249,452
712202L3: Joint degeneration, localized - knee & lower leg, SL3	8	$3,273,047	687	8	$3,193,905	665	$3,197,798
439300L4: Chronic obstructive pulmonary disease, SL4	9	$2,688,610	553	9	$2,471,034	530	$2,469,505
386800L2: Congestive heart failure, SL2	10	$2,596,885	1,175	12	$2,172,176	1,148	$2,217,941
Total for All Chronic ETGs	--	$131,300,165	116,465	--	$123,259,766	115,105	$124,681,652

Table 5.11: Comparison of 2003 Touching and 2003 Complete Samples for Acute ETGs

Symmetry Baseline Run

ETG: Description	2003 Touching Episodes			2003 Complete Episodes			Grouped Claims in 2003
	Rank in Total Cost: Acute ETGs	Total Episode Costs	# of 2003 Touching Episodes	Rank in Total Cost: Acute ETGs	Total Episode Costs	# of 2003 Complete Episodes	Total Cost of 2003 Claims
713103L2: Closed fracture or dislocation - thigh, hip & pelvis, SL2	1	$3,969,283	310	1	$2,997,335	249	$2,962,354
713103L3: Closed fracture or dislocation - thigh, hip & pelvis, SL3	2	$2,523,633	148	3	$1,496,659	98	$1,871,774
437400L4: Bacterial lung infections, SL4	3	$2,460,050	514	2	$1,846,848	422	$1,880,980
316500L3: Spinal trauma, SL3	4	$2,098,297	355	5	$1,288,761	277	$1,492,102
475600L1: Non-malignant neoplasm of intestines & abdomen, SL1	5	$1,630,007	1,536	4	$1,327,168	1,420	$1,354,191
208900L1: Other hematologic diseases, SL1	6	$1,610,233	1,724	7	$1,130,868	1,430	$1,106,089
476300L1: Bowel obstruction, SL1	7	$1,363,394	327	6	$1,157,663	297	$1,227,195
441000L1: Pulmonary embolism, SL1	8	$1,351,513	271	12	$775,159	155	$763,611
130400L2: Septicemia, SL2	9	$1,261,433	239	8	$1,108,355	219	$1,090,793
437400L3: Bacterial lung infections, SL3	10	$1,162,225	445	10	$924,564	384	$1,029,749
Total for All Acute ETGs	--	$70,662,907	114,761	--	$53,496,431	107,438	$57,319,738

Table 5.12: Cost Distributions of Top 5 Acute and Chronic ETGs by Total Cost

2003 Complete Episodes, Symmetry Baseline

ETG: Description		Summary Statistics									Fraction of Cost in Top 2% of Episodes of this ETG	Fraction of Cost in Top 5% of Episodes of this ETG
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev		
	Top 5 Acute ETGs by Cost											
713103L2:	**Closed fracture or dislocation - thigh, hip & pelvis, SL2**	$64	$247	$10,190	$20,333	$27,704	$31,914	$42,912	$12,088	$12,064	8.6%	18.1%
437400L4:	**Bacterial lung infections, SL4**	$67	$306	$2,507	$5,599	$10,747	$14,871	$21,011	$4,338	$6,914	18.1%	29.4%
713103L3:	**Closed fracture or dislocation - thigh, hip & pelvis, SL3**	$273	$4,468	$16,089	$22,396	$30,411	$36,682	$49,557	$15,438	$12,053	7.0%	15.4%
475600L1:	**Non-malignant neoplasm of intestines & abdomen, SL1**	$223	$438	$589	$742	$1,040	$1,508	$5,413	$927	$2,329	33.2%	41.7%
316500L3:	**Spinal trauma, SL3**	$55	$163	$1,036	$6,774	$13,905	$18,737	$26,773	$4,533	$6,657	14.3%	27.9%
	Top 5 Chronic ETGs by Cost											
386500L2:	**Ischemic heart disease, SL2**	$60	$212	$872	$2,619	$9,883	$17,264	$30,851	$3,483	$7,388	23.5%	43.6%
386500L1:	**Ischemic heart disease, SL1**	$40	$101	$349	$1,238	$3,441	$9,917	$15,333	$1,704	$4,202	28.9%	50.4%
386500L3:	**Ischemic heart disease, SL3**	$268	$1,087	$6,354	$15,828	$28,311	$35,689	$51,477	$11,313	$16,080	14.7%	25.5%
351700L1:	**Cataract, SL1**	$0	$49	$72	$152	$1,599	$2,829	$3,051	$425	$834	16.2%	37.0%
316000L2:	**Cerebral vascular accident, SL2**	$40	$128	$487	$2,752	$7,977	$14,786	$28,202	$3,057	$7,268	27.2%	47.1%
	All Chronic and Acute ETGs	$15	$40	$97	$316	$1,272	$3,220	$8,875	$794	$3,296	47.7%	67.4%

5.3 Sensitivity of Findings to Changes in Symmetry Input and Configuration Files

Our Baseline run, described in Section 5.1, constitutes what we determined to be the best system for running Symmetry in order to group Medicare claims into episodes of care and eventually to perform physician attribution. We chose our Baseline based on both recommendations made by Symmetry and by testing the different available options; the results of these tests are presented in this section, wherein we change Symmetry's input file and configuration parameters and examine the change in grouping outcomes. To document these effects, this section describes the outcomes of 11 additional runs representing variations from the Baseline specification. Table 5.13 gives a brief description of each of these runs, based on the modifications made in either the input or the configuration file. Runs 2-6 comprise changes to the input file, and runs 7-12 constitute changes in the configuration file.

Table 5.13: Symmetry Input File and Configuration File Runs

Run	Change to	Description
Baseline (Run 1)	--	Input and configuration files as described in section 4.1 and 4.2
Run 2	Input file	Use the admitting diagnosis code (for IP and SNF) as the first diagnosis code
Run 3	Input file	Use only the first listed diagnosis code
Run 4	Input file	Use the admitting diagnosis code (for IP and SNF) as the only diagnosis code. For other claims, use the first listed diagnosis code
Run 5	Input file	Use procedure codes only for OP claims and blank the revenue center codes
Run 6	Input file	Reorder input records
Run 7	Configuration	Set Unlimited Episode Length = YES
Run 8	Configuration	Set first diagnosis code as primary = YES
Run 9	Configuration	Set track patient comorbidity = YES
Run 10	Configuration	Set link facility records = NO
Run 11	Configuration	Set days between facility records = 7 (in this case, the link facility records option was turned on)
Run 12	Configuration	Set custom clean periods = 1 day for first 100 ETG types

Tables 5.14, 5.15, 5.17 and 5.18 combine the output of the 12 runs, summarizing the results so that they are comparable to those presented in Tables 5.1 to 5.4. (Tables by major practice category and episode type for each run are omitted from this report due to their length, but are available upon request.) Table 5.19 combines the results of the 12 runs summarizing the number of ungrouped claims by file type corresponding to the findings given in Table 5.8.

Table 5.16 presents several measures of the number and costs of claims that switched episodes in response to altering the Baseline specification implied by the Runs designated in Table 5.13. Table 5.16 provides findings considering two sets of claim reassignments: (1) claims that switched episodes with different ETGs, and (2) claims that switched episodes with different start/end dates.[43] We identify a claim as changing ETGs by comparing the ETG classification for the claim from the Baseline run to the ETG assigned to the same claim in the comparison run. When a claim experiences such a shift, there is no question that it has switched episodes. Consequently, the first two columns of Table 5.16 represent lower bounds for the reassignment of claims and costs attributable to the designated variation in the Baseline run. To provide additional information for switches that might occur across episodes but within ETG categories, the other columns in Table 5.16 assess whether a claim switched episodes by comparing the start and end dates of the episode to which the claim was assigned. If a claim's episode start or end date changes, this implies that the claim has moved to another episode, or that another claim has been assigned to the episode that alters the episode's start or end date; in either case, the claim has been grouped into an episode composed of a different set of claims. Depending on the circumstances of an episode's date change, the figures in the other columns of Table 5.16 give ranges above the lower bound values on how many claims and costs shifted episodes in response to the alteration in the Baseline run.[44]

[43] For claims that were broken into multiple pseudo-claims for Symmetry, we consider only the winning episode for each claim according to the cost rule described in Section 3.1.1. In rare cases, more than one episode is tied for having the most pseudo-claims; when this occurs, we match each episode's ETG and dates separately. A claim that changes any of its tied episodes will be counted as a claim changing episodes, but the costs for that claim are divided in proportion to the number of episodes that changed or did not change.

[44] There are three scenarios for claims shifting between episodes in relationship to start/end dates:
(1) A claim can move from the middle of one episode to the middle of another with a different start or end date (or both). In this scenario, we identify individual claims as switching episodes and the figures in Table 5.16 give the exact change in the number and cost of claims reassigned to different episodes.
(2) A claim that moves can define the dates for its original or new episode, or both, by having either the most extreme start/end date with no ties. In this scenario, we count the moving claim as changing episode dates but can also register changes in episode dates for claims that were a part of the their original episodes.

5.3.1 Varying Diagnosis Codes (Runs 2 through 4)

To improve our understanding of how the Symmetry grouper uses information on diagnoses from Medicare claims, we explore the consequences of varying the diagnoses included as input in constructed pseudo-claims. As demonstrated below, replacing the principal diagnosis code with the admitting diagnosis does not produce substantial differences in grouping results; varying the number of diagnoses codes makes a somewhat larger difference.

If we restrict the data in the input file to contain only one diagnosis code per claim as done in runs 3 and 4, about 2% fewer claims are grouped into episodes and 5% fewer episodes are created (Table 5.14). Less diagnosis information presumably limits the types of episodes that can be used for each of the claims. Changing the first diagnosis to the admitting diagnosis (Run 2) has less of an impact than varying the number of diagnosis codes (runs 3 and 4). This may be due to two reasons. First, the admitting diagnosis in many cases is similar, if not identical, to the principal diagnosis. Second, the admitting diagnosis is present in only IP and SNF claims, which represent a small minority of the claims data. The same analysis and trends hold if we restrict our sample to episodes touching the analysis year of 2003 (Table 5.15).

An analysis of average episode cost and length and number of episodes shows that using one diagnosis as opposed to four (Runs 3 and 4) results in virtually no change in episode lengths or costs (Table 5.17). For instance, the 90th percentile has a cost per chronic episode of $2,061 and episode length of 310 days in the Baseline. Runs 3 and 4, which use a single diagnosis, have a cost per chronic episode at the 90th percentile of $2,091 and $2,104 respectively; both have episode lengths of 309 days at the 90th percentile. Acute episodes and complete acute episodes also follow this pattern. Likewise, changing the first diagnosis code to the admitting diagnosis (Run 2) produces a small effect on the episode cost and length distributions.

Consequently, the quantities in Table 5.16 describing switches in the number and cost of claim across episodes with different dates can overestimate the true measure of these changes.
(3) A claim that does not define an episode start/end date can move between two episodes with the exact same start and end dates. In this scenario we do not register any episode date changes. As a consequence, the quantities in Table 5.16 describing switches in the number and cost of claim across episodes with different dates can underestimate the true measure of these changes.

Table 5.14: Summary Statistics for Variations of Input and Configuration Files

All Claims, Symmetry

Run #	% Ungrouped Claims	Total # Episodes	Fraction of All Episodes		Fraction of all 2002-2004 Claims Costs		
			% Chronic Episodes	% Acute Episodes	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in Ungrouped Claims
Baseline (Run 1)	14.6%	672,600	50.5%	49.6%	65.0%	29.6%	5.3%
Run 2	14.6%	671,503	50.4%	49.6%	65.1%	29.5%	5.4%
Run 3	16.4%	641,257	48.5%	51.5%	61.5%	31.3%	7.3%
Run 4	16.4%	640,743	48.4%	51.6%	61.3%	31.3%	7.4%
Run 5	15.0%	669,090	50.3%	49.7%	64.4%	30.0%	5.6%
Run 6	14.6%	673,465	50.4%	49.6%	65.1%	29.6%	5.3%
Run 7	14.6%	510,188	35.8%	64.2%	64.9%	29.7%	5.4%
Run 8	14.6%	676,818	50.2%	49.8%	64.9%	29.8%	5.3%
Run 9	14.6%	672,600	50.5%	49.6%	65.0%	29.6%	5.3%
Run 10	14.6%	672,603	50.5%	49.6%	65.0%	29.7%	5.3%
Run 11	14.6%	672,600	50.5%	49.6%	65.0%	29.6%	5.3%
Run 12	14.6%	672,600	50.5%	49.6%	65.0%	29.6%	5.3%

A similar result can be seen for the person level analysis (Table 5.18). Using a single diagnosis code (runs 3 and 4) results in no change in the average number of episodes per person and little change in the distribution of per capita episode costs. Just as for the episode level analysis, using the admitting diagnosis in place of the first diagnosis (Run 2) leads to little change in the outcomes.

Symmetry's grouping of episodes from different Medicare claim types shows that using a single diagnosis code per claim results in fewer claims grouped into episodes for all file types (Table 5.19). This difference is most pronounced for OP, SNF, HH, and HS claims. The smaller changes in PB and DME claims are expected because the Baseline specification already inputs PB and DME line items with a single diagnosis code.

While changes in the use of diagnosis codes do not lead to substantive changes in numbers of ungrouped episodes, costs and lengths of episodes, or the number of episodes per person, these changes from the baseline do lead to significant numbers of claims shifting across ETGs and episodes. Table 5.16 shows that using the admitting diagnosis code in place of the

first diagnosis (Run 2) leads to a small shift, 1.2%, in claims across ETGs; however, the costs associated with claims shifting across ETGs represent 6.5% of all claim costs. We also find that episode dates for 1.6% of claims change, implying that these claims shift across episodes either within an ETG or across ETGs; costs associated with these shifting claims represent 6.9 % of all costs. When combining claims that shift across ETGs or whose episode dates change, we see that 2.2% of claims shift across episodes, with 8.1% of costs associated with these claims shifting across either ETGs or episodes. Using a single diagnosis code (Run 3) leads to 13.1% of claims shifting from one ETG to another. This shift in claims produces a 23.2% shift in costs across ETGs. Additionally, 15.0% of the claims change episode dates, with 25.1% percent of costs associated with these claims shifting episode dates. Claims that either shift across ETGs or change episode dates account for 20.6% of all claims grouped, with 34.7% of all costs associated with these shifting episodes. We observe similar changes when we use the admitting diagnosis, where available, as the only diagnosis input on institutional claims. These results show that diagnosis codes play a critical role in assigning a claim to an ETG or particular episode.

Table 5.15: Summary Statistics for Variations of Input and Configuration Files

2003 Touching Episodes, Symmetry

		Fraction of All 2003 Touching Episodes			Fraction of All 2003 Touching Episode Costs		
Run #	**Total # 2003 Touching Episodes**	**% Chronic Episodes**	**% Acute Episodes**	**% 2003 Complete Acute Episodes**	**% of Costs in Chronic Episodes**	**% of Costs in Acute Episodes**	**% of Costs in 2003 Complete Acute Episodes**
Baseline (Run 1)	231,226	50.4%	49.6%	46.5%	65.0%	35.0%	26.5%
Run 2	230,900	50.3%	49.7%	46.5%	65.0%	35.0%	26.5%
Run 3	220,387	48.4%	51.7%	48.4%	62.6%	37.4%	28.2%
Run 4	220,243	48.3%	51.7%	48.4%	62.4%	37.6%	28.5%
Run 5	229,986	50.2%	49.8%	46.6%	64.5%	35.5%	26.8%
Run 6	231,518	50.3%	49.7%	46.5%	65.1%	34.9%	26.4%
Run 7	237,652	52.7%	47.3%	44.1%	81.7%	18.3%	13.3%
Run 8	232,644	50.1%	49.9%	46.8%	64.8%	35.2%	26.5%
Run 9	231,226	50.4%	49.6%	46.5%	65.0%	35.0%	26.5%
Run 10	231,228	50.4%	49.6%	46.5%	65.0%	35.0%	26.5%
Run 11	231,226	50.4%	49.6%	46.5%	65.0%	35.0%	26.5%
Run 12	231,226	50.4%	49.6%	46.5%	65.0%	35.0%	26.5%

Table 5.16: Claims Grouped to Different Episodes by Variations on Input and Configuration Files

All Claims, Symmetry

Run #	% of Claims that Change ETG	% of Total Cost in Claims that Change ETG	% of Claims that Change Episode Dates	% of Total Cost in Claims that Change Episode Dates	% of Claims that Change ETG or Episode Dates	% of Total Cost in Claims that Change ETG or Episode Dates
Run 2	1.2%	6.5%	1.6%	6.9%	2.2%	8.1%
Run 3	13.1%	23.2%	15.0%	25.1%	20.6%	34.7%
Run 4	14.0%	29.1%	15.9%	29.5%	21.8%	39.7%
Run 5	1.7%	1.9%	4.9%	6.7%	5.1%	7.0%
Run 6	0.4%	0.6%	0.7%	1.0%	0.9%	1.1%
Run 7	8.8%	8.5%	52.0%	54.6%	52.2%	55.0%
Run 8	1.1%	1.7%	3.1%	4.8%	3.2%	5.0%
Run 9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Run 10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Run 11	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Run 12	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 5.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files

2003 Touching Episodes, Symmetry

Run #	Type of Episode	Cost and Length per Episode	Summary Statistics							
			10%	25%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	Chronic	Cost per Episode ($)	$22	$60	$488	$2,061	$4,824	$12,823	$1,127	$4,165
		Length per Episode (days)	1	1	223	310	337	352	116	124
	Acute	Cost per Episode ($)	$9	$40	$227	$793	$2,478	$6,484	$616	$2,798
		Length per Episode (days)	1	1	29	91	168	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$641	$1,753	$5,239	$498	$2,299
		Length per Episode (days)	1	1	21	63	107	184	22	48
Run 2	Chronic	Cost per Episode ($)	$23	$60	$490	$2,083	$4,854	$12,756	$1,129	$4,169
		Length per Episode (days)	1	1	223	310	337	353	116	124
	Acute	Cost per Episode ($)	$9	$40	$226	$786	$2,411	$6,591	$616	$2,796
		Length per Episode (days)	1	1	30	91	169	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$635	$1,687	$5,235	$497	$2,302
		Length per Episode (days)	1	1	21	63	107	185	22	48
Run 3	Chronic	Cost per Episode ($)	$27	$63	$496	$2,091	$4,871	$13,326	$1,159	$4,295
		Length per Episode (days)	1	1	221	309	336	352	115	123
	Acute	Cost per Episode ($)	$16	$40	$244	$858	$2,643	$6,763	$649	$2,904
		Length per Episode (days)	1	1	30	90	164	320	31	67
	2003 Complete Acute	Cost per Episode ($)	$13	$40	$202	$688	$1,914	$5,446	$522	$2,316
		Length per Episode (days)	1	1	22	63	106	181	22	47
Run 4	Chronic	Cost per Episode ($)	$27	$63	$495	$2,104	$4,884	$13,272	$1,157	$4,278
		Length per Episode (days)	1	1	222	309	336	352	115	123
	Acute	Cost per Episode ($)	$16	$40	$244	$853	$2,611	$6,958	$652	$2,901
		Length per Episode (days)	1	1	30	90	164	321	31	67
	2003 Complete Acute	Cost per Episode ($)	$13	$40	$202	$684	$1,889	$5,510	$527	$2,369
		Length per Episode (days)	1	1	22	63	106	181	22	47

Table 5.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Symmetry

Run #	Type of Episode	Cost and Length per Episode	Summary Statistics							
			10%	25%	75%	90%	95%	98%	Mean	Std Dev
Run 5	Chronic	Cost per Episode ($)	$20	$58	$486	$2,068	$4,854	$12,879	$1,128	$4,172
		Length per Episode (days)	1	1	221	309	337	352	115	123
	Acute	Cost per Episode ($)	$8	$40	$234	$819	$2,555	$6,581	$625	$2,811
		Length per Episode (days)	1	1	30	92	170	328	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$193	$658	$1,817	$5,281	$505	$2,307
		Length per Episode (days)	1	1	22	64	108	186	22	48
Run 6	Chronic	Cost per Episode ($)	$23	$60	$488	$2,057	$4,824	$12,822	$1,127	$4,163
		Length per Episode (days)	1	1	223	310	337	353	116	124
	Acute	Cost per Episode ($)	$8	$40	$224	$789	$2,462	$6,468	$613	$2,794
		Length per Episode (days)	1	1	29	91	168	325	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$186	$636	$1,746	$5,213	$496	$2,297
		Length per Episode (days)	1	1	21	63	107	184	22	48
Run 7	Chronic	Cost per Episode ($)	$63	$146	$1,596	$5,950	$13,022	$24,190	$2,567	$7,523
		Length per Episode (days)	8	323	864	999	1044	1071	569	342
	Acute	Cost per Episode ($)	$8	$40	$231	$841	$2,680	$6,742	$643	$2,984
		Length per Episode (days)	1	1	29	90	164	353	36	100
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$186	$642	$1,767	$5,257	$498	$2,298
		Length per Episode (days)	1	1	20	61	101	169	20	45
Run 8	Chronic	Cost per Episode ($)	$22	$60	$483	$2,049	$4,817	$12,762	$1,124	$4,158
		Length per Episode (days)	1	1	222	310	337	352	115	123
	Acute	Cost per Episode ($)	$9	$40	$227	$789	$2,433	$6,380	$612	$2,792
		Length per Episode (days)	1	1	29	91	166	323	31	68
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$189	$640	$1,717	$5,187	$493	$2,251
		Length per Episode (days)	1	1	21	63	107	183	21	47

Table 5.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Symmetry

Run #	Type of Episode	Cost and Length per Episode	Summary Statistics							
			10%	25%	75%	90%	95%	98%	Mean	Std Dev
Run 9	Chronic	Cost per Episode ($)	$22	$60	$488	$2,061	$4,824	$12,823	$1,127	$4,165
		Length per Episode (days)	1	1	223	310	337	352	116	124
	Acute	Cost per Episode ($)	$9	$40	$227	$793	$2,478	$6,484	$616	$2,798
		Length per Episode (days)	1	1	29	91	168	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$641	$1,753	$5,239	$498	$2,299
		Length per Episode (days)	1	1	21	63	107	184	22	48
Run 10	Chronic	Cost per Episode ($)	$22	$60	$488	$2,061	$4,824	$12,823	$1,127	$4,164
		Length per Episode (days)	1	1	223	310	337	352	116	124
	Acute	Cost per Episode ($)	$9	$40	$227	$793	$2,480	$6,488	$616	$2,800
		Length per Episode (days)	1	1	29	91	168	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$641	$1,753	$5,240	$498	$2,300
		Length per Episode (days)	1	1	21	63	107	184	22	48
Run 11	Chronic	Cost per Episode ($)	$22	$60	$488	$2,061	$4,824	$12,824	$1,128	$4,166
		Length per Episode (days)	1	1	223	310	337	352	116	124
	Acute	Cost per Episode ($)	$9	$40	$227	$793	$2,478	$6,478	$616	$2,797
		Length per Episode (days)	1	1	29	91	168	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$641	$1,753	$5,239	$498	$2,299
		Length per Episode (days)	1	1	21	63	107	184	22	48
Run 12	Chronic	Cost per Episode ($)	$22	$60	$488	$2,061	$4,824	$12,823	$1,127	$4,165
		Length per Episode (days)	1	1	223	310	337	352	116	124
	Acute	Cost per Episode ($)	$9	$40	$227	$793	$2,478	$6,484	$616	$2,798
		Length per Episode (days)	1	1	29	91	168	326	32	69
	2003 Complete Acute	Cost per Episode ($)	$5	$38	$187	$641	$1,753	$5,239	$498	$2,299
		Length per Episode (days)	1	1	21	63	107	184	22	48

Table 5.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files

2003 Touching Episodes, Symmetry

Run #	# of Episodes and Cost per Person	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,492
Run 2	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,359	$14,298	$25,214	$41,104	$5,219	$11,501
Run 3	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	4	5	6	7	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$101	$369	$1,300	$4,298	$14,022	$24,642	$40,594	$5,106	$11,160
Run 4	# of Episodes per Person:	2	3	5	8	11	12	15	6	4
	Chronic	1	1	2	4	5	6	7	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$101	$369	$1,300	$4,290	$13,995	$24,659	$40,491	$5,105	$11,174

Table 5.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Symmetry

Run #	# of Episodes and Cost per Person	Summary Statistics 10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 5	**# of Episodes per Person:**	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$104	$377	$1,325	$4,363	$14,309	$25,246	$41,161	$5,226	$11,506
Run 6	**# of Episodes per Person:**	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,365	$14,307	$25,161	$41,077	$5,220	$11,483
Run 7	**# of Episodes per Person:**	2	3	5	8	11	13	16	6	4
	Chronic	1	2	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$258	$938	$3,261	$11,277	$28,255	$43,165	$65,982	$10,119	$18,185
Run 8	**# of Episodes per Person:**	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,328	$4,368	$14,300	$25,161	$41,284	$5,224	$11,490

Table 5.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Symmetry

Run #	# of Episodes and Cost per Person	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 9	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,492
Run 10	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,494
Run 11	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,492
Run 12	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	3	4	6	7	8	3	2
	Acute	0	1	2	4	6	8	10	3	3
	2003 Complete Acute	0	1	2	4	6	7	9	3	2
	Total Cost per Person	$106	$379	$1,327	$4,368	$14,309	$25,185	$41,049	$5,223	$11,492

Table 5.19: Ungrouped Claims by Claim Type for Variations on Input and Configuration Files

All Claims, Symmetry

	Baseline (Run1)		Run 2		Run 3		Run 4	
Claim Type	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped
IP	122	0%	120	0%	128	0%	130	0%
OP	68,665	14%	68,790	14%	93,804	19%	93,883	19%
SNF	205	2%	197	2%	1,064	11%	1,272	14%
HH	982	8%	984	8%	2,309	19%	2,333	20%
HS	711	23%	711	23%	906	29%	915	30%
PB	561,489	14%	563,289	14%	609,668	15%	610,642	15%
DME	103,979	25%	104,352	25%	120,312	29%	120,636	29%
	Run 5		**Run 6**		**Run 7**		**Run 8**	
Claim Type	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped
IP	122	0%	122	0%	122	0%	122	0%
OP	82,546	17%	68,678	14%	68,732	14%	68,681	14%
SNF	205	2%	205	2%	205	2%	205	2%
HH	985	8%	982	8%	982	8%	981	8%
HS	711	23%	711	23%	714	23%	711	23%
PB	566,249	14%	561,470	14%	561,936	14%	561,494	14%
DME	105,691	26%	103,976	25%	105,289	26%	104,077	25%
	Run 9		**Run 10**		**Run 11**		**Run 12**	
Claim Type	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped	# Ungrouped	% Ungrouped
IP	122	0%	120	0%	122	0%	122	0%
OP	68,665	14%	68,665	14%	68,664	14%	68,665	14%
SNF	205	2%	205	2%	205	2%	205	2%
HH	982	8%	982	8%	982	8%	982	8%
HS	711	23%	711	23%	711	23%	711	23%
PB	561,489	14%	561,489	14%	561,488	14%	561,489	14%
DME	103,979	25%	103,979	25%	103,979	25%	103,979	25%

5.3.2 Varying Procedure Codes (Run 5)

We now turn to the question of how the Symmetry grouper uses information on procedure codes and revenue center codes from Medicare claims.

The Symmetry grouper allows the user to include both revenue center and HCPCS/CPT procedure codes on input records. IP, SNF and HS claims generally have only revenue center codes for their individual service items. In contrast, OP and HH claims almost universally have both revenue center and HCPCS/CPT procedure codes, allowing the user to decide whether to use either one or both. Our baseline run of the grouper uses revenue center codes and, when available, associated HCPCS/CPT in creating the pseudo-claim input records from institutional claims.

Run 5 explores the impact of using procedure codes alone when creating the pseudo-claims for OP claims. Instead of using revenue center codes along with their corresponding procedure codes to construct pseudo-claims from OP, we use HCPCS/CPT codes alone to define an input record in this run.[45] Omitting revenue center codes from OP input records leads to a 0.4% increase in the fraction of ungrouped claims and a 0.3% increase in the share of cost in ungrouped claims (Table 5.14). The additional ungrouped claims are almost entirely OP claims (Table 5.19); an additional 3% of OP claims fail to group under this modification. This increase in the number of ungrouped OP claims is likely related to the fact that 3% of OP claims have only revenue center codes, and hence are input with no procedure codes under this modification. Run 5 produces only marginal effects on the other statistics: the total number of episodes barely changes, declining by just 0.5%, and the distributions of the costs and lengths of episodes barely changes as a result of this modification. However, 5.1% of claims shift across episodes (Table 5.16), either within the same episode type or across ETGs. These shifting claims represent 7.0% of all costs. These results are consistent with Symmetry's overall episode grouping philosophy, which relies on procedure codes as well as diagnosis codes to attach claims to episodes.

An additional run (results not presented in the tables) assessed the impact of blanking all procedure codes and revenue center codes from the data. In this case, all claims remain

[45] More specifically, we create a single pseudo-claim for every HCPCS/CPT code listed on the claim, leaving blank the revenue center code. In those instances when a revenue code on an OP claim has no corresponding procedure code, we input a single pseudo-claim with blank revenue center code and procedure code variables.

ungrouped. This happens because revenue center codes or procedure codes are necessary for Symmetry to assign anchor records.[46] If revenue center and procedure codes are absent, then Symmetry will assign the claim as an ancillary service. Thus blanking all procedure and revenue center codes precludes claims from being anchors, which leads to all claims being ungrouped.

5.3.3 Reordering Input Records (Run 6)

In conducting our empirical analyses, we incidentally discovered that a reorganization of input files induced an unexpected change in findings. Symmetry's software requires input records be sorted by person, start date and end date, which creates start-end date categories for each person. All of our runs use input files that obey this structure, with the Baseline run relying on a pre-sorted input file extracted directly from the Medicare SAFs with input records constructed as they appear on the claim. However, in some cases there are multiple records for the same person that have identical start and end dates, and Symmetry's documentation does not state as to how such claims should be ordered.

In Run 6, our input file continues to obey this structure, but we randomly reorder input records within the required person - start date - end date categories and reapplied Symmetry's grouping algorithm. The row corresponding to Run 6 in Table 5.14 shows an almost imperceptible change occurs in the main results compared to the Baseline run, with the number of episodes increasing by merely 865. The changes are also miniscule for the statistics presented in Tables 5.15, 5.17, and 5.18.

The more important, though, is finding that records and claims are reallocated to different episodes in Run 6 compared to the Baseline run (Table 5.16). The reordering of the input records produces a change in the assignment of 0.4% of the claims to different ETGs. Assignment to a new ETG implies association with a different health-care treatment. Furthermore, 0.9% of claims are assigned to different episodes, differing either in terms of ETG or in episode start or end dates. This reassignment implies that as approximately 1% of total costs are reallocated to different episodes of care (and potentially to different providers). We initially presumed that the same input data and configuration parameters would produce exactly the same grouping results, and this is not true. While the changes appear to be minor, costs are

[46] Anchor records are claims that are allowed to start an episode. For a brief discussion of anchor records, go to section 4.3.

reallocated simply based on the order in which the user inputs the data, moving nearly $6.5 million worth of claims to different episodes for our sample of 20% of Colorado beneficiaries; this would be over $32 million for 100% of Colorado.

5.3.4 Varying Symmetry Configuration File (Runs 7 through 12)

Altering parameter values in the configuration file, for the most part, induces only minimal changes on the statistics presented here to describe episode creation. Tracking patient co-morbidity (Run 9) or setting the custom clean periods to 1 for the first 100 ETG types (Run 12) produces no change on the number of episodes created (Table 5.15 and Table 5.17), and no shifts in claims across episodes or ETGs (Table 5.16). [47]

Changing the options for the "link facility records" parameter (either by deactivating linking in Run 10 or letting the days between facility records be the max in Run 11) makes little difference in the summary statistics describing either the numbers or distributional properties of episodes, and almost no difference in claims being linked to individual episodes or ETGs.[48] This is unsurprising because the "link facility records" feature is designed to combine multiple claims for a single hospital stay. Multiple IP claims for a single hospital admission are quite rare; the 32,590 IP claims in our 20% Colorado sample comprise 32,486 admissions, so just 104 of the IP claims are later claims for an ongoing hospital stay.[49] (See Section 7.3.4 for more details about these calculations and numbers.) One would expect that varying the options for this feature in this analysis is likely to have little effect on the integration of IP claims because the vast majority of IP claims represent distinct admissions.

Most of these runs also do not affect the total number of ungrouped claims (Table 5.14) and the number of ungrouped claims by claim type (Table 5.19). However, using the first diagnosis code as primary (Run 8) results in a slight increase in the number of episodes created, even though the same percentage of ungrouped claims results. Examining the number of

[47] Symmetry uses the custom clean periods option to create an alternative measure of episode completeness. They are not used in the grouping process; changing the custom clean period for an ETG does not alter the clean period used by the grouper for that ETG.
[48] There were marginal grouping changes affected by these options but they were less than 0.05% and were rounded down to 0.0%.
[49] Multiple claims for a single stay occur for two reasons. First, CMS sometimes makes interim payments during an admission with the final claim covering the remaining part of the payment assessed to the complete admission. Second, CMS occasionally issues outlier payments that can generate multiple claims. Information available on IP claims identifies whether they are part of the same admission.

ungrouped claims by claim type shows that the number of ungrouped claims changes marginally. Looking at claims changing across episodes (Table 5.16), we find that 3.2% of claims shift across episodes, and 5.0% of costs shift with these claims.

Setting the episode length limit to unlimited (Run 7) results in significantly fewer episodes created, since restricting episode length forces the creation of additional episodes. Additionally, chronic episodes now make up a lower proportion of the number of episodes (35.8%, versus 50.5% in the Baseline run), while accounting for almost the same share of the total cost. This result is consistent with what one would expect from this setting because multiple chronic episodes are more likely to be combined into a single lengthier and more expensive episode, while acute episodes are mainly unaffected. We also find that 52.0% of claims change episode dates (Table 5.16), and 8.8% change ETGs when episode length is not restricted. Again, the change in claim dates is likely a result of annualized chronic episodes combining into longer chronic episodes.

Most configuration file changes also produce relatively minimal changes in cost per episode, episode length, and number of episodes per person (Tables 5.17 and 5.18). However, allowing unlimited episode length leads to chronic episodes with significantly greater cost and length, particularly above the 75th percentile. This is also the result of chronic episodes grouping into longer, expensive episodes. Unlimited episode length has the opposite effect on complete acute episodes as they have slightly shorter lengths. This effect happens because longer acute episodes are likely to be considered incomplete. When looking at all chronic and acute episodes, allowing unlimited episode length results in significantly longer episode lengths and higher cost (Table 5.17).

5.3.5 Overview of Sensitivities to Changes in Symmetry Input and Configuration Files

The results in this section reveal how the overall picture of Symmetry's grouping outcomes varies in response to choices made in structuring its input file and in setting its configuration options. The following points summarize these findings.

- Not including secondary diagnoses in input records (runs 3 and 4) leads to nearly a 5% decrease in the number of episodes, an increase in the share of ungrouped claims from 14.6% to 16.4%, and only minor changes in the distributional properties of chronic and acute episodes. More significantly, it induces the reassignment of over 20% of claims to

different episodes, by ETG or date change, representing more than a 34% shift of costs across episodes.

- Switching from using both revenue center and HCPCS/CPT codes to HCPCS/CPT codes alone for OP claims barely affects most of the summary statistics on episode grouping, but causes 3% more OP claims to remain ungrouped and produces a 5% reassignment of claims to different episodes resulting in a corresponding 7% reallocation of costs.
- Randomly reordering input records within beneficiary/start-date/end-date categories (Run 6) produces a distinguishable effect on the number of episodes and regroups 0.9% of claims and 1.1% of costs to different episodes.
- Extending the episode length limit from 365 to unlimited (Run 7) decreases the number of episodes by nearly 25%, increases the average length of chronic episodes, and produces almost a 9% reassignment of claims and costs to different ETGs.
- Other adjustments of Symmetry's configuration – first diagnosis as primary (Run 8), track comorbidity (Run 9), link facility records (Run 10), days between facility records (Run 11), and custom clean periods (Run 12) – generate only marginal differences in the summary statistics on episodes.

5.4 Practical Considerations in Applying Symmetry Grouper to Medicare Data

In considering the functionality of the Symmetry grouper, we also explore several practical issues that arise in applying the grouper to capture Medicare practice patterns for physician attribution. This section highlights two potential considerations. First, we analyze the ability of Symmetry's episode groupings to emulate two important patterns of care expected under Medicare's payment policies: (1) IP stays are normally accompanied by physician services; and (2) SNF stays constitute a continuation of inpatient care. Second, we investigate the impact of waiting different lengths of time for claims data to accrue before implementing the episode grouper. Essentially, this tests the effect of grouping the Medicare claims sooner after the end of an analysis period (such as 2003) compared to waiting for a longer history of claims data.

5.4.1 Patterns of Physician Services During IP Stays

As described in Section 2.6, Medicare's benefit structure pays for flows of services that influence linkages of IP claims to PB claims. In particular, Medicare pays for E&M services by a physician during a hospital admission for a medical condition. As a result, one would expect to see these payments affecting practice patterns. Indeed, the evidence in Table 2.8 clearly documents that this practice is the norm. The findings in this table reveal that the frequency of

PB claims concurrent with IP stays almost always attains the one-per-day average for the shorter lengths of stay, and typically attains nearly this average for the longer IP claims.

A question arises concerning the extent to which Symmetry's episodes link concurrent PB claims to IP episodes. To answer this question, Table 5.20 mimics the structure of Table 2.8. In addition to reproducing the information in Table 2.8 showing the share of IP claims with at least an average of one daily physician visit as counted by all concurrent PB claims, Table 5.20 incorporates rows showing the share of IP claims with concurrent PB claims assigned to the same episode under the Baseline run of the Symmetry grouper.[50] The new column in Table 5.20 designated "Episode Assignment" distinguishes two sets of frequencies. The rows identified as "No restriction" count concurrent PB claims irrespective of how they are grouped; these percentages merely replicate the contents of Table 2.8. The rows marked "Same as IP claim" count only those concurrent PB claims that are grouped to the same episode as their corresponding IP stay. The second row, for instance, reports the percentage of IP stays that have an average of one or more PB claims per day assigned to the IP claim's episode, with rates listed by length of claim.

Although daily PB and E&M services appear to be the norm in Table 5.20, the PB and E&M claims for these services are often grouped to different episodes than the IP stay. Moreover, the longer the IP stay, the more likely these PB services and E&M services are grouped to other episodes. The middle panel of the table shows the amounts of concurrent PB services that occur during IP stays along with the degree to which these services are grouped to their concurrent IP stay. Examining the results for two-day IP stays in Table 5.20, 83% of inpatient claims have at least daily PB claims grouped to the same episode. Inspection of the figure directly above this number indicates that this share could be as high as 98% given the number of concurrent PB claims in the raw data. Moreover, whereas 95% of the 5-day stays have concurrent PB submissions equaling or exceeding the one-per-day average, only 69% of these 5-day admissions achieve this daily average when counting only those PB claims grouped to the same episode as the hospital admission. Turning to the middle panel of the table which shows the extent of E&M services concurrent with IP stays and the linkage of these services with

[50] When pseudo-claims from an IP claim are grouped to different episodes, a PB claim is considered to be assigned to the same episode as the IP claim when it is grouped to the episode that is assigned the cost of the IP claim under the plurality rule.

their respective IP claims, the patterns here mirror those seen for the PB claims in the upper panel. Referring to the lower panel of the table that restricts E&M claims to include only CPT codes reflecting hospital visits, one sees that 62% of IP stays lasting 8 to 14 days have sufficient claims to achieve daily E&M hospital visits, but only 26% of IP claims have enough E&M hospital-visit claims grouped to them to attain daily visits during the stay. Inspection of the last entries in the "Overall Match Rate" column reveals that virtually all IP stays (95%) have at least one PB claim for an E&M hospital visit, but only 77% have at least one of these claims grouped to the same episode. Entries in this column above these indicate that 69% of IP stays have daily E&M hospital visits, but only 42% have daily visits grouped to the same episode.

Given these findings, we explored alternatives to the Baseline run of the Symmetry grouper to investigate whether a closer match could be attained between assignments of IP claims and concurrent PB claims. One reason that physician claims may not group with institutional claims is that more than one diagnosis may be needed to enhance linkage of claims. To expand the information on the PB claim beyond the single line item diagnosis, we added diagnoses from the header record that accompanies Part B claims. Up to four "header" diagnoses are found on each Medicare PB claim, which apply to all of the individual line items on the claim. This modification essentially expands the number of diagnoses from one to as many as four: the primary diagnoses being the line-tem diagnosis, and up to three being co-morbid conditions. Our Baseline run relies on only the line diagnosis for both PB and DME claims.

Table 5.21 presents summary statistics describing the grouping results produced by this modification of the input files used to run the ETG grouper. Including PB header diagnoses in addition to the line-item diagnosis leads to a fairly large drop in the percentage of ungrouped claims, from 14.6% to 8.9%, and a 5.1 percentage point increase in the share of chronic episodes. This is what one would expect: the additional diagnoses on PB claims allow them to be grouped to more often to different episodes. One motivation behind including these additional diagnoses is to allow more PB claims (especially E&M claims) that occur during the course of a Room & Board (R&B) IP claim to be grouped to the same episode as that stay.

Table 5.20: Match Rate of Concurrent "Daily" PB and E&M Claims to Same Episode as IP Admission

All PB Claims During IP Admissions with Medical DRGs, Symmetry Baseline

Concurrent PB Claims			Length of Inpatient Claim (Days)										Overall Match Rate
Claim Type	Occurrence During IP Claim	Episode Assignment	1	2	3	4	5	6	7	8-14	15-21	22+	
All PB Claims	At least one per day	No restriction	95%	98%	97%	97%	95%	93%	92%	84%	71%	64%	93%
		Same as IP claim	84%	83%	79%	71%	69%	63%	56%	45%	29%	21%	67%
	At least one per day, except 1 day	No restriction		99%	99%	98%	98%	97%	95%	88%	75%	65%	95%
		Same as IP claim		91%	86%	80%	77%	70%	63%	51%	33%	24%	74%
	At least one per day, except 2 days	No restriction			99%	99%	99%	98%	97%	91%	78%	68%	96%
		Same as IP claim			92%	86%	83%	75%	70%	57%	36%	26%	76%
	At least one	No restriction	95%	99%	99%	100%	99%	100%	100%	99%	99%	95%	99%
		Same as IP claim	84%	91%	92%	92%	92%	90%	90%	86%	81%	81%	90%
All E&M PB Claims	At least one per day	No restriction	87%	90%	90%	85%	79%	75%	72%	68%	57%	49%	81%
		Same as IP claim	73%	69%	63%	53%	46%	42%	37%	30%	19%	14%	50%
	At least one per day, except 1 day	No restriction		97%	95%	94%	91%	86%	81%	73%	60%	52%	88%
		Same as IP claim		84%	74%	66%	61%	52%	45%	37%	23%	16%	61%
	At least one per day, except 2 days	No restriction			98%	97%	96%	94%	89%	79%	64%	54%	91%
		Same as IP claim			86%	75%	72%	63%	55%	42%	27%	18%	66%
	At least one	No restriction	87%	97%	98%	99%	99%	99%	98%	98%	98%	93%	98%
		Same as IP claim	73%	84%	86%	85%	86%	85%	83%	81%	76%	76%	84%
"Hospital" E&M PB Claims	At least one per day	No restriction	77%	75%	78%	70%	67%	66%	64%	62%	54%	48%	69%
		Same as IP claim	63%	56%	53%	42%	38%	34%	32%	26%	17%	14%	42%
	At least one per day, except 1 day	No restriction		90%	92%	90%	84%	80%	75%	70%	58%	49%	83%
		Same as IP claim		74%	69%	61%	54%	46%	41%	34%	21%	16%	55%
	At least one per day, except 2 days	No restriction			96%	95%	94%	89%	82%	75%	62%	52%	88%
		Same as IP claim			78%	71%	67%	58%	50%	40%	26%	18%	61%
	At least one	No restriction	77%	90%	96%	97%	98%	98%	98%	98%	98%	91%	95%
		Same as IP claim	63%	74%	78%	78%	81%	79%	78%	77%	74%	73%	77%
Number of IP Claims			409	3,358	3,995	3,733	2,567	1,683	1,250	2,914	633	415	20,957

Table 5.21: Summary Statistics for Including PB Header Diagnoses Compared to Baseline

All Claims, Symmetry

Decision on PB Header Diagnoses	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	% Cost of Chronic Episodes	% Cost of Acute Episodes	% Cost of Ungrouped Claims
Header Diagnoses Not Included (Baseline)	14.6%	672,600	50.5%	49.6%	65.0%	29.6%	5.3%
Header Diagnoses Included	8.9%	691,899	55.6%	44.4%	67.9%	28.1%	4.0%

Tables 5.22 and 5.23 summarize the effects of including the header diagnoses on the assignment of PB claims to the same episode as a concurrent IP stay. According to Table 5.22, the extra diagnoses slightly increase the number of PB claims grouped to the same episode as a concurrent IP stay, by 1.6 percentage points. The overall fraction remains under 60%. Table 5.23 replicates the structure of Table 5.20, except the grouping results now rely on Symmetry's software with header diagnoses added to the PB claims. While this modification changes the number and composition of episode types, it does not regroup claims in a manner more consistent with the flow of services that might be expected under Medicare's benefit structure.

Table 5.22: Impact of Including PB Header Diagnoses on IP-PB Linking Issue

All Claims, Symmetry

Statistics on PB Claims and IP Claims	
Total # of Medicare Claims	5,049,696
# of Room and Board (R&B) IP Claims	32,561
Header Diagnoses Not Included (Baseline)	
Total # of PB Claims Concurrent with a Grouped R&B IP Claim	453,052
# of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	255,431
% of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	56.4%
Header Diagnoses Included	
Total # of PB Claims Concurrent with a Grouped R&B IP Claim	453,052
# of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	262,820
% of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	58.0%

Table 5.23: Match Rate of Concurrent "Daily" PB and E&M Claims to Same Episode as IP Claim

All PB Claims During IP Claims with Medical DRGs, Symmetry with Header Diagnoses

Concurrent PB Claims			Length of Inpatient Claim (Days)										Overall Match Rate
Claim Type	Occurrence During IP Claim	Episode Assignment	1	2	3	4	5	6	7	8-14	15-21	22+	
All PB Claims	At least one per day	No restriction	95%	98%	97%	97%	95%	93%	92%	84%	71%	64%	93%
		Same as IP claim	82%	81%	77%	72%	70%	65%	59%	48%	30%	23%	67%
	At least one per day, except 1 day	No restriction		99%	99%	98%	98%	97%	95%	88%	75%	65%	95%
		Same as IP claim		89%	84%	80%	78%	73%	67%	53%	35%	24%	74%
	At least one per day, except 2 days	No restriction			99%	99%	99%	98%	97%	91%	78%	68%	96%
		Same as IP claim			91%	85%	83%	78%	72%	58%	39%	26%	77%
	At least one	No restriction	95%	99%	99%	100%	99%	100%	100%	99%	99%	95%	99%
		Same as IP claim	82%	89%	91%	91%	92%	92%	91%	87%	84%	82%	90%
All E&M PB Claims	At least one per day	No restriction	87%	90%	90%	85%	79%	75%	72%	68%	57%	49%	81%
		Same as IP claim	70%	64%	61%	54%	50%	45%	40%	32%	22%	16%	50%
	At least one per day, except 1 day	No restriction		97%	95%	94%	91%	86%	81%	73%	60%	52%	88%
		Same as IP claim		81%	73%	67%	63%	56%	50%	39%	26%	17%	62%
	At least one per day, except 2 days	No restriction			98%	97%	96%	94%	89%	79%	64%	54%	91%
		Same as IP claim			84%	75%	73%	66%	58%	45%	30%	19%	67%
	At least one	No restriction	87%	97%	98%	99%	99%	99%	98%	98%	98%	93%	98%
		Same as IP claim	70%	81%	84%	85%	86%	87%	85%	82%	77%	76%	83%
"Hospital" E&M PB Claims	At least one per day	No restriction	77%	75%	78%	70%	67%	66%	64%	62%	54%	48%	69%
		Same as IP claim	60%	52%	51%	43%	40%	37%	35%	28%	20%	14%	42%
	At least one per day, except 1 day	No restriction		90%	92%	90%	84%	80%	75%	70%	58%	49%	83%
		Same as IP claim		70%	68%	62%	56%	50%	45%	36%	25%	16%	56%
	At least one per day, except 2 days	No restriction			96%	95%	94%	89%	82%	75%	62%	52%	88%
		Same as IP claim			77%	71%	69%	61%	53%	42%	29%	18%	62%
	At least one	No restriction	77%	90%	96%	97%	98%	98%	98%	98%	98%	91%	95%
		Same as IP claim	60%	70%	77%	78%	81%	83%	81%	79%	75%	73%	77%
Number of IP Claims			409	3,358	3,995	3,733	2,567	1,683	1,250	2,914	633	415	20,957

5.4.2 Linking SNF Care to IP Stays

In sharp contrast to the above discussion of expected practice patterns and PB claims, Medicare's payment rules for SNF claims are rigorously specified. A SNF claim must follow an IP claim with a minimum 3-day stay, must occur within 30 days of the hospital discharge date, and be related to the same condition as the hospitalization. Medicare always considers this service to be a continuation of care.

Table 5.24 shows the extent of linkage of SNF claims to the episodes of IP stays for the Baseline run of the ETG grouper. Candidate SNFs in this table refer to those claims that occur within 30 days of a hospital discharge for a grouped stay lasting at least 3 days. A match is deemed to have occurred when a SNF claim is grouped with any one of these IP stays. As the table shows, nearly all SNF claims are candidates under our specification. Those that are not identified as candidates are: (1) SNF claims that follow an ungrouped IP claim, (2) associated with an IP stay beyond the range of our data, (3) for SNF admissions exempt from the 30 day interval requirement either for continued care in a SNF or for medical reasons, or (4) are denied claims.[51] Of these candidate SNF claims, the Baseline run groups only 48.2% to episodes with candidate IP claims.[52]

Table 5.24 also presents the grouping rate of SNF and IP claims into the same episodes achieved by the above formulation of the ETG grouper that adds PB header diagnoses to the line-tem diagnosis in the input records of PB claims. SNF claims may lack sufficient diagnosis or procedure information to enable direct linkage to what appears on the associated IP claims. Adding more diagnoses to PB claims might provide bridging information that permits enhanced linkage. However, we see in Table 5.24 that expansion of PB diagnoses produces a slight decrease in linkage rates of SNF claims compared to the Baseline run, with a drop from 48.2% of candidate SNF claims to 47.7%. This decrease may reflect SNF claims being grouped to episodes for co-existent or co-morbid conditions reported in the PB header diagnoses that are not linked to the originating IP stay.

[51] Of the 543 SNF claims that are not identified as candidates, 91 occur within 30 days of January 1, 2002, and 40 occur after an IP claim that was not grouped. Most of the remaining non-candidate claims list condition codes that indentify exemptions or denials; however 124 of these claims do not list condition codes.

[52] We identify a link between IP and SNF claims when the costs from each of the candidate IP and SNF parent claims are linked to the same episode as assigned by the plurality rule. There are often ties for SNF pseudo-claims (340 in the baseline run), so we consider an IP and SNF claim linked when the cost from the IP claim is assigned to either of the episodes that are assigned costs from the candidate SNF claim.

Table 5.24: Impact of Including PB Header Diagnoses on IP-SNF Linking Issue

All Claims, Symmetry

Statistics on SNF Claims and IP Claims	
Total Number of SNF Claims	9,336
# of SNF Claims that are Candidates for IP Linking (start within 30 days of the end of a Grouped IP claim)	8,793
% of SNF Claims that are Candidates for IP linking	94.2%
Total # of SNF Claims that are Candidates for IP linking	8,793
Header Diagnoses Not Included (Baseline)	
# Grouped to the Same Episode as an IP Claim	4,239
% Grouped to the Same Episode as an IP Claim	48.2%
Header Diagnoses Included	
# Grouped to the Same Episode as an IP Claim	4,196
% Grouped to the Same Episode as an IP Claim	47.7%

These findings question the ability of Symmetry's episode groupings to reflect some of the practice patterns expected under Medicare payment policies.[53] Of course, the ETG grouper was not designed to capture these patterns. We anticipate that the algorithm would require information beyond diagnosis and procedures to do so.

5.4.3 Effect of Altering Time Horizon for Including Claims

Thus far, our analysis in this chapter has focused on 2003 findings calculated using data that are complete through 2004. In practice, however, Medicare may not want to wait until after the end of 2004 to assess physicians' resource use in 2003. Therefore, one practical question in implementing the groupers for Medicare is the degree to which episode groupings change with longer or shorter periods of Medicare data. Complete episodes should by definition represent an entire instance of a disease and hence should not be influenced by the addition of later claims. If extending the time horizon changes the characteristics of Symmetry's complete episodes, it will be difficult to evaluate physicians using the Symmetry grouper.

To test the impact of adding more months of data to the sample, we compare how the findings differ for a shorter sample. To do this, we subset the 2002-2004 Medicare claims data for 20% of the population of Colorado to exclude all Medicare claims with an end date after June

[53] We also tried to adapt Symmetry's "Link Facility Records" feature to bundle IP claims together with concurrent E&M hospital claims. We set the variables Symmetry uses in linking hospital claims to indicate that the E&M claims were instead facility claims at the same hospital as the concurrent IP stay, and that they were part of a multi-claim hospital stay. This change produced a negligible change in grouping.

30, 2004. Summary statistics for this reduced sample for Symmetry are found in Table 5.25, showing the total number and cost of episodes, alongside breakdowns by acute and chronic episodes and ungrouped claims. In comparing Table 5.25 to Table 5.1, we see that the ratio of Medicare claims grouped to chronic versus acute episodes, along with their associated costs, is quite similar between the two samples.

Table 5.25: Summary Statistics for Reduced Time Horizon Sample
All Claims January 2002-June 2004, Symmetry

Total # Claims	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	Total Cost in 2002-2004	% Cost of Chronic Episodes	% Cost of Acute Episodes	% Cost of Ungrouped Claims
4,097,049	14.8%	576,539	51.5%	48.6%	$462,343,157	64.2%	30.2%	5.6%

Although the summary statistics for the reduced sample are similar to the Baseline, the important question is whether a significant share of individual claims, specifically those from 2003 Complete Episodes, are grouped differently under the two scenarios. We explore the differences in claim groupings by considering two possible ways a claim's episode can change. A claim can be assigned to a different ETG or the episode it belongs to can have a different start or end date.[54] The first set of results are the statistics from grouping solely the reduced sample of Medicare claims (January 1, 2002 to June 30, 2004). Our comparison results are statistics for the Baseline sample (January 1, 2002 to December 31, 2004) compared to only those Medicare claims in the reduced sample timeframe (January 1, 2002 to June 30, 2004). An episode is designated complete if it satisfies the completeness criteria from Section 3.1 in the reduced sample.

The results in Table 5.26 reveal that 2.5% of claims assigned to 2003 Complete episodes are regrouped to new episodes, implying a reassignment of 3.5% of costs. Moreover, 1.8% of claims and 2.7% of costs are grouped to entirely different ETGs. Although the difference is not large, the fact that some complete episodes are affected indicates that Symmetry's 2003

[54] Using episode start and end dates by claim can miss some episode changes and can over-count changes in other instances. (See footnote 44 and the discussion in Section 5.3 for further explanation.) Unfortunately, it is not easy to track precisely how claims switch across episode assignments because episode identification numbers differ in each run of the grouper software.

Complete Episodes are not necessarily complete even after waiting for all claims to come in six months after the end of 2003. This has implications for evaluating resource use using Symmetry, since performing the same analysis at a later time in the point will lead to different results.

Table 5.26: Changes in Grouping of Claims Due to Adding 6 Months of Medicare Data
2003 Complete Episodes for January 2002-June 2004 Sample, Symmetry

Claims Grouped to 2003 Complete Episodes	# of Medicare Claims	% of Medicare Claims	Cost of Medicare Claims	% of Associated Cost of Medicare Claims
All Claims	1,410,706	100.0%	$179,112,167	100.0%
Claims that Change ETG	25,383	1.8%	$4,853,953	2.7%
Claims that Change Episode Dates	20,134	1.4%	$4,371,377	2.4%
Claims that Change ETG or Episode Dates	35,706	2.5%	$6,222,444	3.5%

5.5 Overview of Applying Symmetry Grouper to Medicare Data

A major goal of this report is to understand the issues in adapting Symmetry's software to group Medicare claims into episodes of health events, especially from the perspective of assessing costs across these events. There are nine main characteristics of the Symmetry software of particular note when it is applied to Medicare claims:

- Depending on the type of Medicare claim, Symmetry relies on revenue center codes, procedure codes or a combination in its grouping process: The availability of these codes on different types of claims is principally dictated by Medicare payment rules.
    - For institutional claims in Medicare, only revenue center codes are universally reported, with each code designating a particular medical service. We create service-level input records for the ETG grouper, which we term pseudo-claims, using a single revenue center code as the designator of the service. In some instances, a revenue center code on a claim has an associated HCPCS/CPT procedure code (which typically conveys more detail about the form of the service), and when available, we include this accompanying procedure code on the corresponding input record as well. Whereas all institutional pseudo-claims have a revenue center code, many do not have an accompanying procedure code. Of pseudo-claims constructed from IP claims, 2% have a HCPCS or CPT code; 7% of pseudo-claims from SNF claims have a HCPCS/CPT code; and 6% of input records from HS claims have a procedure code. In contrast to these types of claims, OP and HH claims typically have a procedure code accompanying their revenue center codes; 72% of pseudo-claims from OP claims and 88% from HH claims have a HCPCS/CPT code.

- Constructing input records for OP claims ignoring revenue center codes and using only information supplied by HCPCS/CPT procedure codes (Run 5) results in slightly more ungrouped claims, most all of them being OP claims, and induces 7% of costs to shift across episodes.

- For non-institutional Medicare services, PB and DME claims are readily separated into line items associated with a single HCPCS or CPT code; these claim types have no revenue center codes. Input records for PB and DME claims include the line-item procedure code as their indicator of the medical service performed.

- The ETG software inputs each claim as a set of service-level records, with each record individually assigned to an episode. This can lead to a parent institutional claim being linked to multiple episodes:

  - Each pseudo-claim (i.e., input record) constructed from an IP, OP, SNF, HH or HS claim consists of a revenue center code, the corresponding HCPCS/CPT procedure code when present, and up to four diagnoses associated with the parent claim.

  - While Symmetry allows for up to 4 ICD-9 procedure codes to be input with each pseudo-claim, Symmetry's algorithm does not use ICD-9 procedure codes in its grouping process. Medicare uses these codes to identify DRG classifications which determine payments.

  - Each pseudo-claim constructed from a PB and DME claim consists of a single HCPCS/CPT procedure code and the line-item diagnosis code.

  - Symmetry's grouper often links pseudo-claims from a single parent claim to different episodes. This results in one (aggregate) Medicare claim being grouped into more than one episode. Over 52% of SNF claims are split across episodes, as are 23% of IP claims, 40% of HH claims, 13% of OP claims, and 15% of HS claims (Table 5.27 below).

Table 5.27: Claims with Pseudo-Claims Split Across Multiple Episodes by Claim Type

All Claims, Symmetry Baseline Run

Claim Type	# Claims	% by Claim Type
IP	7,490	23%
OP	64,376	13%
SNF	4,860	52%
HH	4,712	40%
HS	456	15%
PB	N/A	N/A
DME	N/A	N/A

- Medicare claims data commonly have more diagnosis codes than are accepted in Symmetry input records:
    - The ETG grouper's input records can incorporate up to 4 diagnosis codes. 82% of IP claims, 70% of SNF claims, and 38% of HH claims have more than 4 codes.
    - Our investigations suggest that the inclusion of extra diagnoses on input records is unlikely to alter the number and distributional characteristics of episodes, but it could induce appreciable shifts in claims across episode types. Using just the primary diagnosis code (Run 3) leads to only a 5% decrease in the number of episodes, small changes in the distributions of their costs and lengths, and only a 1.8 percentage point rise in the cost of ungrouped claims compared to using the first 4 codes. However, without any secondary diagnoses, 21% of claims either change ETGs or episode dates (implying episode shifts), which results in 35% of claim costs being redistributed to other episodes.
- The construction of Complete Episodes generally approximates the annual cost of claims assigned to the different ETG categories: Complete episodes include all chronic episodes ending in 2003, and only those acute episodes that begin at least one clean period after the beginning of 2002 and end in 2003.
    - The costs of claims grouped to 2003 Complete Episodes for an ETG closely approximate the annual costs assignable to ETGs within a calendar year. The cost of 2003 Complete Chronic Episodes equals 99% of the annual claims costs assigned to chronic episodes in the year 2003; and the corresponding figure for all acute episodes is 93% of annual claims cost.
    - Symmetry divides acute conditions into complete episodes using clean periods. For the top ten highest-cost acute ETGs, episodes of the same type sometimes occur within the designated clean period when the dates of claims are used to identify the beginnings and ends of episodes. In particular, depending on the type of ETG, between 0.6% and 35.4% of the same-type episodes take place within clean periods. In some rare instances, these episodes can even overlap, meaning that one episode starts before the prior one ends.
    - Symmetry starts and terminates chronic episodes in fixed 12-month periods. For the vast majority of afflicted individuals, one chronic episode immediately follows another. For the top ten highest-cost chronic ETGs, chronic episodes of the same ETG run as continuous events for individuals between 18% and 81% of the time depending on the type of chronic condition.
- Considerable variation exists in the costs of individual episodes within an ETG:
    - The distributions of costs across episodes within an ETG exhibit substantial dispersion. For instance, for each of the top five highest-cost acute and chronic ETGs, the level of cost demarking the most expensive 10% of episodes always exceeds the level demarking the cheapest 10% by at least a factor of four, and in most instances it is far more than two orders of magnitude larger.

- These distributions also reveal that the highest-cost episodes account for large shares of total ETG costs. For the top five acute ETGs, the most expensive 5% of episodes alone account for 15% to 42% of total annual cost for the ETG, and for the top five chronic ETGs this range is 26% to 50%.

- This large amount of cost variation suggests that devising a reliable method of risk adjustment for episodes and beneficiary costs necessary for profiling providers in Medicare settings requires approaches not yet available in the existing ETG software. With multiple comorbidities often present and patients that tend to be much more complex, the risk and severity models developed for commercial populations are unlikely to work as effectively in the Medicare population.

- Symmetry's grouping results depend on the order in which records are input into the grouper:

  - The ETG grouper requires input records be sorted by beneficiary as well as claim start and end dates. The sort order of records within these beneficiary/start-date/end-date compilations is arbitrary, and yet changing this order produces different grouping results for a notable number of beneficiaries.

  - In a typical example (Run 6), we show that reordering within these beneficiary/start-date/end-date compilations leads to a change in the assigned ETG type for 0.4% of Medicare claims. More significantly, 0.9% of Medicare claims change their assigned ETGs or episode dates, implying a 1.1% reallocation of Medicare costs to different episodes of care.

- Symmetry's groupings of 2003 Complete Episodes depend on the time horizons used to include claims in 2004:

  - Even after including claims from the first half of 2004, adding claims for the second 6 months of 2004 produces changes in the formulation of 2003 Complete Episodes. In particular, 2.5% of claims accounting for 3.5% of costs are moved to a different 2003 episode by adding the 6-month extension of the time horizon in 2004. While this shift is not large, one might expect virtually no impact on 2003 Complete Episodes since the first 6 months of 2004 already well exceeds the longest clean period of any acute ETG and chronic ETGs are truncated on an annual basis.

  - In a Medicare policy setting, this finding implies that 2003 grouping results will depend on the horizon specified in 2004 when claims will no longer be counted; counting claims with service dates up until mid-year 2004 will produce somewhat different findings than waiting for all claims in 2004.

- Symmetry offers no guidance on how to allocate the cost of a Medicare claim to its pseudo-claims, leaving questions about how to apportion the cost of the claim across its linked episodes:

- When Symmetry assigns the pseudo-claims of a single Medicare claim to multiple episodes, one faces the challenge of how to distribute the cost of this claim across these episodes. Our analysis allocates the entire claim payment to only one of its episodes based on a majority rule, with all remaining episodes receiving none of the claim's cost. Like any such allocation rule, ours may be inappropriate for assessing the costs of episodes.

- An alternative way to resolve the cost allocation problem is to input each institutional claim as a single record. Symmetry limits this record to include at most one revenue center code and one procedure code from the original claim. With many codes appearing on claims, the choice of which single revenue and/or procedure code to include on the single input record may be somewhat subjective. (Selecting the room and board revenue center code is a popular option, but many institutional claims lack this code.) The choice will affect the way Symmetry groups claims to episodes (a logical inference because pseudo-claims, which differ only by revenue/procedure codes, do get grouped into different episodes).

- The ETG grouping algorithms are not designed to follow the flow of services expected under Medicare's benefit structures, and episodes constructed by Symmetry often do not emulate some of the practice patterns seen in Medicare data.

  - Medicare's payment polices promote medical care that link IP stays to post-acute care and to physician services. For post-acute care, this concept is embedded in the Medicare benefit rules; SNF claims are only paid when they are a continuation of inpatient care. For physician claims, Medicare pays for E&M services during IP stays (e.g., daily visits during an admission for a medical condition). Near daily PB visits are, in fact, the norm for IP stays in Medicare data.

  - The ETG grouper does not explicitly incorporate these Medicare practice norms and does not fully capture them in its construction of episodes. Only 48% of SNF claims are grouped to the same episodes as the initiating IP claims. Overall, 69% of IP stays have daily E&M hospital visits, but only 42% have daily visits grouped to the same episode by Symmetry. Moreover, the ETG grouper often assigns components of a single IP claim to multiple episodes, which raises the issue of how to allocate the various SNF and IP-affiliated PB claims to the candidate episodes.

  - In an attempt to strengthen agreement with Medicare policies, we expanded the number of diagnoses on PB claims by adding "header" diagnoses. Including these additional diagnoses only slightly increases the fraction of PB claims assigned to the same episode as a concurrent IP stay, from 56.4% to 58%. This approach also slightly decreases the fraction of SNF claims grouped to the same episode as an IP stay from 48.2% to 47.7%. While this modification significantly changes the number and composition of episodes, it fails to regroup claims in a manner more consistent with Medicare's concept of treatment episodes.

6 SPECIFICATION OF BASELINE APPLICATION OF MEDSTAT GROUPER TO MEDICARE DATA

For each of the groupers, we establish a specification of input file characteristics and software configuration settings that represent our "Baseline" application of the grouper software. Within the normal settings of the software, the Baseline represents our determination of the input file and configuration options that best suit the Medicare claims data. This chapter describes the Baseline application of the Medstat grouper to Medicare claims, including the major decisions that go into the selection of this application. We also describe the output file produced by Medstat and its role in our analysis. The following chapter presents the findings from the Baseline run using these settings, as well as comparisons using alternative specifications.

6.1 Structure of Medstat Input File for Baseline Run

The Medstat MEG software organizes its input files so that each record represents a single claim. In structuring the input file for the Medstat software, however, decisions must be made regarding the use of diagnosis codes and procedure codes; revenue center codes are not used by Medstat. Additionally, Medstat does call for the inclusion of x-ray/lab flags for appropriate procedures. Start and end dates, and payment amounts for each claim are also entered, but are not discussed here (see Chapter 2). In this subsection, we describe the choices made on each of these input elements for the Baseline run. These decisions are summarized in Table 6.1, which shows how we structure the input file by claim type.

In our Baseline input file structure, we include all diagnosis codes in each record. For PB and DME claims, we use the line-item diagnosis code instead of the header diagnosis list because it is the relevant diagnosis that corresponds to the procedure performed for non-institutional claims. We input aggregate payments for institutional claims and line-item payments for non-institutional claims. Although not shown on Table 6.1, claims dates are also included in the input file; we use the start and end dates from the claim, as described in Table 2.5.

Table 6.1: Diagnosis and Procedure Data Used in Baseline Medstat Run

File	Diagnosis Codes	Use of Procedure Codes	X-ray/Lab Flag
IP	All diagnosis codes	First 15 distinct procedure codes on claim; must be of same type. We select ICD-9 codes if available, otherwise HCPCS if available.	No claims with x-ray/ lab flag
OP		First 15 distinct procedure codes on claim; must be of same type. We select CPT codes if available, otherwise HCPCS if available.	X-ray/lab flag only for appropriate procedures
SNF		No procedure codes used; rarely available on any claims.	No claims with x-ray/ lab flag
HH		First 15 distinct procedure codes; must be of same type. We select HCPCS codes if available, otherwise CPT if available.	
HS		No procedure codes used; rarely available on any claims.	
PB	Line-item diagnosis code	Listed HCPCS/CPT code for each line item.	X-ray/lab flag only for appropriate procedures
DME			

Many of the key decisions in creating the input file involve selecting the types of procedure codes to include for input records from institutional claims. Medstat requires that only a single type of procedure code be used for each input record. Thus, if a claim has multiple types of procedure codes (e.g., both CPT and HCPCS codes), only codes of one type can be inputted for the claim and the rest must be omitted. Our decision regarding which type of procedure code to incorporate on an input record draws upon Medicare payment policies, which naturally influence which procedures show up on a claim category. Starting with institutional claims, IP claims commonly report ICD-9 procedure codes since these codes can determine the DRG assigned to the claim which specifies its payment. Accordingly, we include ICD-9 procedure codes on input records for IP claims if available; if no such codes appear, we then include the next most common code seen on IP claims, HCPCS codes. As discussed in Section 2.2, CPT

codes are used for payments by the OP PPS, and HCPCS codes are principally used by the HH PPS. Consequently, for OP claims we input CPT codes if available, and otherwise input HCPCS codes. For HH claims, we input HCPCS codes if available, and otherwise input CPT codes. One rarely sees any procedure codes on SNF and HS claims, as Medicare reimbursements for these claims are determined by prospective payment systems that do not consider procedure codes. Consequently, we do not include any procedure codes for SNF and HS claim types. In the analyses presented below, we examine the impacts of altering the choices of which procedure codes to input for the various claim categories, including deletion of procedure codes all together, and our findings generally reveal that alternative selections lead to little change in episode grouping outcomes.

Turning to non-institutional claims, PB and DME claims only list one procedure code per input record because the claims are broken into line items at the service level. So, no decision need be made regarding which procedure code to use for these input records.

One critical use of the procedure codes in applications of the Medstat grouper involves the setting an x-ray/lab flags. This flag plays a vital role in the MEG grouper in that it determines whether a claim can start an episode—Medstat's software prevents claims flagged as an x-ray or lab procedure from starting an episode. The flag must be set to '0' (not flagged) or '1' (flagged) by the user for each input record depending on whether or not it is an x-ray or lab procedure. Medstat supplies a recommended list of procedure codes for setting the x-ray/lab flag.[55] In assigning x-ray/lab flags, we generally follow Medstat's recommendation; we use procedure codes to flag all claims as x-ray/lab with the exception of IP claims. For the Baseline run, we allow all IP claims to start an episode (that is, lab/x-ray is automatically unflagged) and use any available procedure codes to flag claims from other file types. Permitting all IP claims to start an episode is sensible, and such a blanket rule is required since the IP claims typically

[55] List of HCPCS/CPT Procedure Codes Corresponding to Setting Medstat X-ray/Lab Flags:

'70000 - 89999',	'92531 - 92605',	'95812 - 95852',	'96110 - 96120',	'D8000 – D9248',
'90765 - 90775',	'92610 - 92633',	'95860 - 95904',	'97750 - 97755',	'D9610 – D9999',
'90801 - 90802',	'93000 - 93278',	'95921 - 95937',	'99000 - 99140',	'E0000 – E9999',
'91000 - 91065',	'93307 - 93350',	'95951 - 95951'	'99170 - 99173',	'G0001 – G0127',
'91110 - 91299',	'93600 - 93623',	'95954 - 95955',	'A0000 - C9999',	'G0130 – G0148',
'92015 - 92506',	'93875 - 95078',	'95958 - 95967',	'D0120 - D0999'	'G0175 – G0180',
'92511 - 92520',	'95805 - 95810',	'96000 - 96103',	'D5110 - D7140',	'G0202 – G0234'

include only revenue center codes. For other claims with missing procedure codes, there is no basis for flagging the claims as x-ray/lab, so these claims also remain unflagged.

While Medstat supplies a list of HCPCS and CPT codes corresponding to lab or x-ray procedures, a rule is still needed to determine the x-ray/lab flag for the many claims that have multiple procedure codes. In such instances, we set the x-ray/lab flag for the claim only when all available codes identify a lab or x-ray procedure. If an OP claim has both CPT and HCPCS codes, and all its CPT codes indicate x-ray or lab services, then we flag the claim regardless of the type of HCPCS procedure codes (since only a single type of procedure code can be used per claim). Table 6.2 provides the proportions of the x-ray/lab flagged input records by claim type following Medstat's recommendations.

Table 6.2: Distribution of X-ray/Lab Flags for Medstat Baseline Run

Flag by Claim Type[56]		# of Claims	% by Claim Type
IP	**0**	32,590	100%
OP	**0**	219,720	45.57%
	1	262,492	54.43%
SNF	**0**	9,336	100%
HH	**0**	11,860	100%
HS	**0**	3,082	100%
PB	**0**	1,914,532	46.68%
	1	2,186,663	53.32%
DME	**0**	12,990	3.17%
	1	396,431	96.83%
Total # of claims		5,049,696	100%

A final issue with the inputting of procedure codes concerns the fact that the Medstat software has limit of 15 on the number of procedure codes, and OP claims can have more than this number of codes. As shown in Table 6.3, only a small fraction of OP claims have more than 15 procedure codes. Moreover, the two ways in which procedure codes are used by Medstat suggest that claims violating this limit do not pose a substantive problem for grouping. Medstat

[56] 0 in this column means the claim did not contain an x-ray/lab procedure and is allowed to start an episode; 1 means the claim includes an x-ray/lab procedure and is not permitted to begin an episode.

primarily utilizes procedure code information to determine whether a claim can start an episode by assigning a x-ray/lab flag. So, the limit would not pose a problem if one were to use all procedure codes when assessing the presence of x-ray/lab services on the claim. Medstat also uses procedure codes to ensure that there is a service associated with the principal diagnosis. If there is not a logical pairing between the principal diagnosis and any procedure code, the Medstat software checks the remaining diagnosis codes to find a pairing with any of the procedure codes. If it then finds a pairing between a secondary diagnosis code and a procedure code, this secondary diagnosis code is also used for episode assignment. The 15 code limit only poses a problem for this feature in Medstat, then, when none of the included 15 procedure codes logically pairs with the principal diagnosis code but one of the omitted codes does.

Table 6.3: Distribution of the Number of Procedure Codes for OP Claims

# of Procedure Codes	# of Claims	% of All OP Claims
1-15 codes	456,925	94.76%
> 15 codes	11,402	2.36%
No codes	13,885	2.88%
Total	482,212	100%

In addition to diagnoses and procedure code information, date, cost and beneficiary information is included as input. Start and end date information is used by Medstat for grouping (see Section 2.3). Both beneficiary information (age and gender) and cost information are not used for grouping, but instead are included as input for the purpose of post-grouping analysis.

6.2 Structure of Medstat Configuration File for "Baseline" Run

Medstat offers a number of different configuration options, allowing the user to change how the software groups claims into episodes. Table 6.4 lists the main options, their role and our choice of settings for the Baseline run. We also note which of these configurations we vary in subsequent runs.

The first option is structuring inpatient claims to capture inpatient stays or admissions. According to Medstat's documentation, one should set "BUILD_ADMISSIONS = YES" unless

all inpatient claims have already been grouped so that each individual record identifies a single admission. Raw IP claims are not structured in this way. The software requires that IP claims are either already built into admissions by the user prior to running the MEG grouper, or that the Build Admission feature is turned on so that IP claims can be built by the software. These admissions are then used to group the episodes.[57]

Table 6.4: Medstat Configuration for Baseline Run

Option	Role	Baseline Setting	Varied in Runs
Build Admissions	Tells the software to group facility claims into inpatient stays or "admissions."	YES	YES
Episode Length Limit	Allows the user to set the maximum length of an acute or chronic episode.	1 year for acute episodes	
Stratify Chronic Episodes	Allows the user to determine whether certain chronic MEGs are split into chronic episodes and acute flare-ups.	YES	
Look Back Period	Allows the user to set the number of days for which the software looks back from the start of an episode to group X-ray/Lab flagged claims to a particular episode.	15 days	
Chronic Episode Time Window	Type of chronic time window – based on a year time window (YEAR) or by limited duration (DURATION).	YEAR	NO
Year Start	Beginning date of year used to cut off Chronic Episodes if using a year time window.	1-Jan	

Otherwise, for the Baseline run, we set options either to their defaults or to the settings most parallel to Symmetry. We set the parameter "EPSDLIMIT = 365" in Medstat's Baseline configuration file to make it comparable to Symmetry's episode limit of 365 days, and we set the parameter "EPSDCHRONIC = YEAR" to cause it to make chronic episodes that are comparable to Symmetry's annually truncated episodes. Our Baseline run follows Medstat's

[57] When utilizing Medstat's build admission option, a user flags all claims as either "inpatient" or "outpatient." The user also inputs claims as either "facility" or "professional", and registers inpatient claims as "room and board" when applicable. Medstat does not have any additional specifications that correspond to each of the seven claim types that make up Medicare data. For runs utilizing the build admission feature, we classify IP claims as "inpatient," and all other claim types as "outpatient."

recommendation to set "STRATIFY_CHRONIC= YES" to allow the grouper to divide some chronic MEGs into chronic conditions and acute flare-ups. We also use Medstat's default value of 15 days for "episode look back period," which controls how many days before the start of an episode the grouper looks for associated x-ray and lab claims. After the look-back process, Medstat identifies ungrouped claims with non-specific diagnosis codes and uses "inclusion logic" to group non-specific claims to appropriate episodes with close dates.[58]

6.3 Structure of Medstat Output Files

Our analysis utilizes two output files produced by the MEG grouper. The first file links each claim to a particular episode. The second file presents the characteristics of each episode, describing its total cost, its start and end dates, visit counts (roughly equivalent to the number of claims), and the episode type assigned within Medstat's MEG classification system. We use this second file only as a means to determine the MEG associated with the episode for each claim, and calculate episode dates and costs using our definitions discussed in Section 3.1.1. An episode's start date is the start date of the first claim in the episode, its end date is the end date of the last claim in the episode, and its cost is the sum of the costs of all of the claims in the episode. We perform these calculations ourselves because of potential concerns over how Medstat calculates episode dates and costs.

The episode start and end dates calculated by Medstat can differ from our start and end dates for the same episode. Medstat's documentation does not detail how episode start and end dates are calculated, but it does suggest that episode dates are defined by visits. Our approach to episode date assignment does not differentiate among claim types. Table 6.5 shows that over 95% of Medstat's acute episodes have the same dates as calculated by Medstat and Acumen. Another 3.5% of acute episodes have the same start date but an earlier end date, a pattern consistent with Medstat's documentation. According to Medstat's documentation, an episode end date is the start date of the last claim in the episode unless the claim is an IP claim, in which case the end date is the start date of the claim plus the length of stay. As we describe in Chapter 7, changing some of the specifications for the grouper affect episode dates and hence these statistics.

[58]The documentation does not specify what a close date is, or whether the look-back period defines a close date (Version 7.1 User Guide, page 9).

Table 6.5: Comparison of Acute Episode Start and End Dates

All Acute Episodes, Medstat

Compared to Acumen Calculation:			
Medstat Start Date is	**Medstat End Date is**	**# of Episodes**	**% of Episodes**
Earlier	Earlier	16	0.00%
	Same	55	0.01%
	Later	4,413	1.12%
Same	Earlier	13,829	3.51%
	Same	375,033	95.19%
	Later	56	0.01%
Later	Earlier	76	0.02%
	Same	496	0.13%
	Later	5	0.00%

The MEG grouper creates chronic episodes by dividing chronic care into fixed time periods, which we set to a calendar year. Medstat uses the designated period for chronic episodes to assign dates, so all chronic episodes start on January 1st and end on December 31st. In contrast, our approach treats the calculation of lengths for chronic episodes in the same as for acute episodes, using the earliest and latest dates of services grouped to the episode. As a result, our computations for each chronic episode should almost always show shorter episode lengths than Medstat's calculations. Table 6.6 shows that virtually all chronic episodes are longer under Medstat's calculations than under Acumen's.

In Version 7.1 of the MEG grouper, Medstat's calculation of cost agrees with our approach wherein episode costs are simply the sum of the costs of claims making up the episode.[59]

[59] The vendor confirmed that our method for calculating the dates and costs of episodes is reasonable. In previous versions of the MEG grouper, Medstat's calculation of cost differed from the sum of claim costs for some episodes.

Table 6.6: Comparison of Chronic Episode Start and End Dates

All Chronic Episodes, Medstat

Compared to Acumen Calculation:			
Medstat Start Date is	**Medstat End Date is**	**# of Episodes**	**% of Episodes**
Earlier	Earlier	1,216	0.46%
	Same	2,976	1.11%
	Later	262,013	98.11%
Same	Earlier	15	0.01%
	Same	198	0.07%
	Later	579	0.22%
Later	Earlier	0	0.00%
	Same	0	0.00%
	Later	77	0.03%

7 ASSESSMENT OF RESULTS FOR MEDSTAT GROUPER USING MEDICARE DATA

This chapter provides results on episode groupings obtained for Medicare claims using the Medstat MEG software. We begin in the first section with an overview of the grouping results for the Baseline run, focusing on 2003 Touching Episodes. These are the results one would obtain using the Baseline settings to group claims to understand resource utilization in 2003. In practice, performance measurement may focus primarily on completed episodes. Therefore, the second section of this chapter examines the results for completed episodes. Recognizing that the Baseline settings are not the only options for running the Medstat software, the third section examines the sensitivity of the Medstat findings to changes in the input file and configuration settings. In Section 7.4, the discussion then turns to specific difficulties have encountered in applying the Medstat grouping software to Medicare claims data. The final section, 7.5, summarizes the Medstat results; due to the technical nature of the findings, some readers may wish to go directly to this summary.

7.1 Reference Results from Medstat Baseline Run

Our 20% sample of continuously enrolled Colorado beneficiaries between 2002 and 2004 consists of 5,049,696 Medicare claims, totaling $585,447,839 in value. As Table 7.1 reveals, the Medstat Baseline run groups these 5.05 million claims into 661,053 episodes in the three year period, with 40.4% of these episodes determined to be chronic and 59.6% determined to be acute. The chronic episodes are relatively more expensive than the acute episodes, accounting for 43.4% of the total claims costs during the period. Nearly 1 in 4 claims are not grouped, although the ungrouped claims account for only 8.4% of the total claims costs.

Table 7.1: Summary Statistics for Claims, Episodes and Costs

All Claims, Medstat Baseline Run

			Fraction of All Episodes			Fraction of all 2002-2004 Claims Costs		
Total # Claims	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	Total Cost in 2002-2004	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in Ungrouped Claims
5,049,696	23.2%	661,053	40.4%	59.6%	$585,447,839	43.4%	48.1%	8.4%

As shown in Table 7.2, about 230,000 of the episodes between 2002 and 2004 are 2003 Touching Episodes, as 2003 is the relevant analysis year. The 2003 Touching Episodes for the Medstat grouper are split between chronic and acute MEGs at about the same rates, with 60.5% acute episodes and 39.5% chronic episodes. Of the 2003 Touching episodes, 56% are deemed complete acute. The higher cost of chronic episodes over the whole period is also true when we restrict our sample to 2003 Touching Episodes; chronic episodes make up a disproportionately large percentage of the cost in the analysis year (though still less than acute episodes in total).

Table 7.2: Episode Cost and Length Percentiles

2003 Touching Episodes, Medstat Baseline Run

	Fraction of All 2003 Touching Episodes				Fraction of All 2003 Touching Episode Costs		
Total # 2003 Touching Episodes	% Chronic Episodes	% Acute Episodes	% 2003 Complete Acute Episodes	Total Cost of 2003 Touching Episodes	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in 2003 Complete Acute Episodes
229,925	39.5%	60.5%	56.0%	$200,786,393	41.4%	58.6%	44.3%

Table 7.3 presents summary statistics on the costs and lengths of 2003 chronic episodes, along with corresponding information on acute episodes making up both Touching and Complete samples. As grouped by the Baseline Medstat run, the average chronic episode in 2003 cost Medicare $916, while the average complete acute episode cost $690. Whereas the average length of chronic episodes equaled 125 days with 2% of these episodes lasting longer than 346 days, the average length of complete acute episodes was 24 days with 2% of these episodes going beyond 255 days. Complete Episodes are a strict subset of Touching Episodes, with the Complete group excluding those episodes that: (1) started in 2003 (or 2002) and lasted into 2004, and (2) started with a clean period overlapping January 1, 2002. Because the excluded episodes either were long enough to extend into 2004 or started earlier in 2002, they tend to have greater lengths on average than those making up the Complete group. Consequently, it is not surprising to see that the average length of episodes in the acute 2003 Touching group exceeded those in

the Complete sample by 13 days, nor is it unexpected to see that the average episode cost in the Touching sample surpassed the average of the Complete sample by about 23%.[60]

Table 7.3: Episode Cost and Length Percentiles

2003 Touching Episodes, Medstat Baseline Run

Type of Episode	Cost and Length per Episode	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,447	$3,982	$11,170	$916	$3,523
	Length per Episode (days)	1	1	101	231	298	328	346	125	120
Acute	Cost per Episode ($)	$21	$40	$83	$341	$1,510	$3,797	$9,082	$845	$3,539
	Length per Episode (days)	1	1	1	30	109	257	357	37	82
2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$257	$1,202	$3,003	$7,316	$690	$2,850
	Length per Episode (days)	1	1	1	18	65	122	255	24	57

Table 7.4 reports episodes and costs per beneficiary for those who had at least one 2003 Touching episode (96.3% of our Colorado sample). During the analysis year, the average beneficiary experiences 6 episodes. A notable range in the number of episodes experienced per beneficiary exists in this period, with the median beneficiary having 5 episodes and the beneficiary at the 95th percentile having 13 episodes. Across all episodes in the period, the average Medicare cost per beneficiary is $5,110. Costs can go much higher, however, with the 98th percentile at $40,842.

[60] 7% of acute Touching Episodes do not qualify for being in the Complete group. Most of these episodes began in 2003 but lasted too long to end in 2003. This 7% had a mean length of 204 days, and an average cost of $2786.

Table 7.4: Episodes and Total Costs per Person

All Beneficiaries with at Least One 2003 Touching Episode, Medstat Baseline Run

Type of Episode	Summary Statistics								
	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
# of Episodes per Person:	2	3	5	8	11	13	15	6	4
Chronic	1	1	2	3	4	5	6	2	1
Acute	0	1	3	5	8	9	11	4	3
2003 Complete Acute	0	1	3	5	7	9	11	3	3
Total Cost per Person	$80	$310	$1,142	$4,189	$14,384	$25,435	$40,842	$5,110	$11,425

Medstat episodes are grouped both by major practice categories (shown in Table 7.5) and by focal disease classifications (shown in Table 7.6 and Table 7.7). In the Baseline run, Medstat's higher level classification shows that episodes classified as musculoskeletal system and connective tissue constitute the largest fraction of all episodes at 16.1%, as well as the highest percentage of complete acute episodes at 11.3%. Circulatory system episodes comprise the second greatest percentage of chronic episodes at 9.5%, after the "Other" category, which combines many chronic diseases to place first with 11.5% of chronic episodes, and third for all episodes (12.9%). Table 7.6 and Table 7.7 provide the more detailed breakdown to focal disease, with summary statistics on costs by focal disease reported in Table 7.6 and episode length by focal disease in Table 7.7.

Table 7.5: Major Diagnostic Category Classifications

2003 Touching Episodes, Medstat Baseline Run

Major Diagnostic Category	% Chronic Episodes	% 2003 Complete Acute Episodes	% Acute Incomplete Episodes	% All Episodes
Musculoskeletal System and Connective Tissue	3.5	11.3	1.3	16.1
Circulatory System	9.5	3.3	0.8	13.6
Other	11.5	1.2	0.2	12.9
EYE	2.7	8.5	0.2	11.4
Digestive System	0.3	6.5	0.2	7.0
Respiratory System	1.9	4.1	0.3	6.3
Skin, Subcutaneous Tissue and Breast	0.9	4.5	0.2	5.6
Ear, Nose Mouth and Throat	0.0	5.1	0.2	5.3
Endocrine, Nutritional and Metabolic System	4.2	0.3	0.0	4.6
Nervous System	1.6	2.4	0.2	4.2
Kidney and Urinary Tract	0.5	2.9	0.2	3.6
Male Reproductive System	1.7	0.3	0.0	2.0
Female Reproductive System	0.5	1.4	0.1	1.9
Blood and Blood Forming Organs and Immunological Disorders	0.2	1.2	0.2	1.6
Mental Diseases and Disorders	0.1	1.0	0.2	1.3
Infectious and Parasitic DDs	0.1	1.1	0.0	1.2
Injuries, Poison, and Toxic Effects of Drugs	.	0.5	0.0	0.5
Hepatobiliary System and Pancreas	0.1	0.3	0.0	0.4
Dental	0.1	0.2	0.0	0.3
Newborn and Other Neonates (Perinatal Period)	0.1	0.0	.	0.1
Human Immunodeficiency Virus Infection	0.0	0.1	0.0	0.1
Burns	.	0.0	0.0	0.0
Genetic Disorders	.	0.0	0.0	0.0
TOTAL	39.5	56.0	4.5	100.0

Table 7.6: Cost Statistics for Individual Focal Disease MEGs

2003 Touching Episodes, Medstat Baseline Run

MEG: Description	Rank		Cost per Episode							Total Cost of 2003 Claims
	Rank in Total Cost	Rank in Std Dev of Cost	10%	50%	90%	98%	Average Cost	Std Dev of Cost	Total Episode Cost	
9: Congestive Heart Failure	18	144	$47	$284	$2,579	$11,037	$1,198	$3,111	$2,330,440	$2,254,568
49: Diabetes Mellitus Type 1 Maintenance	82	181	$41	$188	$1,323	$7,868	$778	$2,497	$544,339	$463,514
50: Diabetes Mellitus Type 2 and Hyperglycemic States Maintenance	16	233	$69	$270	$888	$4,857	$608	$1,739	$2,873,021	$2,572,008
51: Diabetes Mellitus with Complications	86	60	$61	$2,081	$13,094	$30,372	$4,436	$6,773	$483,518	$455,479
336: Neoplasm, Malignant: Prostate	13	125	$40	$180	$4,743	$13,928	$1,674	$3,825	$3,449,336	$3,448,940
348: Fracture: Femur, Head or Neck	8	21	$71	$10,657	$27,886	$40,531	$12,678	$11,518	$5,565,764	$4,254,619
395: Cerebrovascular Dis, Chronic Maintenance	127	129	$40	$133	$2,610	$18,808	$1,221	$3,679	$240,495	$227,783
396: Cerebrovascular Dis with TIA	30	154	$40	$236	$4,332	$9,890	$1,458	$2,978	$1,547,253	$1,435,839
397: Cerebrovascular Dis with Stroke	4	16	$39	$351	$15,022	$43,834	$4,995	$12,586	$6,483,703	$4,713,234
500: Chronic Obstructive Pulmonary Disease	10	117	$44	$551	$4,694	$10,901	$1,967	$4,280	$5,444,646	$5,100,847

Table 7.7: Number, Length, and Timing of Episodes by Focal Disease MEG

2003 Touching Episodes, Medstat Baseline Run

MEG: Description	Number, Length, and Timing of 2003 Touching Episodes										
	Rank			Percentiles					% Start and End in Different Years		
	Rank in # of Claims	Rank in # of Episodes	# of Episodes	20%	50%	80%	Average (days)	Std Dev (days)	Start 2002 End 2003	Start 2003 End 2004	Start 2002 End 2004
9: Congestive Heart Failure	12	25	1,946	6	135	288	151	126	0.6%	1.4%	0.0%
49: Diabetes Mellitus Type 1 Maintenance	62	67	700	1	156	302	160	145	1.9%	9.1%	0.3%
50: Diabetes Mellitus Type 2 and Hyperglycemic States Maintenance	7	11	4,729	98	252	322	221	123	2.6%	7.8%	0.1%
51: Diabetes Mellitus with Complications	211	176	109	1	6	76	45	86	4.6%	8.3%	0.0%
336: Neoplasm, Malignant: Prostate	13	23	2,061	6	169	271	149	117	0.1%	0.2%	0.0%
348: Fracture: Femur, Head or Neck	44	90	439	13	73	133	90	89	16.2%	22.1%	0.0%
395: Cerebrovascular Dis, Chronic Maintenance	149	141	197	1	46	189	91	107	1.5%	1.5%	0.0%
396: Cerebrovascular Dis with TIA	51	48	1,061	1	5	36	30	64	3.5%	4.1%	0.0%
397: Cerebrovascular Dis with Stroke	22	39	1,298	1	26	130	78	114	11.6%	12.0%	0.1%
500: Chronic Obstructive Pulmonary Disease	6	19	2,768	9	219	336	194	141	0.6%	1.3%	0.0%

Finally, Table 7.8 reports the extent to which Medstat successfully groups Medicare claims to episodes for each claim type. IP, SNF, HH and HS claims are virtually always grouped. About three-quarters of PB and OP claims are grouped, but a large share of DME claims – close to half – is not grouped.

Table 7.8: Ungrouped Claims by Claim Type
All Claims, Medstat Baseline Run

Claim Type	# of Claims Ungrouped	% of Claims Ungrouped
IP	176	0.5%
OP	123,849	25.7%
SNF	3	0.0%
HH	11	0.1%
HS	0	0.0%
PB	864,654	21.1%
DME	181,321	44.3%

7.2 Specification of Complete Episodes

For the Baseline results shown so far, we have analyzed samples consisting of all claims grouped to episodes in the 2002-04 period, or all claims grouped to 2003 Touching Episodes. These samples offer useful data sources for examining the ways in which Medstat groups claims into episodes, but, as we have discussed previously, studies conducting physician attribution typically restrict samples to include only episodes deemed complete by a grouper algorithm and selected to create a sample representative of the medical treatments and costs for the time horizon under analysis. Most acute 2003 Touching Episodes meet Medstat's definition of complete, in that most have sufficiently long MEG-specific clean periods before and after start and end dates. Medstat defines completeness for chronic episodes by annual periods, so all claims grouped to chronic episodes within a 12 month time frame are designated as complete by the MEG grouper. In addition to being in the 2003 Touching sample and being marked as complete by the grouping software, our sample of 2003 Complete Episodes also requires two additional conditions: (1) included acute episodes must have started longer than a clean period after January 1, 2002 and must have ended in 2003; and (2) chronic episodes must have ended in 2003. These conditions limit the Complete sample to episodes with well-defined start dates in

2002 or 2003, and eliminate episodes that end in 2004. Most episodes that end in 2004 become members of the 2004 Complete sample. As already discussed in Sections 3.1.2 and 5.2, and as will be shown below for Medstat, the collection of 2003 Complete Episodes provides a sample that is representative of the cost of finalized medical treatments for the year 2003.

Table 7.9 displays the role of clean periods in defining the share of 2003 Touching Episodes allocated to 2003 Complete Episodes. The top portion of the table presents summary statistics for the top 10 cost acute MEGs, and the bottom part of the table lists analogous findings for the top 10 chronic MEGs. The first column lists the rank by cost considering all episode types, and the second column shows the number of episodes for each MEG in the 2003 Touching sample. The next column presents the fraction of 2003 Touching episodes that start within a clean period of January 1st, 2002—the length of the relevant clean period varies by MEG—and shows that only a small share of 2003 Touching episodes are dropped by this requirement for defining our formulation of Complete episodes. Arrhythmias episodes show the largest share within the MEG's clean period from the beginning of 2002, at 4.5%, with the remaining top 10 acute MEGs showing less than 2% of episodes that cannot be considered complete by this criterion. The fourth column presents statistics on the fraction of episodes that are separated from other episodes of the same type by less than a clean period, using our designation of episode dates and the clean period for the assigned MEG. The results show that the share of acute episodes starting within a clean period of an adjacent episode in the same MEG ranges from a low of 0.1% for cataract episodes to a high of 20.3% for arrhythmias episodes. Finally, the fifth column shows that, although rare, there are a number of acute MEG episodes of the same type that overlap in time.

For chronic MEGs, Table 7.9 demonstrates that the majority of episodes in the 2003 Touching group immediately follow an episode of the same type.[61] Chronic episodes run as uninterrupted events for individuals between 53% and 87% of the time depending on the type of chronic condition. This is consistent with the perspective that chronic conditions embody a persistent illness that the MEG grouper divides into annual observation periods. We also see a

[61] Medstat assigns all chronic MEGs a clean period of 999 as a placeholder. In this report we use 365 days as the clean period for chronic MEGs, since Medstat uses an annual cutoff for such episodes rather than actually using the clean periods. Under an annual cutoff, claims dated one year apart should always be grouped to different episodes.

number of overlapping chronic episodes in the last column of the table, although this is likely a consequence of our episode dates differing from dates assigned by Medstat. Among chronic MEGs with more than 90% of their claim costs in 2003, 8% include claims in either 2002 or 2004, with most of those in 2004.

As discussed in Section 5.2, statistics calculated using the 2003 Touching Episodes overestimate the length and cost of treatments that occurred during 2003. Episodes that overlap periods are, on average, longer and more costly than those that are inclusive within a period. The Touching sample disproportionately incorporates such overlap episodes since it includes episodes that straddle either 2002-03 or 2003-04. To create a sample that is representative of finalized medical care for an annual period, researchers can select episodes either that end in the period or that start in the period; this limits the sample to include only episodes that overlap one end of a period, along with episodes fully contained within the period. The group of 2003 Complete Episodes is such a sample.[62]

Table 7.10 compares the total costs of the top 10 cost acute MEGs using the 2003 Complete and Touching samples along with the samples consisting of all claims in 2003 grouped to the corresponding MEG types.[63] Inspection of the results reveals that costs for Complete Episodes are sometimes higher and at other time lower than total cost of annual claims for individual acute MEGs, but in all instances Complete Episodes costs more closely approximate annual claim costs than do Touching Episodes. Accumulating across all acute MEGs reported at the bottom of the table, Complete Episodes are about 94% of annual claims costs. This occurs even though 2003 Complete Episodes include a significant share of costs from 2002 claims. These costs, however, are offset by the set of claims that contribute to 2003 claims costs but are grouped to episodes ending in 2004.

Table 7.11 shows a similar pattern for chronic MEGs. For 8 of the top 10 chronic MEGs, we see at most only a 3% difference between Complete total costs and annual costs for grouped 2003 claims. Type 2 diabetes and congestive heart failure episodes are the exceptions, with Complete costs being 89% and 87% of annual claims costs respectively. Considering total costs

[62] Footnote 59 and Tables 7.10 and 7.11 illustrate the degree to which the Touching Episodes sample overestimates per episode costs of medical care overall and for particular MEGs. As noted previously, this phenomena is termed length-biased in the sampling statistical duration literature.
[63] We define a 2003 claim as one that has a service start date in 2003.

aggregated across all chronic MEGs listed in the bottom row of the table, we see that less than a 2% difference exists in cost between 2003 Complete Episodes and 2003 claims grouped to chronic ETGs; the costs for the Touching sample exceed 2003 annual costs by more than 4%.

Table 7.12 presents statistics depicting the distribution of per episode costs for the top-5-cost acute MEGs, the top-5 chronic MEGs, and for all MEGs combined reported at the bottom of the table. In addition to means and standard deviations, this table reports several percentiles of the distributions to convey the extent of variation in costs across episodes within MEG classifications. The distributions exhibit substantial dispersion in costs across episodes within a MEG. For each of the top five highest-cost acute and chronic MEGs, the level of cost demarking the most expensive 10% of episodes (i.e., the 90th percentile) always exceeds the level demarking the cheapest 10% (i.e., the 10th percentile) by at least an order of magnitude, and in most instances it is more than two orders of magnitude larger. Even for Pneumonia, which is one of the less extreme cases, its cheapest 10% of episodes costs $40 or less, while the most expensive 10% of episodes cost $7,332 or more per episode. The table further reveals that the highest-cost episodes account for large shares of total MEG costs. Considering the total costs for all MEGs, the last row and column shows that 67.3% of these costs are incurred by the most expensive 5% of episodes. Among the top 5 acute MEGs, the most expensive 5% of episodes account for 25.2% to 48.4% of total MEG costs. For the top 5 chronic MEGs, the most expensive 5% account for 34.6% to 63.8% of all costs in that MEG. Overall, Table 7.12 demonstrates that considerable variation exists in the costs of individual episodes within a MEG.

Table 7.9: Clean Period Statistics by MEG

2003 Touching Episodes, Medstat Baseline Run

MEG: Description	Rank in Total Cost: All MEGs	# of Episodes	% Within a Clean Period of January 1, 2002	% Within a Clean Period of Another Episode of Same MEG	# of Overlapping Episodes
Top Ten Acute MEGs by Costs					
11: Acute Myocardial Infarction	3	596	0.0%	1.7%	2
397: Cerebrovascular Dis with Stroke	4	1,298	1.3%	10.2%	33
510: Pneumonia: Bacterial	5	1,762	0.3%	0.7%	2
6: Arrhythmias	6	5,356	4.5%	20.3%	52
426: Complications of Surgical and Medical Care	7	1,180	0.2%	2.2%	10
348: Fracture: Femur, Head or Neck	8	439	0.7%	3.2%	1
92: Cataract	9	12,593	0.1%	0.1%	6
391: Other Spinal and Back Disorders	14	3,953	0.3%	1.4%	7
389: Other Arthropathies, Bone and Joint Disorders	15	10,089	1.6%	7.8%	16
189: Urinary Tract Infections	19	3,115	0.1%	1.2%	7
Top Ten Chronic MEGs by Costs					
374: Osteoarthritis	1	6,741	0.7%	63.1%	39
10: Angina Pectoris, Chronic Maintenance	2	4,891	0.5%	75.8%	27
500: Chronic Obstructive Pulmonary Disease	10	2,768	0.7%	67.6%	36
430: Encounter for Preventive Health Services	11	25,439	0.0%	80.9%	8
13: Essential Hypertension	12	13,238	0.2%	73.3%	24
336: Neoplasm, Malignant: Prostate	13	2,061	0.1%	77.2%	0
50: Diabetes Mellitus Type 2 and Hyperglycemic States	16	4,729	2.8%	86.9%	303
187: Renal Failure	17	596	0.3%	53.5%	3
9: Congestive Heart Failure	18	1,946	0.6%	62.6%	28
160: Neoplasm, Malignant: Colon and Rectum	21	391	1.8%	69.8%	13

Table 7.10: Comparison of 2003 Touching and 2003 Complete Samples for Acute MEGs

Medstat Baseline Run

MEG: Description	2003 Touching Episodes			2003 Complete Episodes			Grouped Claims in 2003
	Rank in Total Cost: Acute MEGs	Total Episode Costs	# of 2003 Touching Episodes	Rank in Total Cost: Acute MEGs	Total Episode Costs	# of 2003 Complete Episodes	Total Cost of 2003 Claims
11: Acute Myocardial Infarction	1	$6,618,364	596	1	$6,049,496	548	$5,969,031
397: Cerebrovascular Dis with Stroke	2	$6,483,703	1,298	5	$4,229,642	1,125	$4,713,234
510: Pneumonia: Bacterial	3	$6,117,923	1,762	4	$4,471,679	1,558	$5,206,059
6: Arrhythmias	4	$6,023,777	5,356	7	$3,527,237	3,979	$4,216,433
426: Complications of Surgical and Medical Care	5	$5,926,753	1,180	3	$4,881,653	1,103	$4,991,811
348: Fracture: Femur, Head or Neck	6	$5,565,764	439	6	$3,847,990	339	$4,254,619
92: Cataract	7	$5,477,331	12,593	2	$5,006,152	12,377	$5,052,603
391: Other Spinal and Back Disorders	8	$3,352,839	3,953	8	$2,316,587	3,521	$2,363,119
389: Other Arthropathies, Bone and Joint Disorders	9	$3,318,956	10,089	9	$2,286,344	8,737	$2,454,671
189: Urinary Tract Infections	10	$2,323,329	3,115	12	$1,705,342	2,933	$1,934,798
Total for All Acute MEGs	--	$117,600,770	139,137	--	$88,887,264	128,830	$95,004,647

Table 7.11: Comparison of 2003 Touching and 2003 Complete Samples for Chronic MEGs

Medstat Baseline Run

MEG: Description	2003 Touching Episodes			2003 Complete Episodes			Grouped Claims in 2003
	Rank in Total Cost: Chronic MEGs	Total Episode Costs	# of 2003 Touching Episodes	Rank in Total Cost: Chronic MEGs	Total Episode Costs	# of 2003 Complete Episodes	Total Cost of 2003 Claims
374: Osteoarthritis	1	$15,948,028	6,741	1	$15,397,575	6,694	$15,283,155
10: Angina Pectoris, Chronic Maintenance	2	$9,144,631	4,891	2	$8,917,133	4,872	$8,852,789
500: Chronic Obstructive Pulmonary Disease	3	$5,444,646	2,768	3	$5,084,125	2,732	$5,100,847
430: Encounter for Preventive Health Services	4	$4,889,198	25,439	4	$4,633,195	25,396	$4,778,575
13: Essential Hypertension	5	$4,627,912	13,238	5	$4,364,827	13,196	$4,472,797
336: Neoplasm, Malignant: Prostate	6	$3,449,336	2,061	6	$3,411,592	2,057	$3,448,940
50: Diabetes Mellitus Type 2 and Hyperglycemic States	7	$2,873,021	4,729	8	$2,293,547	4,352	$2,572,008
187: Renal Failure	8	$2,517,158	596	7	$2,431,194	591	$2,506,834
9: Congestive Heart Failure	9	$2,330,440	1,946	10	$1,965,883	1,919	$2,254,568
160: Neoplasm, Malignant: Colon and Rectum	10	$2,285,561	391	9	$2,140,778	384	$2,122,632
Total for All Chronic MEGs	--	$83,185,623	90,788	--	$78,351,850	89,979	$79,781,901

Table 7.12: Cost Distributions of Top 5 Acute and Chronic MEGs by Total Cost

2003 Complete Episodes, Medstat Baseline Run

MEG: Description	Summary Statistics									Fraction of Cost in Top 2% of Episodes of this MEG	Fraction of Cost in Top 5% of Episodes of this MEG
	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev		
Top 5 Acute MEGs by Cost											
11: Acute Myocardial Infarction	$63	$362	$7,215	$14,590	$28,532	$35,641	$48,047	$11,039	$14,979	13.9%	25.2%
92: Cataract	$0	$48	$72	$207	$1,476	$1,820	$2,898	$404	$739	16.0%	34.9%
426: Complications of Surgical and Medical Care	$40	$103	$628	$5,482	$13,650	$19,811	$29,329	$4,426	$7,806	18.6%	34.7%
510: Pneumonia: Bacterial	$40	$81	$348	$4,264	$7,332	$11,885	$17,752	$2,870	$5,385	20.7%	35.5%
397: Cerebrovascular Dis with Stroke	$35	$63	$247	$3,541	$10,760	$19,074	$33,273	$3,760	$9,592	28.6%	48.4%
Top 5 Chronic MEGs by Cost											
374: Osteoarthritis	$40	$109	$361	$1,236	$9,485	$14,405	$20,901	$2,300	$5,314	23.7%	46.3%
10: Angina Pectoris, Chronic Maintenance	$44	$100	$285	$1,099	$4,066	$10,493	$19,495	$1,830	$4,830	31.7%	53.5%
500: Chronic Obstructive Pulmonary Disease	$43	$113	$527	$2,485	$4,595	$6,209	$9,693	$1,861	$4,008	22.5%	34.6%
430: Encounter for Preventive Health Services	$15	$18	$43	$105	$226	$454	$1,277	$182	$977	52.2%	63.8%
13: Essential Hypertension	$33	$63	$121	$226	$441	$809	$2,890	$331	$1,383	42.7%	55.8%
All Acute and Chronic MEGs	$18	$40	$92	$291	$1,263	$3,286	$8,648	$764	$3,081	47.1%	67.3%

7.3 Sensitivity of Findings to Changes in Medstat Input and Configuration Files

The Baseline settings described in Section 7.1 above constitute what we have determined to be the best method for running Medstat in order to group Medicare claims into episodes of care with the eventual goal of physician attribution. Our choice of the Baseline settings is based on the recommended settings of the grouper as well as on testing the available options to determine their impact. In this section we explore how the results from the Baseline differ if we change the input file structure and configuration settings. We repeat the analysis for the Baseline run in Section 7.1 for 14 additional runs. Table 7.12 describes how each of these 14 runs differs from the Baseline. Seven of these runs (2-8) test the impact of varying the input file, by changing the diagnosis codes, procedure codes, and x-ray/lab flags. Additionally, we change each of the configuration options in turn to analyze the impact of the options offered by Medstat (runs 9-15).

Tables 7.14, 7.15, 7.17 and 7.18 combine the output of the 15 runs, summarizing the results so that they are comparable to those presented in Tables 7.1 to 7.4. (Tables on Major Diagnostic categories and episode types for each run are omitted in this report due to their length, but are available on request.) Table 7.19 combines the results of the 15 runs summarizing the number of ungrouped claims by claim type corresponding to the findings given in Table 7.8.

Table 7.16 shows shifts of claims and their associated costs to episodes with different MEGs and/or different start/end dates as a result of changing the baseline settings. We identify a claim as changing MEGs by comparing the MEG classification for a claim from the baseline run to the MEG assigned to a claim in comparison run. When a claim experiences such a shift, there's no question that it has switched episodes; and, so, the first two columns of Table 7.16 provide lower bounds on the reassignment of claims and costs attributable to prescribed variation in the Baseline run. We further infer a claim as changing episodes by comparing the start and end dates of its assigned episode under the two regimes. If a start date or end date changes, this implies that the claim has moved to another episode, or that another claim has been assigned to the episode that changes the episode's start or end date; in either case the composition of the episode the claim is in has changed. Depending on the circumstances of an episode's date change, the figures in Table 7.16 presented for these shifts give ranges above the lower bound on

how many claims and costs switched episodes in response to the alteration in the baseline run. [64]

7.3.1 Varying Diagnosis Codes (Runs 2 through 4)

To assess the influence of diagnosis codes on Medstat's grouping process, we test the effects of altering the diagnosis list used for input. This includes using the first diagnosis code as the only diagnosis code (Run 2), using the admitting diagnosis code as the primary or first diagnosis (Run 3), and using the admitting diagnosis as the only diagnosis code (Run 4).

Table 7.13: Medstat Input File and Configuration File Runs

Run #	Change to	Description
Baseline (Run 1)	--	Input and configuration files as described in section 7.1 and 7.2
Run 2	**Input file**	Use only the first listed diagnosis code.
Run 3	**Input file**	Use the admitting diagnosis code (for IP and SNF) as the first diagnosis code.
Run 4	**Input file**	Use the admitting diagnosis code (for IP and SNF) as the only diagnosis code. For other claims, use the first listed diagnosis code.
Run 5	**Input file**	All procedure codes are blanked out.
Run 6	**Input file**	All x-ray/lab flags are set to 0.
Run 7	**Input file**	X-ray/lab flags are set to 1 for SNF and HS.
Run 8	**Input file**	Reorder input records.
Run 9	**Configuration**	Build Admissions set to 'NO'.
Run 10	**Configuration**	Episode limit is set to 1.
Run 11	**Configuration**	Episode limit is set to 180.
Run 12	**Configuration**	Episode limit is set to 730.
Run 13	**Configuration**	Episode limit is set to 9999 ("Unlimited").
Run 14	**Configuration**	Stratify Chronic is set to 'NO'
Run 15	**Configuration**	Set Lookback Period to 45 Days

[64] See footnote 44 and associated discussion in Section 5.3.

Table 7.14: Summary Statistics for Variations on Input and Configuration Files

All Claims, Medstat

Run #	% Ungrouped Claims	Total # Episodes	Fraction of All Episodes		Fraction of all 2002-2004 Claims Costs		
			% Chronic Episodes	% Acute Episodes	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in Ungrouped Claims
Baseline (Run 1)	23.2%	661,053	40.4%	59.6%	43.4%	48.1%	8.4%
Run 2	23.2%	657,268	40.4%	59.6%	44.4%	47.2%	8.4%
Run 3	23.1%	660,423	40.4%	59.6%	44.2%	47.3%	8.5%
Run 4	23.1%	656,698	40.4%	59.6%	44.9%	46.6%	8.5%
Run 5	23.2%	659,105	40.4%	59.6%	43.4%	48.2%	8.4%
Run 6	0.4%	918,768	40.9%	59.1%	48.4%	51.3%	0.3%
Run 7	23.3%	660,274	40.4%	59.6%	41.9%	46.7%	11.5%
Run 8	23.2%	661,046	40.4%	59.6%	43.4%	48.1%	8.4%
Run 9	23.1%	661,175	40.4%	59.6%	44.3%	47.4%	8.3%
Run 10	26.7%	1,060,023	25.4%	74.6%	45.7%	44.2%	10.1%
Run 11	23.5%	673,556	40.0%	60.0%	44.2%	47.2%	8.6%
Run 12	22.9%	656,375	40.6%	59.4%	43.3%	48.4%	8.3%
Run 13	22.9%	654,970	40.6%	59.4%	43.2%	48.5%	8.2%
Run 14	23.0%	656,812	41.5%	58.5%	50.2%	41.5%	8.3%
Run 15	22.5%	661,053	40.4%	59.6%	43.5%	48.3%	8.2%

Table 7.15: Summary Statistics for Variations on Input and Configuration Files

2003 Touching Episodes, Medstat

Run #	Total # 2003 Touching Episodes	Fraction of All 2003 Touching Episodes			Fraction of All 2003 Touching Episode Costs		
		% Chronic Episodes	% Acute Episodes	% 2003 Complete Acute Episodes	% of Costs in Chronic Episodes	% of Costs in Acute Episodes	% of Costs in 2003 Complete Acute Episodes
Baseline (Run 1)	229,925	39.5%	60.5%	56.0%	41.4%	58.6%	44.3%
Run 2	228,721	39.5%	60.6%	56.1%	42.2%	57.9%	43.3%
Run 3	229,766	39.5%	60.5%	56.0%	41.8%	58.2%	43.6%
Run 4	228,581	39.4%	60.6%	56.0%	42.1%	57.9%	42.9%
Run 5	229,333	39.5%	60.5%	56.0%	41.4%	58.6%	44.3%
Run 6	317,498	39.7%	60.3%	55.8%	42.1%	57.9%	42.5%
Run 7	229,648	39.5%	60.5%	56.1%	41.4%	58.6%	44.7%
Run 8	229,923	39.5%	60.5%	56.0%	41.4%	58.6%	44.3%
Run 9	229,958	39.5%	60.5%	56.0%	42.2%	57.8%	43.5%
Run 10	356,768	25.7%	74.3%	74.1%	50.1%	49.9%	47.5%
Run 11	233,716	39.2%	60.8%	57.1%	43.5%	56.5%	45.6%
Run 12	228,313	39.6%	60.4%	55.4%	40.3%	59.7%	41.3%
Run 13	228,286	39.6%	60.4%	55.4%	39.9%	60.1%	40.8%
Run 14	228,390	40.5%	59.5%	55.1%	48.7%	51.3%	38.4%
Run 15	230,302	39.5%	60.5%	56.0%	41.5%	58.5%	44.0%

Table 7.16: Claims Grouped to Different Episodes by Variations on Input and Configuration Files

All Claims, Medstat

Run #	% of Claims that Change MEG	% of Total Cost in Claims that Change MEG	% of Claims that Change Episode Dates	% of Total Cost in Claims that Change Episode Dates	% of Claims that Change MEG or Episode Dates	% of Total Cost in Claims that Change MEG or Episode Dates
Run 2	1.1%	5.6%	2.5%	8.1%	2.7%	8.7%
Run 3	0.7%	10.2%	1.5%	11.0%	1.6%	12.1%
Run 4	1.7%	14.7%	3.8%	17.6%	4.1%	19.1%
Run 5	0.6%	1.1%	1.7%	3.3%	1.8%	3.4%
Run 6	28.9%	15.0%	37.0%	27.5%	38.5%	28.9%
Run 7	0.2%	2.3%	0.4%	3.7%	0.4%	3.7%
Run 8	0.2%	0.2%	0.3%	0.5%	0.4%	0.6%
Run 9	0.1%	3.8%	0.4%	5.0%	0.4%	5.0%
Run 10	8.6%	7.3%	29.7%	39.7%	29.9%	40.1%
Run 11	2.2%	1.6%	9.3%	8.1%	9.5%	8.2%
Run 12	1.3%	1.0%	5.9%	4.3%	5.9%	4.3%
Run 13	1.6%	1.1%	6.3%	4.5%	6.3%	4.5%
Run 14	1.6%	7.0%	1.5%	5.9%	2.0%	7.6%
Run 15	0.6%	0.3%	3.3%	3.5%	3.3%	3.5%

Table 7.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files

2003 Touching Episodes, Medstat

Run #	Type of Episode	Cost and Length per Episode	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,447	$3,982	$11,170	$916	$3,523
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$341	$1,510	$3,797	$9,082	$845	$3,539
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$257	$1,202	$3,003	$7,316	$690	$2,850
		Length per Episode (days)	1	1	1	18	65	122	255	24	57
Run 2	Chronic	Cost per Episode ($)	$18	$45	$121	$341	$1,419	$4,063	$11,548	$941	$3,754
		Length per Episode (days)	1	1	103	232	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$338	$1,513	$3,812	$9,060	$842	$3,473
		Length per Episode (days)	1	1	1	30	109	259	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$254	$1,192	$2,996	$7,252	$681	$2,748
		Length per Episode (days)	1	1	1	18	65	122	257	24	57
Run 3	Chronic	Cost per Episode ($)	$18	$44	$120	$343	$1,486	$4,121	$11,397	$928	$3,522
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$339	$1,492	$3,743	$8,989	$843	$3,558
		Length per Episode (days)	1	1	1	30	109	258	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$255	$1,159	$2,934	$7,135	$682	$2,935
		Length per Episode (days)	1	1	1	18	65	122	256	24	57
Run 4	Chronic	Cost per Episode ($)	$18	$45	$121	$342	$1,462	$4,166	$11,583	$944	$3,651
		Length per Episode (days)	1	1	103	232	298	328	346	126	120
	Acute	Cost per Episode ($)	$21	$40	$83	$336	$1,497	$3,780	$9,067	$845	$3,538
		Length per Episode (days)	1	1	1	30	110	260	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$251	$1,151	$2,939	$7,114	$676	$2,865
		Length per Episode (days)	1	1	1	18	65	122	257	24	57
Run 5	Chronic	Cost per Episode ($)	$18	$45	$121	$345	$1,430	$3,949	$11,176	$918	$3,541
		Length per Episode (days)	1	1	102	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$341	$1,520	$3,811	$9,105	$849	$3,552
		Length per Episode (days)	1	1	1	30	109	259	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$256	$1,212	$3,020	$7,355	$693	$2,865
		Length per Episode (days)	1	1	1	18	64	122	257	24	57

Table 7.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Medstat

Run #	Type of Episode	Cost and Length per Episode	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 6	Chronic	Cost per Episode ($)	$17	$43	$109	$306	$1,086	$2,689	$8,159	$733	$2,989
		Length per Episode (days)	1	1	87	223	295	326	344	119	119
	Acute	Cost per Episode ($)	$8	$31	$72	$238	$1,124	$2,740	$6,790	$664	$3,065
		Length per Episode (days)	1	1	1	29	114	279	358	37	84
	2003 Complete Acute	Cost per Episode ($)	$7	$29	$64	$179	$742	$1,992	$5,360	$527	$2,471
		Length per Episode (days)	1	1	1	15	63	128	263	23	58
Run 7	Chronic	Cost per Episode ($)	$18	$44	$120	$338	$1,374	$3,790	$10,828	$888	$3,458
		Length per Episode (days)	1	1	100	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$337	$1,484	$3,664	$8,619	$820	$3,458
		Length per Episode (days)	1	1	1	30	109	256	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$255	$1,167	$2,942	$7,079	$675	$2,801
		Length per Episode (days)	1	1	1	18	64	122	255	24	57
Run 8	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,447	$3,982	$11,172	$916	$3,523
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$341	$1,511	$3,801	$9,082	$845	$3,538
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$257	$1,202	$3,006	$7,325	$690	$2,845
		Length per Episode (days)	1	1	1	18	65	122	256	24	57
Run 9	Chronic	Cost per Episode ($)	$18	$45	$121	$346	$1,528	$4,321	$11,488	$934	$3,410
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$84	$342	$1,525	$3,881	$9,134	$833	$3,374
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$258	$1,224	$3,069	$7,413	$677	$2,691
		Length per Episode (days)	1	1	1	18	65	122	255	24	57
Run 10	Chronic	Cost per Episode ($)	$18	$47	$125	$365	$1,630	$4,317	$11,714	$977	$3,684
		Length per Episode (days)	1	1	110	238	303	332	349	129	121
	Acute	Cost per Episode ($)	$15	$29	$50	$98	$363	$1,236	$3,803	$337	$1,890
		Length per Episode (days)	1	1	1	1	3	11	17	3	13
	2003 Complete Acute	Cost per Episode ($)	$15	$29	$50	$98	$355	$1,153	$3,640	$321	$1,753
		Length per Episode (days)	1	1	1	1	3	11	16	2	7

Table 7.17: Episode Cost and Length Percentiles for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Medstat

Run #	Type of Episode	Cost and Length per Episode	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 11	Chronic	Cost per Episode ($)	$18	$45	$121	$350	$1,497	$4,010	$11,183	$925	$3,538
		Length per Episode (days)	1	1	104	232	299	329	346	126	120
	Acute	Cost per Episode ($)	$21	$40	$83	$304	$1,360	$3,376	$8,319	$774	$3,237
		Length per Episode (days)	1	1	1	31	106	162	176	28	51
	2003 Complete Acute	Cost per Episode ($)	$19	$40	$75	$257	$1,127	$2,889	$7,036	$666	$2,727
		Length per Episode (days)	1	1	1	21	74	142	173	22	43
Run 12	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,446	$3,982	$11,164	$916	$3,521
		Length per Episode (days)	1	1	100	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$350	$1,562	$4,121	$9,569	$890	$3,723
		Length per Episode (days)	1	1	1	29	106	277	561	45	120
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$72	$244	$1,120	$2,942	$7,167	$671	$2,801
		Length per Episode (days)	1	1	1	16	59	103	191	21	52
Run 13	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,446	$3,982	$11,164	$916	$3,521
		Length per Episode (days)	1	1	100	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$350	$1,581	$4,174	$9,737	$901	$3,786
		Length per Episode (days)	1	1	1	29	106	274	580	48	139
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$72	$243	$1,115	$2,937	$7,144	$668	$2,792
		Length per Episode (days)	1	1	1	16	58	101	187	21	51
Run 14	Chronic	Cost per Episode ($)	$18	$45	$122	$359	$1,672	$4,650	$12,925	$1,048	$4,065
		Length per Episode (days)	1	1	100	231	299	329	346	125	120
	Acute	Cost per Episode ($)	$20	$40	$81	$325	$1,424	$3,327	$7,714	$754	$3,093
		Length per Episode (days)	1	1	1	30	108	256	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$72	$245	$1,070	$2,729	$6,089	$609	$2,409
		Length per Episode (days)	1	1	1	18	64	120	253	24	57
Run 15	Chronic	Cost per Episode ($)	$18	$45	$121	$346	$1,473	$4,024	$11,221	$925	$3,546
		Length per Episode (days)	1	1	102	232	299	329	347	125	120
	Acute	Cost per Episode ($)	$21	$40	$85	$346	$1,517	$3,815	$9,100	$849	$3,542
		Length per Episode (days)	1	1	1	32	111	260	360	38	83
	2003 Complete Acute	Cost per Episode ($)	$19	$40	$74	$261	$1,208	$3,006	$7,332	$692	$2,851
		Length per Episode (days)	1	1	1	21	66	123	253	24	57

Table 7.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files

2003 Touching Episodes, Medstat

Run #	# of Episodes and Cost per Person	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,189	$14,384	$25,435	$40,842	$5,110	$11,425
Run 2	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,204	$14,368	$25,475	$41,047	$5,128	$11,482
Run 3	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,198	$14,406	$25,444	$40,877	$5,125	$11,494
Run 4	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	10	3	3
	Total Cost per Person	$80	$310	$1,142	$4,214	$14,406	$25,465	$40,994	$5,142	$11,549
Run 5	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,194	$14,361	$25,443	$40,927	$5,115	$11,443

Table 7.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Medstat

Run #	# of Episodes and Cost per Person	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 6	# of Episodes per Person:	2	4	7	11	15	18	21	8	5
	Chronic	1	2	3	4	6	7	8	3	2
	Acute	1	2	4	7	10	12	15	5	4
	2003 Complete Acute	1	2	4	6	9	11	14	4	4
	Total Cost per Person	$119	$438	$1,508	$4,962	$15,110	$26,376	$42,309	$5,552	$11,767
Run 7	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$309	$1,138	$4,160	$13,932	$24,378	$38,896	$4,950	$10,983
Run 8	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,191	$14,395	$25,435	$40,877	$5,111	$11,420
Run 9	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,199	$14,387	$25,304	$40,799	$5,110	$11,379
Run 10	# of Episodes per Person:	2	3	6	11	19	26	35	9	9
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	2	4	9	16	23	32	7	9
	2003 Complete Acute	0	2	4	9	16	23	32	7	9
	Total Cost per Person	$77	$287	$968	$3,533	$12,774	$23,236	$37,835	$4,554	$10,487

Table 7.18: Episodes and Total Costs per Person for Variations on Input and Configuration Files (Continued)

2003 Touching Episodes, Medstat

Run #	# of Episodes and Cost per Person	Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Run 11	# of Episodes per Person:	2	3	5	8	11	13	16	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	10	12	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$307	$1,110	$4,019	$13,925	$24,794	$40,041	$4,956	$11,090
Run 12	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	7	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	8	10	3	3
	Total Cost per Person	$81	$315	$1,174	$4,366	$14,716	$25,799	$41,538	$5,228	$11,617
Run 13	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	7	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	8	10	3	3
	Total Cost per Person	$81	$316	$1,183	$4,414	$14,798	$26,005	$41,715	$5,270	$11,698
Run 14	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	2
	Acute	0	1	3	5	7	9	11	3	3
	2003 Complete Acute	0	1	3	5	7	8	10	3	3
	Total Cost per Person	$80	$310	$1,141	$4,171	$14,309	$25,259	$40,639	$5,076	$11,312
Run 15	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$81	$312	$1,154	$4,248	$14,498	$25,547	$41,217	$5,152	$11,491

Table 7.19: Ungrouped Claims by Claim Type for Variations on Input and Configuration Files

All Claims, Medstat

Claim Type	Baseline (Run 1) # Ungrouped	Baseline (Run 1) % Ungrouped	Run 2 # Ungrouped	Run 2 % Ungrouped	Run 3 # Ungrouped	Run 3 % Ungrouped	Run 4 # Ungrouped	Run 4 % Ungrouped	Run 5 # Ungrouped	Run 5 % Ungrouped
IP	176	0.5%	176	0.5%	170	0.5%	170	0.5%	176	0.5%
OP	123,849	25.7%	122,751	25.5%	123,795	25.7%	122,675	25.4%	123,128	25.5%
SNF	3	0.0%	7	0.1%	139	1.5%	145	1.6%	3	0.0%
HH	11	0.1%	11	0.1%	11	0.1%	11	0.1%	11	0.1%
HS	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
PB	864,654	21.1%	865,678	21.1%	861,098	21.0%	862,120	21.0%	865,300	21.1%
DME	181,321	44.3%	181,661	44.4%	181,126	44.2%	181,479	44.3%	181,682	44.4%

Claim Type	Run 6 # Ungrouped	Run 6 % Ungrouped	Run 7 # Ungrouped	Run 7 % Ungrouped	Run 8 # Ungrouped	Run 8 % Ungrouped	Run 9 # Ungrouped	Run 9 % Ungrouped	Run 10 # Ungrouped	Run 10 % Ungrouped
IP	176	0.5%	176	0.5%	176	0.5%	11	0.0%	176	0.5%
OP	56	0.0%	124,099	25.7%	123,849	25.7%	123,720	25.7%	148,589	30.8%
SNF	3	0.0%	3,394	36.4%	3	0.0%	3	0.0%	3	0.0%
HH	11	0.1%	11	0.1%	11	0.1%	11	0.1%	11	0.1%
HS	0	0.0%	1,773	57.5%	0	0.0%	0	0.0%	0	0.0%
PB	12,123	0.3%	865,759	21.1%	864,654	21.1%	863,841	21.1%	976,571	23.8%
DME	8,681	2.1%	181,750	44.4%	181,321	44.3%	181,156	44.2%	223,813	54.7%

Claim Type	Run 11 # Ungrouped	Run 11 % Ungrouped	Run 12 # Ungrouped	Run 12 % Ungrouped	Run 13 # Ungrouped	Run 13 % Ungrouped	Run 14 # Ungrouped	Run 14 % Ungrouped	Run 15 # Ungrouped	Run 15 % Ungrouped
IP	176	0.5%	176	0.5%	176	0.5%	176	0.5%	176	0.5%
OP	125,407	26.0%	123,117	25.5%	122,845	25.5%	122,918	25.5%	119,101	24.7%
SNF	3	0.0%	3	0.0%	3	0.0%	3	0.0%	3	0.0%
HH	11	0.1%	11	0.1%	11	0.1%	11	0.1%	11	0.1%
HS	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
PB	869,427	21.2%	862,302	21.0%	861,444	21.0%	859,812	21.0%	840,501	20.5%
DME	192,104	46.9%	173,081	42.3%	170,474	41.6%	180,213	44.0%	178,695	43.6%

Overall, variations in this inputted diagnosis information do not affect the creation and grouping of episodes as measured by the statistics presented in Tables 7.14-7.18. Essentially no changes occur in the fraction of claims grouped into episodes, in the number of episodes created or in the compositional breakdown of episodes into acute and chronic classifications (Table 7.14 and 7.15). Moreover, no changes can be seen in the distributional properties of chronic and acute episodes and in the number and cost of episodes per person for Runs 2-4 in Tables 7.17-7.18.[65]

SNF claims are the main claim type that is sensitive to the introduction of the admitting diagnosis. Table 7.19 shows the breakdown of ungrouped claims based on the file type for the different runs, and Table 7.20 shows the absolute change in the number of ungrouped claims per claim type in response to changing diagnoses codes. When the admitting diagnosis is used for SNF claims over 1% fewer claims are grouped to episodes. The fraction of ungrouped claims changes for other claim types as well, but by a much smaller amount.

Table 7.20: Change in Number of Ungrouped Claims when Varying Diagnosis Codes
All Claims, Medstat

Claim Type	Only 1 Diagnosis Code Used (Run 2)		First Diagnosis = Admit Diagnosis (Run 3)		Only Diagnosis = Admit Diagnosis (Run 4)	
	#	%	#	%	#	%
IP	0	0.0%	6	0.0%	6	0.0%
OP	1,098	0.2%	54	0.0%	1,174	0.2%
SNF	-4	0.0%	-136	-1.5%	-142	-1.5%
HH	0	0.0%	0	0.0%	0	0.0%
HS	0	0.0%	0	0.0%	0	0.0%
PB	-1,024	0.0%	3,556	0.1%	2,534	0.1%
DME	-340	-0.1%	195	0.0%	-158	0.0%

The changes in grouping also do not affect episode duration or the cost of each episode. Table 7.17 highlights the distribution of episode costs and lengths when varying the diagnosis codes (compare runs 2 through 4 with Baseline).

[65] This analysis does not measure the extent to which use of secondary diagnoses influence the assignment of claims to alternative episode stages. Medstat also uses secondary diagnoses to determine the "stage" of an episode which is relevant to the risk adjustment of episodes, a topic not covered in this report.

While changes in the use of diagnosis codes do not lead to significant changes in ungrouped episodes, costs and lengths of episodes, or the number of episodes per person, these changes from the baseline do lead to significant numbers of claims shifting across MEGs and episodes. Table 7.16 shows that using the admitting diagnosis code in place of the first diagnosis (Run 3) leads to a small shift, 0.7%, in claims across MEGs; however the costs associated with claims shifting across MEGs represent 10.2% of all claim costs. We also find that 1.6% of claims change either episode dates or MEGs, implying that these claims shift across episodes either within an MEG or across MEGs; costs associated with these shifting claims represent 12.1% of all costs. Using a single diagnosis code leads to a 1.1% (Run 2) and 1.7% (Run 4) shift in claims from one MEG to another. These shifts in claims produce 5.6% and 14.7% shifts in costs across MEGs respectively. Claims that either shift across MEGs or change episode dates account for 2.7% and 4.1% of all claims depending on the diagnosis code used, with 8.7% and 19.1% of all costs associated with these claims shifting episodes. These results show that diagnosis codes play a critical role in assigning a claim to an MEG or particular episode.

With regard to the specific episodes and in particular the focal diseases, the number of diagnosis codes specified in the claims (either one or all) does not significantly change the cost, number of episodes, and number of claims grouped into the episode type. Using the admitting diagnosis as the first diagnosis also does not significantly change the results. Because the tables by run and episode type are quite large, they have been omitted from this report but can be furnished upon request.

7.3.2 Varying Procedure Codes and X-ray/Lab Flags (Runs 5 through 7)

To test the impact of varying the procedure codes and the x-ray/lab flags, a number of different changes are made to both the procedure codes used as well as the x-ray/lab flags used for the input file.

Although Medstat allows up to 15 procedure codes from its input records, this information has little impact on its actual grouping process. Procedure codes are relevant mainly in that they are used in the setting of the x-ray/lab flags and thus dictate whether or not a claim may start an episode. Run 5 tests the role of procedure codes by keeping the x-ray/lab flags constant from the Baseline run and blanking all procedure codes in the claims. Thus, x-ray/labs are still not allowed to start an episode, but the claims in this run do not provide specific

information as to what type of procedure is covered. Table 7.14 shows only a tiny deviation in the total number of episodes resulting from blanking out procedure codes (Run 5). This result confirms the statement in the Medstat manual that the grouper uses procedure codes to choose among valid diagnosis codes for grouping claims: "When a procedure code and two diagnoses are available, the MEG grouper considers logical pairings of diagnoses and procedures to determine which diagnosis should be used to assign the episode group for a detail record."[66] Medstat's documentation also indicates that procedure codes are not used in the disease staging process.

Table 7.16 does show some shifts, albeit relatively small, of claims across MEGS and episodes resulting from blanking all procedure codes on claims. A total of 1.8% of claims either shift across MEGs or episodes as a result of this change from Baseline settings, with 3.4% of costs shifting with these claims.

As noted above, the main role of procedure codes in Medstat's grouping process is to set the x-ray/lab flags that dictate whether a claim is permitted by the software to begin an episode. To understand the role played by these x-ray/lab flags in the grouping process, we conduct three runs to test the consequences of three cases: (i) all x-ray/lab flags set to 1, (ii) all x-ray/lab flags set to 0 (Run 6), and (iii) change SNF and HS x-ray/lab flags to 1 (Run 7).

(i) All x-ray/lab flags set to 1

Flagging all claims (i.e. setting the x-ray/lab flag to 1) causes all of the claims to remain ungrouped. Since no further analysis can be performed in this case, we leave this run out of the tables.

(ii) All x-ray/lab flags set to 0 (Run 6)

When all the x-ray/lab flags are set to 0 (unflagged), virtually all of the claims are grouped (Table 7.14). This confirms that x-ray/lab flags are responsible for informing the software whether a claim can start an episode, and that allowing all claims to start episodes

[66] This feature of MEG 7.1 marks a change from version 6. As we confirmed in previous testing, Medstat documented that MEG 6.0 groups "based solely on diagnosis codes and does not take into account procedure codes."

results in virtually 100% grouping. The total number of 2003 Touching Episodes increases to 317,498, a 38% increase over the Baseline (Table 7.15).

Although the proportion of complete acute episodes remains almost constant, the average cost of a complete acute episode decreases by roughly 24%, from $690 to $527 (Table 7.17). The decrease in average cost can be explained by the sharp increase in number of episodes, a result of previously ungrouped lab and x-ray claims constituting their own, low-cost episodes.

Looking at ungrouped claims by claim type (Table 7.19, Run 6), we see that setting the x-ray/lab flags to 0 causes only a small fraction of claims (less than 0.5% for all file types except for IP and DME) to remain ungrouped. These remaining ungrouped claims most likely persist because of the presence of improper diagnosis codes that the software cannot use. Additionally, the only changes occur in DME, OP, and PB claims because the Baseline run has the x-ray/lab flags for almost all the IP, HS, HH, and SNF claims set to 0.[67]

We also see a significant number of claims shifting across MEGs and episodes (Table 7.16). Setting the flag to 0 leads to 38.5% of claims either changing MEGs or episode dates. Given that this run results in nearly all claims grouping, most of this shifting is likely the result of ungrouped claims grouping. This results in 28.9% of costs being reassigned to different MEGs or episodes.

(iii) Change SNF and HS x-ray/lab flags to 1 (Run 7)

For the Baseline run, the x-ray/lab flags for all HS claims are set to 0 (unflagged), since there are never any codes indicating x-ray or laboratory procedures on HS claims, and almost all SNF claims have the flag set to 0 as procedure codes are only very rarely included on these claims. In Run 7, all SNF and HS claims have x-ray/lab flags set to 1 (flagged) to determine the impact the x-ray/lab flags have on the grouper and these specific claim types in particular.

Compared to the Baseline findings, inspection of Table 7.14 reveals that flagging SNF and HS claims leads to little change in number and composition of episodes, but it produces a substantial increase in the cost of ungrouped claims even though the overall proportion of

[67] The Medstat Baseline run uses any available procedure codes for HS and SNF claims to set the x-ray/lab flag. Since almost none of those claims have procedure codes it is almost always set to 0. IP claims are also, by construction, not flagged.

ungrouped claims remains almost unchanged. This is likely due to the fact that while these two claim types represent a small fraction of all claims, they comprise a large share of costs. The number of ungrouped SNF and HS claims increases from 3 to 3,394 for SNF and 0 to 1,773 for HS claims. Even though all SNF and HS claims are flagged, only 36% of SNF claims and 58% of HS claims remain ungrouped, indicating that the software is still able to group many of these claim types into already existent episodes (Table 7.19, Run 7).

Additionally, the slightly smaller number of total episodes likely results from SNF and HS not being able to start episodes. If the episodes that were once started by SNF or HS claims only consisted of the SNF/HS claim and other x-ray/lab claims, then flagging the SNF/HS claims would mean that these episodes would not be created in this run.

Setting x-ray/lab flags for SNF and HS claims to 1 leads to relatively small changes in claim reassignment to different MEGs or episodes. Combining both claims changing MEGs and claims whose episode dates have changed, we see that 0.4% of claims shift MEGs or episode dates. This leads to a reallocation of 3.7% of total costs across episodes.

7.3.3 Reordering Input Records (Run 8)

Medstat requires that claims be sorted a certain way in order for the grouper to work. Per their recommendations, we sort input records by beneficiary (required by Medstat), start date (also required), and end date in all of our runs. However, there are many cases where two claims for the same person share the same start and end dates, so the user still has a choice as to how to order the input records when following Medstat's ordering rules, even after applying the non-required condition that claims be sorted by end date. We test whether the order of these claims influences grouping outcomes in Run 8. To these this, we use the Baseline claim ordering (sorted by person, start date, and end date categories), but within this sorting reorder the claims at random. That is, we change the input order of claims with identical beneficiaries, start dates and end dates.

The rows corresponding to Run 8 in Table 7.14 and Table 7.15 reveal that almost unnoticeable changes occurred in the main results compared to the Baseline run, with the number of episodes decreasing by just seven. Although the summary statistics show little difference from the Baseline, a number of claims are reallocated to different episodes in Run 8 compared to

the Baseline run (Table 7.16). The reordering of the input records induces changes in the assignment of 0.2% of Medicare claims to new MEGs, implying switches to different health-care treatments. Further, 0.4% of Medicare claims are assigned to different episodes, with different episodes interpreted as being either a new type or having a new start date. This reassignment means that 0.6% of total costs are reallocated to different episodes of care (and potentially to different providers). This shows that costs are reallocated simply based on the order in which the user inputs the data, shifting nearly $4 million worth of claims to different episodes for our sample of 20% of Colorado beneficiaries; this would be almost $20 million for 100% of Colorado.

7.3.4 Varying Medstat Configuration File (Runs 9-15)

A number of our runs alter key parameters of Medstat's configuration file. In this subsection, we consider the effect of these changes on its episode grouping results. These parameters include: (i) build admissions for facility records and (ii) episode limit length,[68] (iii) stratifying chronic episodes, and (iv) setting the look-back period.

(i) Facility Admissions Build Feature

Medstat's Admission Build feature designates an "admission time window" that specifies a period of time encompassed by a single admission. Multiple room and board facility records can be joined together to make one admission. In a commercial setting, for example, a patient can be hospitalized for several weeks and the hospital can submit multiple claims to pay for the stay. The purpose of the Facility Admissions Build feature is to combine these claims. Medstat requests that all inpatient data be grouped into stays of admission, either manually or by using the software's build admission feature on facility records.[69]

In Medicare, more than one claim can show up for a single stay, since CMS sometimes makes interim payments during an admission with the final claim covering the remaining part of the payment assessed to the complete admission. (There can also be outlier payments or adjustments for admissions that generate multiple claims.) Information available on inpatient claims identifies whether they are part of the same admission. CMS uses this information to

[68] The episode length setting uses Medstat's episode date assignments; however, we present the results using our date assignments.
[69] The "Admission Build" feature is described on pages 12 and 13 of the Version 7.1 User Guide.

build its MedPAR files, which provide data for stays rather than for claims. If the inpatient data have not already been grouped into admissions by implementing a MEDPAR-type procedure, the user must utilize the "Build Admissions" feature in Medstat's configuration file to build admissions out of facility records. Otherwise, the software assumes that each record is a separate admission. Since Medicare IP claims do not always represent complete admissions, we use Medstat's Build Admissions feature for the Baseline run.

To assess the influence of this feature on grouping, we create two sets of IP input data. The first set uses raw IP claims that do not correspond to admissions. The second dataset manually combines all the IP claims into admissions, and then treats these combined claims as input records. This manual combination of IP claims uses information from individual Medicare claims to infer whether this claim represents a partial record for an admission to a hospital and, if so, the other claims that cover the associated admission. For Medicare data, IP claims make up an admission when they belong to the same beneficiary, have the same admission date, and have the same provider. However, the vast majority of Medicare IP claims represent a single admission. Manually building admissions produces 32,486 admissions from 32,590 IP claims. The second dataset with manually built admissions, then, has only 104 fewer records than the one associated with IP claims. Tables 7.21 to 7.24 compare findings for the different data sets with the build admissions feature set to YES or NO.

The Baseline run uses the raw IP claims with the facility admissions build feature. Turning off Medstat's facility admissions build feature does not produce significant variation in the output from Baseline. Setting the "Build Admissions" option to "NO" (Run 9) leads to a slight increase in the number of episodes from 661,053 to 661,175 (summarized in Table 7.21). The average cost of complete acute episodes decreases marginally (from $690 to $677), as does the average cost of all acute episodes (from $845 to $833). The average cost of chronic episodes shows a slight increase (from $916 to $934).

When we manually build admissions using the rules specified above, changing the Build Admission setting from YES to NO produces similar results to those seen with the raw claims. In particular, when manually building admissions and keeping Medstat's Facility Admissions

Build feature enabled,[70] the number of total episodes remains almost unchanged from the Baseline result, going from 661,053 episodes to 661,120 (Table 7.21). The cost and length of complete episodes (Table 7.24) as well as the number and cost of episodes per person (Table 7.24) also remain virtually unchanged.

Manually building admissions also does not change outcomes appreciably when the configuration file for Medstat is set to "Build Admissions" = NO. This setting increases the number of episodes from the Baseline figure of 661,053 to 661,239, which is a larger increase than when using the Baseline data with Facility Admissions Build disabled. The average cost, length, and number per person of complete acute episodes do not change between the two runs in which build admissions is set to NO. The total cost of all episodes per person is also almost unchanged.

Running the grouper with "Build Admissions" = NO does produce some shifts in claims across MEGs and episodes (Table 7.16). In total, 0.4% of claims either shift MEGs or episodes. While this appears to be a small shift, it does lead to 5% of costs shifting across MEGs or episodes.

[70] If MEG builds admissions from IP claims using the same method as MedPAR does, using the Facility Admissions Build feature on IP claims that have already been manually built into admissions should lead to no changes at all. While this is approximately true, the groupings are slightly different for the two settings.

Table 7.21: Comparison Statistics for Variations on Facility Admissions Build Feature, Medstat

All Claims, Medstat

Build Admissions Settings	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	% Cost of Chronic Episodes	% Cost of Acute Episodes	% Cost of Ungrouped Claims
Baseline (Run 1)	23.2%	661,053	40.4%	59.6%	43.4%	48.1%	8.4%
Build Admissions = NO (Run 9)	23.1%	661,175	40.4%	59.6%	44.3%	47.4%	8.3%
Manually Build Admissions, Medstat Build Admissions = YES	23.2%	661,120	40.4%	59.6%	43.4%	48.2%	8.4%
Manually Build Admissions, Medstat Build Admissions = NO	23.1%	661,239	40.4%	59.6%	44.2%	47.5%	8.3%

Table 7.22: Comparison Statistics for Variations on Facility Admissions Build Feature, Medstat

2003 Touching Episodes, Medstat

Build Admissions Settings	Total # Episodes	% Chronic Episodes	% Acute Episodes	% 2003 Complete Acute Episodes	% Cost of Chronic Episodes	% Cost of Acute Episodes	% Cost of 2003 Complete Acute Episodes
Baseline (Run 1)	229,925	39.5%	60.5%	56.0%	41.4%	58.6%	44.3%
Build Admissions = NO (Run 9)	229,958	39.5%	60.5%	56.0%	42.2%	57.8%	43.5%
Manually Build Admissions, Medstat Build Admissions = YES	229,952	39.5%	60.5%	56.0%	41.4%	58.6%	44.2%
Manually Build Admissions, Medstat Build Admissions = NO	229,983	39.5%	60.5%	56.0%	42.2%	57.8%	43.4%

Table 7.23: Cost and Length Percentiles for Variations on Facility Admissions Build Feature

2003 Touching Episodes, Medstat

Build Admissions Settings	Type of Episode	Cost and Length per Episode	10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,447	$3,982	$11,170	$916	$3,523
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$83	$341	$1,510	$3,797	$9,082	$845	$3,539
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$257	$1,202	$3,003	$7,316	$690	$2,850
		Length per Episode (days)	1	1	1	18	65	122	255	24	57
Build Admissions = NO (Run 9)	Chronic	Cost per Episode ($)	$18	$45	$121	$346	$1,528	$4,321	$11,488	$934	$3,410
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$84	$342	$1,525	$3,881	$9,134	$833	$3,374
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$258	$1,224	$3,069	$7,413	$677	$2,691
		Length per Episode (days)	1	1	1	18	65	122	255	24	57
Manually Build Admissions, Medstat Build Admissions = YES	Chronic	Cost per Episode ($)	$18	$44	$120	$342	$1,446	$3,980	$11,157	$915	$3,517
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$84	$342	$1,511	$3,809	$9,104	$846	$3,524
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$257	$1,206	$3,008	$7,333	$690	$2,830
		Length per Episode (days)	1	1	1	18	65	122	255	24	57
Manually Build Admissions, Medstat Build Admissions = NO	Chronic	Cost per Episode ($)	$18	$45	$121	$346	$1,525	$4,314	$11,483	$933	$3,404
		Length per Episode (days)	1	1	101	231	298	328	346	125	120
	Acute	Cost per Episode ($)	$21	$40	$84	$343	$1,527	$3,891	$9,154	$834	$3,359
		Length per Episode (days)	1	1	1	30	109	257	357	37	82
	2003 Complete Acute	Cost per Episode ($)	$18	$40	$73	$258	$1,227	$3,076	$7,414	$677	$2,671
		Length per Episode (days)	1	1	1	18	65	122	255	24	57

Table 7.24: Episodes and Costs per Person for Variations on Facility Admissions Build Feature

2003 Touching Episodes, Medstat

Build Admissions Settings		Summary Statistics								
		10%	25%	50%	75%	90%	95%	98%	Mean	Std Dev
Baseline (Run 1)	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,189	$14,384	$25,435	$40,842	$5,110	$11,425
Build Admissions = NO (Run 9)	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,199	$14,387	$25,304	$40,799	$5,110	$11,379
Manually Build Admissions, Medstat Build Admissions = YES	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,191	$14,384	$25,422	$40,837	$5,109	$11,415
Manually Build Admissions, Medstat Build Admissions = NO	# of Episodes per Person:	2	3	5	8	11	13	15	6	4
	Chronic	1	1	2	3	4	5	6	2	1
	Acute	0	1	3	5	8	9	11	4	3
	2003 Complete Acute	0	1	3	5	7	9	11	3	3
	Total Cost per Person	$80	$310	$1,142	$4,202	$14,387	$25,263	$40,719	$5,108	$11,367

Table 7.25 shows that small changes in episode grouping are not surprising, since the majority (90.9%) of admissions created by Medstat have one IP claim. Turning off Medstat's Facility Admissions Build feature, then, should not change the grouping of IP claims significantly. Furthermore, because IP claims make up less than 1% of all claims, the impact of combined IP claims on the overall grouping process is not significant.

Table 7.25: Medstat Created Admissions with One or More IP Claims

All Claims, Medstat Baseline Run

Medstat Created Admissions	#	%
1 IP claim	26,895	90.9%
More than 1 IP claim	2,683	9.1%
Total	29,578	100.0%

(ii) Episode Length Limit Feature (Runs 10-13)

To test the effects of varying the acute and chronic episode lengths simultaneously, we set the episode limit length to 1 day, 180 days, 730 days, and unlimited (runs 10 through 13 respectively) all while keeping the chronic length set to "YEAR". Doing so illustrates several trends in grouping and cost. Increasing the episode length limit decreases the total number of episodes (from a maximum of 1,060,023 episodes when episode the limit length is 1 day to a minimum of 654,970 episodes when episode limit length is unlimited), as well as the fraction of ungrouped claims and the fraction of costs represented by ungrouped claims (Table 7.26). The number of episodes per person also trends downward as episode duration is extended, while the average length of acute episodes increases, implying a trend toward fewer and longer acute episodes.

Table 7.26: Statistics for Variations on Medstat's Episode Limit Feature

All Claims, Medstat

Episode Length Limit Setting	% Ungrouped Claims	Total # Episodes	% Cost of Ungrouped Claims
Episode Limit 1 Day (Run 10)	26.7%	1,060,023	10.1%
Episode Limit 180 Days (Run 11)	23.5%	673,556	8.6%
Episode Limit 365 days (Baseline – Run 1)	23.2%	661,053	8.4%
Episode Limit 730 Days (Run 12)	22.9%	656,375	8.3%
Episode Length Unlimited (Run 13)	22.9%	654,970	8.2%

Table 7.16 shows that changes in episode length settings produce significant shifts across MEGs and episodes. The shift in MEGs from the Baseline declines as episode length limits are increased. Claims shifting across episodes increases dramatically as episode length limits are increased. This shift across episodes, as measured by changes in the episode dates of assigned MEG of a claim, is likely a result of episode length limited chronic episodes merging as the episode length limit is increased.

(iii) Stratifying Chronic Episodes (Run 14)

Medstat MEG version 7.0 added a new feature that allows the grouper to stratify chronic MEGs into chronic diseases and acute flare-ups. The grouper manual recommends that this option be turned on by default. Run 14 tests the effect of turning this option off on the grouping results. The results are generally consistent with Medstat's documentation that states this option divides chronic episodes into episodes of the underlying chronic disease and acute flare-ups of the disease. Turning the option off increases the fraction of cost contained in chronic episodes by 6.8% and decreases the fraction in acute episodes by 6.6%. The total number of episodes also drops from 661,053 to 656,812. Although the overall statistics imply that the changes are solely from acute flare-ups being reclassified into their parent chronic episodes, the detailed breakdown by episode type shows that there are slight changes to many strictly acute MEGs.[71] As Table 7.16 shows, 1.6% of claims shift across MEGs. This is probably due to claims that were being

[71] The complete breakdown by MEG has not been included because of space considerations. It can be furnished upon request.

separated into acute flare-ups of chronic episodes now being grouped together with the parent episode. These results are essentially in line with what we would expect from Medstat's description of the option.

(iv) Set Look-back Period to 45 Days (Run 15)

Medstat allows the user to manually set the look-back period the software uses to check for laboratory claims prior to the first specifically grouped claim in an episode. X-ray/labs that are initially ungrouped are assigned to open, valid episodes if they occur within the look-back period for an episode identified with the x-ray/lab service. After the look-back process, non-specific claims that occur close to open episodes are grouped using "inclusion logic." In Run 15 we test this feature by increasing the look-back period from 15 to 45 days. As one would expect, this leads to a minor decrease in the percentage of ungrouped claims and no change in the actual number of episodes or the proportion that are acute or chronic. The share of costs in acute versus chronic episodes does change very slightly, because some cost is moved from ungrouped claims to claims grouped into episodes. Claims also shift across MEGs and episodes, with 0.6% of claims shifting across MEGs and 3.3% of claims changing episode dates. The fraction of claims changing either episode dates or MEGs is also 3.3%, indicating that nearly every claim that changed MEG also changed episode dates. This implies that the look-back period operates as described, only adding non-specific claims to existing episodes and not creating new ones.

7.3.5 Overview of Sensitivities to Changes in Medstat Options

The results in this section reveal how the overall picture of MEG's grouping varies in response to choices made in structuring its input file and in setting its configuration options. The following points summarize these findings.

- Eliminating all secondary diagnosis codes in all of Medstat's input records (Run 2) leads to virtually no changes in the fraction of claims grouped into episodes, the number of created episodes, the compositional breakdown of episodes into acute and chronic classifications, or the distributional properties of the number and costs of chronic and acute episodes per person. This change in settings does, however, reassign just over 1% of claims and nearly 6% of costs to different MEGs. When considering both MEG reassignment and episode date changes, 2.7% of claims shift across episodes, accounting for a shift of 8.7% in costs.
- Substituting admitting diagnosis for the primary diagnosis (Runs 3 and 4) produces little change in the statistics describing the number and characteristics of episodes, but it does

induce slightly more than a 10% reassignment of costs across MEGs, and 15% when used as the only diagnosis code.

- Although Medstat's input records allow for up to 15 procedure codes, these codes have little effect on grouping outcomes. Blanking out all procedure codes (Run 5) decreases the number of episodes by merely 0.3%, and 1.8% of claims and 3.4% of their corresponding costs shift episodes. In sharp contrast, Medstat's use of procedure codes to set the x-ray/lab flag significantly influences grouping results. This flag prevents records from starting episodes. Turning this flag off for all claims (Run 6) decreases the fraction of ungrouped claims from 23.2% to 0.4%, and leads to a significant number of claims changing MEGs or episodes. Additionally, 38.5% of claims and 28.9% of the claims' corresponding costs shift across episodes. Turning the flag on for all SNF and HS claims (Run 7) only marginally affects grouping outcomes. Only 0.4% of claims shift across episodes, resulting in a shift of 3.7% of costs across episodes.

- Randomly resorting input records within beneficiary/start-date/end-date categories (Run 8) produces a discernible effect on the number of episodes and reassigns 0.4% of claims and 0.6% of costs to different episodes.

- Extending the acute episode length limit from 1 day up to 9999 days (Runs 10 to 13) significantly decreases the number of episodes and increases the average length of acute episodes. It also can lead to as much as 6-30% reassignment of claims and 4-40% of costs to different episodes compared to the Baseline assignments.

- Conversely, other modifications of Medstat's configuration – Facility Admissions Build (Run 9), stratifying chronic episodes (Run 14), and altering the look-back period (Run 15) – produce relatively minor effects on grouping outcomes. The largest impact results from stratifying chronic episodes, where 2% of claims shift episodes, resulting in shift in 7.6% of costs across episodes.

7.4 Practical Considerations in Applying Medstat Grouper to Medicare Data

Beyond exploring the functionality of the MEG grouper, we also examine several practical considerations relevant in the application of this grouper in the attribution of resource utilization in a Medicare setting In this section, we review two of these potential issues: the extent to which Medstat's constructed episodes reflect the patterns of care expected under Medicare benefit structures, and the effect of waiting different lengths of time for claims data to accrue before implementing the episode grouper. Section 7.4.1 evaluates the extent to which Medstat episodes group concurrent PB claims with institutional inpatient claims, and Section 7.4.2 examines Medstat's capacity to link SNF stays to inpatient admissions. Finally, Section 7.4.3 assesses the impact of implementing the MEG grouper with claims data ending sooner in 2004 to see the effect on 2003 episodes of using a shorter time horizon.

7.4.1 Patterns of Physician Services During IP Stays

As described in Section 2.6, Medicare pays for E&M services during hospital admissions for medical conditions. This benefit structure influences practice which results in the linkage of IP claims to particular varieties of PB claims. While daily physician visits are not mandated in Medicare's policy, the evidence (see Table 2.8) demonstrates that in practice IP claims link to a considerable number of concurrent PB and E&M claims. According to these findings, the frequency of PB claims concurrent with IP claims almost always attains the one-per-day average for shorter lengths of claim, and typically attains nearly this average for longer IP claims.

Given the evidence of this pattern in Medicare data, we seek to examine how this pattern is reflected in Medstat's episode grouping. Table 7.27 parallels the structure of Tables 2.8 and 5.20. As well as reproducing the statistics from Table 2.8 that give the fraction of IP stays with concurrent PB claims totaling daily or greater averages, Table 7.27 incorporates rows showing the share of IP claims with concurrent PB claims grouped to the same episode under the Baseline run. The column in Table 7.27 designated "Episode Assignment" distinguishes two sets of statistics. The rows labeled as "No restriction" list shares of stays with concurrent PB claims irrespective of episode assignment by IP stay length; these figures merely replicate the contents of Table 2.8. The rows identified as "Same as IP claim" present shares for only those PB claims that are grouped to the same episode as their concurrent IP claim. The second row, for example, gives the fraction of IP stays with an average of one or more PB claims per day assigned to the IP stay's episode, with rates broken down by length of claim.

One sees in Table 7.20 that daily or near-daily PB and E&M services appear as a norm for most Medicare hospital stays, but the claims for these services are often grouped by Medstat to different episodes than the concurrent IP admission. According to the second column in the table, 98% of two-day IP stays have at least daily PB claims in the raw Medicare data; only 71% of inpatient stays have sufficient PB claims grouped to them to provide for daily visit rates. Whereas 95% of the 5-day stays have concurrent PB submissions equaling or exceeding the one-per-day average, only 49% of these 5-day admissions have daily averages attaining this value when counting only those PB claims grouped to the same episode as the hospital admission. For the longest stays, only 14% have daily or greater PB visits grouped to the same episode, even though the figure above suggests that more than 4 times as many of these long stays have daily

physician visits. These figures for long stays change little when the visit rate allows for up to two days without a visit.

Turning to E&M services, the middle panel of Table 7.27 suggests that daily E&M visits are also the norm, with the overall match rate indicating that 81% of IP stays are accompanied by E&M visits at daily or greater rates. The grouping outcomes, however, do not reflect this pattern, as only 38% of IP claims are assigned to episodes along with E&M claims equaling or exceeding one-per-day averages. Moreover, the longer the IP stay, the more likely that E&M claims are grouped to other episodes. More than two-thirds of IP stays lasting 8 to 14 days show daily E&M visits, but only 21% have these daily visits grouped in the same episode. When considering E&M claims for hospital services, as identified by CPT codes, the final panel shows that virtually all IP admissions (95%) show at least one hospital service visit, but only 64% have at least one of these claims assigned to the same episode. Overall, 69% of IP stays show daily or greater E&M hospital visits, but less than a third of stays are grouped with hospital visits at daily or greater rates. The overall grouping rates increase when the daily restriction is relaxed, but we still only find that less than half of all IP admissions are assigned to episodes along with near-daily or greater E&M hospital services.

In light of these findings, we explore an alternative to the Baseline run to examine whether a closer match rate can be attained between assignments of IP claims and concurrent PB claims. In a discussion of this issue with the vendor, Thomson Medstat suggested a variant of the Admissions Build feature that groups all claims within the dates of service of an inpatient claim into the same episode as the inpatient claim. Implementing this "All Services" Admissions Build consists of modifying input files in a way that registers all Medicare claim types other than IP as an "unknown" record type.[72] This option results in a philosophical shift in the concept of an episode of care: claims that occur during an IP stay are no longer grouped according to diagnosis, and instead are automatically grouped to the same episode as the IP claim based on

[72] The MEG grouper distinguishes inpatient from outpatient claims using the "Record Type" flag. In our baseline run-which follows the recommendations in the Medstat manual for specifying configuration and input files-we flag IP claims flagged as inpatient and all other Medicare claim types (e.g., Part B) flagged as outpatient. The approach suggested by Medstat explicitly requires that physician claims not be flagged and relegated to an "unknown" claim type. This is the core feature of the All Services Admissions Build. In addition, IP claims must be input with a "room and board" designation regardless of whether such a revenue center code appears on the IP claim.

Table 7.27: Match Rate of Concurrent "Daily" PB and E&M Claims to Same Episode as IP Claim

All PB Claims During IP Claims with Medical DRGs, Medstat Baseline

Concurrent PB Claims			Length of Inpatient Claim (Days)										Overall Match Rate
Claim Type	Occurrence During IP Claim	Episode Assignment	1	2	3	4	5	6	7	8-14	15-21	22+	
All PB Claims	At least one per day	No restriction	95%	98%	97%	97%	95%	93%	92%	84%	71%	64%	93%
		Same as IP claim	74%	71%	62%	54%	49%	42%	39%	31%	19%	14%	51%
	At least one per day, except 1 day	No restriction		99%	99%	98%	98%	97%	95%	88%	75%	65%	95%
		Same as IP claim		80%	71%	64%	59%	50%	46%	37%	22%	15%	59%
	At least one per day, except 2 days	No restriction			99%	99%	99%	98%	97%	91%	78%	68%	96%
		Same as IP claim			80%	71%	66%	58%	52%	42%	26%	16%	62%
	At least one	No restriction	95%	99%	99%	100%	99%	100%	100%	99%	99%	95%	99%
		Same as IP claim	74%	80%	80%	80%	81%	80%	80%	78%	73%	71%	79%
All E&M PB Claims	At least one per day	No restriction	87%	90%	90%	85%	79%	75%	72%	68%	57%	49%	81%
		Same as IP claim	62%	57%	48%	41%	34%	29%	27%	21%	13%	9%	38%
	At least one per day, except 1 day	No restriction		97%	95%	94%	91%	86%	81%	73%	60%	52%	88%
		Same as IP claim		72%	59%	51%	46%	38%	34%	27%	17%	11%	48%
	At least one per day, except 2 days	No restriction			98%	97%	96%	94%	89%	79%	64%	54%	91%
		Same as IP claim			73%	59%	56%	48%	41%	31%	21%	12%	52%
	At least one	No restriction	87%	97%	98%	99%	99%	99%	98%	98%	98%	93%	98%
		Same as IP claim	62%	72%	73%	73%	74%	73%	72%	71%	66%	63%	72%
"Hospital" E&M PB Claims	At least one per day	No restriction	77%	75%	78%	70%	67%	66%	64%	62%	54%	48%	69%
		Same as IP claim	53%	46%	41%	32%	28%	25%	24%	18%	12%	9%	32%
	At least one per day, except 1 day	No restriction		90%	92%	90%	84%	80%	75%	70%	58%	49%	83%
		Same as IP claim		62%	54%	48%	40%	35%	32%	25%	16%	10%	43%
	At least one per day, except 2 days	No restriction			96%	95%	94%	89%	82%	75%	62%	52%	88%
		Same as IP claim			64%	56%	53%	43%	38%	29%	20%	11%	48%
	At least one	No restriction	77%	90%	96%	97%	98%	98%	98%	98%	98%	91%	95%
		Same as IP claim	53%	62%	64%	64%	67%	67%	66%	67%	64%	61%	64%
Number of IP Claims			409	3,358	3,995	3,733	2,567	1,683	1,250	2,914	633	415	20,957

dates of service. Table 7.28 explains the conceptual difference between using and not using All Services Admissions Build for PB and SNF claims.

Table 7.28: Overview of All Services Admissions Build

	All Services Admissions Build	Baseline
Effect	All claims provided during an inpatient claim are included in the same episode as the inpatient claim.	Claims are grouped according to the diagnosis, regardless of the diagnosis used in the inpatient claim.
PB Claims Example	If 10 physicians touch a patient during an inpatient claim, the claims from all 10 will be included in the episode.	An episode is generated for each diagnosis type with the result that many episodes can be created, none or one of which includes the inpatient hospital charge.
SNF Claims Example	If a patient is admitted to a nursing home on the day of a hospital discharge, the nursing home claim will also be included with the same episode as the hospital claim.	The nursing home visit can only be included with the episode containing the hospital claim if the diagnoses match.

Table 7.29 reports the basic summary statistics for the results produced by running the Medstat grouper with All Services Admissions Build. Compared to the Baseline, the total number of episodes drops by almost 14,000, but there is only a minor impact on the share and proportion of cost of chronic versus acute episodes.

Table 7.29: Summary Statistics for All Services Admissions Build Compared to Baseline
All Claims, Medstat

Run	% Ungrouped Claims	Total # Episodes	% Chronic Episodes	% Acute Episodes	% Cost of Chronic Episodes	% Cost of Acute Episodes	% Cost of Ungrouped Claims
Baseline	23.2%	661,053	40.4%	59.6%	43.4%	48.1%	8.4%
All Services Admissions Build	21.9%	647,278	40.7%	59.3%	42.2%	49.7%	8.1%

To examine the effectiveness of the All Services Admissions Build in placing PB claims (and in particular E&M claims) into the same episode as a concurrent IP claim, we compare the

grouping of claims that occur during an IP stay for our Baseline to what happens using the All Services Admissions Build option. Table 7.30 presents these findings. In our Baseline run, only 40% of PB claims that occur during a grouped Room & Board (R&B) IP stay are assigned to the same episode as that IP claim (based solely on diagnosis). When we use the All Services Admissions Build feature, 100% of PB claims that occur during a R&B IP stay are grouped to the same episode as that IP claim.[73] We do not present a version of Table 7.27 here because the "episode assignment" rows merely replicate the "no restriction" rows. Therefore, the All Services Admissions Build is entirely effective at grouping IP claims with concurrent PB claims because it does so without exception by mechanically assigning all the claims to an IP stay's episode based purely on the timing of service dates.

Table 7.30: Impact of All Services Admissions Build on IP-PB Linking Issue
All Claims, Medstat

Statistics on PB Claims and IP Claims	
Total # of Medicare Claims	5,049,696
# of Room and Board (R&B) IP Claims	32,561
Baseline	
Total # of PB Claims Concurrent with a Grouped R&B IP Claim	452,550
# of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	181,454
% of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	40.1%
All Services Admissions Build	
Total # of PB Claims Concurrent with a Grouped R&B IP Claim	452,530
# of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	452,530
% of PB Claims Grouped to Same Episode as Concurrent R&B IP Claim	100.0%

7.4.2 Linking Post-Acute Care to IP Claims

In contrast to the discussion above of expected practice patterns and PB claims, Medicare has rigorously specified payment rules for SNF claims. A SNF claim is required to follow an IP claim for a claim of at least 3 days, must start within 30 days of discharge from the hospital, and has to be related to the condition treated during the hospitalization. Medicare uniformly considers this service to be a continuation of care. SNF claims, however, do not necessarily have diagnosis or procedure information that matches what appears on the associated IP claim, and

[73] The number of candidate PB claims differs between the two runs because the number of IP claims grouped to episodes drops when the All Services Admissions Build feature is used. As a result, there are fewer candidate PB claims for the All Services Admissions Build run.

often have diagnosis codes for conditions not associated with the preceding IP stay. Consequently, the grouper does not necessarily group the two claims into the same episode of care. However, since the All Services Admissions Build feature groups all claims that occur during the same period as an R&B IP claim to the same episode, it often causes SNF claims to group to the same episode as a preceding IP claim. This can occur as a result of a SNF stay starting on the same day as the IP discharge, or by the linkage between a SNF claim and a PB claim that is concurrent with the candidate IP stay.

Table 7.31 shows the impact of the All Services Admissions Build feature on grouping SNFs with IP stays. The candidate pool of SNF claims consists of those that occur within 30 days of the end of a grouped IP stay lasting at least 3 days. According to this table, 94.5% of SNF claims in our sample occur within 30 days of the end of a grouped IP claim —most occur very quickly after discharge from the hospital. Those that are not identified as candidates are: (1) SNF claims that follow an ungrouped IP claim, (2) associated with an IP stay beyond the range of our data, (3) for SNF admissions exempt from the 30 day interval requirement either for continued care in a SNF or for medical reasons, or (4) are denied claims.[74] The Medstat Baseline

Table 7.31: Impact of All Services Admissions Build on IP-SNF Linking Issue

All SNF Claims, Medstat

Statistics on SNF Claims and I	
Total Number of SNF Claims	9,336
# of SNF Claims that are Candidates for IP Linking (Start Within 30 Days of the End of a Grouped IP Claim)	8,821
% of SNF claims that are Candidates for IP linking	94.5%
Total # of SNF Claims that are Candidates for IP linking	8,821
Baseline	
# Grouped to the Same Episode as an IP Claim	3,533
% Grouped to the Same Episode as an IP Claim	40.1%
All Services Admissions Build	
# Grouped to the Same Episode as an IP Claim	8,197
% Grouped to the Same Episode as an IP Claim	92.9%

[74] Of the 515 SNF claims that are not identified as candidates, 91 occur within 30 days of January 1, 2002, and 12 occur after an IP claim that was not grouped. Most of the remaining non-candidate claims list condition codes that indentify exemptions or denials; however 124 of these claims do not list condition codes.

run groups 40% of those claims to the same episode as a candidate IP claim. With All Services Admissions Build, the proportion of qualifying SNF claims grouped to the same episode as an IP claim increases from 40% to 93%. The missing matches primarily consist of SNF claims occurring long after IP discharge dates.

All Services Admissions Build is therefore quite effective in grouping physician and SNF claims into the same episode as the contemporaneous IP claim. This comes, however, at the cost of automatically grouping all claims during the period covered by the IP claim into the same episode, which may not always make clinical sense and is at odds with the grouping process implemented by Medstat with settings recommended in its manual. For these reasons, and to produce Medstat results more comparable to those of Symmetry, the Medstat Baseline specification adopted in this study does not use All Services Admissions Build.[75]

7.4.3 Effect of Altering Time Horizon for Including Claims

All of the analysis in this chapter has been based on a sample of all fee-for-service claims for 20% of Colorado beneficiaries for the entire 2002-2004 period. Essentially, this window of data assumes that it would be possible to wait an entire year or more – until all 2004 claims are in – to conduct the episode grouping. In this way, the data include virtually all information relevant to the complete episodes in 2003.[76] In practice, however, one may not want to delay scoring physicians' resource use to ensure the receipt of all the relevant claims data. For this reason, it is crucial to identify what changes, if any, occur if the analysis is performed using a shorter time horizon for selecting claims.

Complete episodes, by definition, represent an entire instance of a disease and hence should not be influenced by the addition of more claims. If extending the time horizon changes the characteristics of complete episodes, the MEG grouper may be difficult to use in physician

[75] Based on the description of the Admissions Build feature in the Medstat manual, we also attempted alternative specifications of the All Services Admissions Build. One such specification was to leave the "Record Type" flag as "Outpatient" for non-IP claims (as opposed to "Unknown") and instead change the "Facility Type" flag to "Facility". Although Medstat's manual implies that all facility records are eligible for inclusion in admissions, this produced only small improvements in the rates at which E&M hospital claims were grouped to the same episode as the concurrent IP claim, and was much less successful than the All Services Admissions Build approach.

[76] The largest clean period used by Medstat is 365 days, which is also the maximum episode length used in our Baseline setting. Using an extra year on either side of the analysis year should therefore allow us to obtain all relevant data for 2003 episodes.

profiling as it would suggest that there needs to be an extended period of time after care is received until profiles could be developed. To test the impact of a changing time horizon, we compare the groupings of claims that are grouped into complete episodes for a shorter time horizon and then extend it to the full 2002-2004 period. This allows us to compare complete episodes for 2003 based on data through June 30, 2004 to the complete episodes based on data through December 31, 2004 (our baseline).

Table 7.32: Summary Statistics for Reduced Time Horizon Sample

All Claims January 2002-June 2004, Medstat

Total # Claims	% Claims	Total # Episodes	% Chronic	% Acute	Total Cost in 2002-2004	% Cost of Chronic	% Cost of Acute	% Cost of
4,097,049	19.4%	590,953	37.7%	62.3%	$462,343,157	33.0%	60.1%	6.9%

Table 7.32 presents summary statistics for the sample that ends in June 2004, including all claims. This shorter sample has about 80% as many claims grouped into about 90% as many episodes as the longer sample (based on comparison to Table 7.1). The drop particularly affects the number of chronic episodes, yielding a 10 percentage point change in the share of costs devoted to chronic episodes. However, these changes should be dominated by changes in episodes for 2004, rather than in 2003.

For the time horizon question, we focus on 2003 Complete Episodes, including chronic episodes ending in 2003 and complete acute episodes. Conceptually, a complete episode should be one that has all relevant clinical data, representing treatment for an illness that has come to its conclusion; adding more data for the same beneficiary well after the end of a complete episode should not affect its composition of claims.[77] When we extend the analysis time horizon Table 7.33), 0.03% of claims from complete episodes in the short time horizon are grouped to different MEGs, meaning that the grouper considers them to be claims for a different illness. Measuring a change in episode assignment to be either a different MEG or different start or end dates, 0.09% of claims, accounting for 0.23% of costs, are grouped to different episodes using data for the

[77] Based on our definition of completeness in Section 3.1, 2003 Complete Episodes in this table include all chronic episodes that end in 2003 and all acute episodes that end in 2003 and start at least one clean period after the beginning of 2002.

longer time horizon.[78] These findings suggest that Medstat's construction of episodes is not sensitive to delaying the time period when claims are collected to attribute costs of the previous year beyond 6 months after the end of the year.

Table 7.33: Changes in Grouping of Claims Due to Adding 6 Months of Medicare Data
2003 Complete Episodes for January 2002-June 2004 Sample, Medstat

Claims Grouped to 2003 Complete Episodes	# of Medicare Claims	% of Medicare Claims	Cost of Medicare Claims	% of Associated Cost of Medicare Claims
All Claims	1,241,770	100%	$167,034,758	100%
Claims that Change MEG	340	0.03%	$73,204	0.04%
Claims that Change Episode Dates	1,040	0.08%	$376,626	0.23%
Claims that Change MEG or Episode Dates	1,142	0.09%	$382,883	0.23%

7.5 Overview of Findings for Medstat Grouper

In considering the use of Medstat's software to group Medicare claims into episodes of health events, our analysis reveals several potential issues. Synthesizing the findings discussed in this section, these issues include the following:

- Medstat's grouping relies almost solely on diagnosis information**:** In the vast majority of cases Medstat's software relies on the diagnosis information from a claim to perform its grouping process. Information about procedures is primarily used to determine whether a claim represents an x-ray/lab event, and in some instances to allow the grouper to decide between more than one valid diagnosis on a given claim.
    - Although Medstat's input records allow for up to 15 procedure codes, blanking all these codes makes only a marginal difference in grouping outcomes. Only 1.8% of claims shift across episodes as a result of blanking out procedure costs, resulting in a shift in 3.4% of costs across episodes.
    - The grouping process does not use any information about DRGs.
    - Medstat's software distinguishes IP and PB claims from other types of Medicare claims, but it does not differentiate among other types of claims. Switching

[78] Using episode start and end dates by claim can miss some episode changes and can over-count changes in other instances. (See footnote 44 and the discussion in Section 5.3 for further explanation.) Unfortunately, precisely tracking how claims switch across episode assignments is not possible because episode identification numbers differ with each run of the grouper software.

claims from one of these sources to another causes no change in constructed episodes.

- Medstat's grouper cannot treat a claim as an aggregate of services possibly linkable to more than one episode:
    - Institutional Medicare claims typically cover a multitude of medical services. Each of these claims is allocated to one and only one episode, and the entire cost associated with this claim is attributed to this single health event.
    - Most Medicare institutional claims are paid with prospective payment systems. Prospective payments not only depend on diagnoses, but also on procedures and the likelihood of comorbidities. The presence of comorbidities can imply existence of multiple episodes of care open at the same time. The inability to associate the cost of any such claim with more than one episode represents a serious challenge in applying Medstat's grouper software to a Medicare population.
- The construction of Complete Episodes generally approximates the annual cost of claims assigned to the different MEG categories: Complete episodes include all chronic episodes ending in 2003, and only those acute episodes that begin at least one clean period after the beginning of 2002 and end in 2003.
    - The costs of claims grouped to 2003 Complete Episodes for a MEG closely approximate the annual costs assignable to MEGs within a calendar year. The cost of 2003 Complete Chronic Episodes equals 98% of the annual claims costs assigned to chronic episodes in the year 2003; and the corresponding figure for all acute episodes is 94% of annual claims cost
    - Medstat divides acute conditions into complete episodes using clean periods. For the top ten highest-cost acute MEGs, episodes of the same type sometimes occur within the designated clean period when the dates of claims are used to identify the beginnings and ends of episodes. In particular, depending on the type of MEG, between 0.1% and 20.3% of the same-type episodes take place within clean periods. In some rare instances, these episodes even overlap, meaning that one episode starts before the prior one ends.
    - Medstat starts and terminates chronic episodes in 12-month periods. For the vast majority of afflicted individuals, one chronic episode immediately follows another. For the top ten highest-cost chronic MEGs, chronic episodes of the same MEG run as uninterrupted events for individuals between 54% and 87% of the time depending on the type of chronic condition. In rare cases, chronic episode of the same type even overlap.

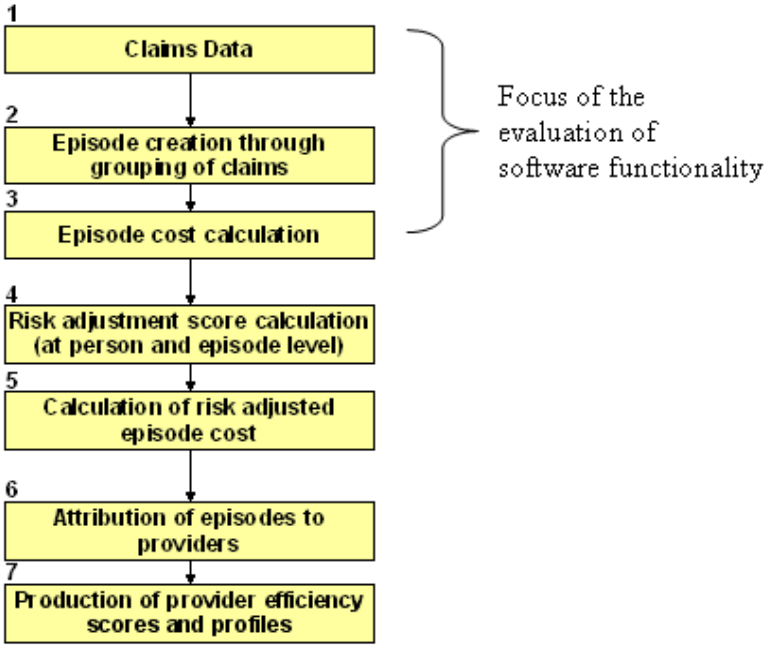
- Considerable variation exists in the costs of individual episodes within a MEG:
    - The distributions of costs across episodes within a MEG exhibit substantial dispersion. For instance, for each of the top five highest-cost acute and chronic MEGs, the level of cost demarking the most expensive 10% of episodes always exceeds the level demarking the cheapest 10% by at least an order of magnitude, and in most instances it is far more than two orders of magnitude larger.
    - These distributions also reveal that the highest-cost episodes account for large shares of total MEG costs. For top five acute MEGs, the top 5% of episodes alone account for 25% to 48% of total annual cost for the MEG, and for chronic MEGs this range is 35% to 64%.
    - This large amount of cost variation suggests that devising a reliable method of risk adjustment for episodes and beneficiary costs necessary for profiling providers in Medicare settings requires approaches not yet available in the existing MEG software. With the multiple comorbidities and the complexity of the patients, the risk and severity models developed for commercial populations are unlikely to work as effectively in the Medicare population.
- Medstat's grouping results depend on the order in which records are input into the grouper:
    - The MEG grouper requires input records be sorted by beneficiary and claim start-dates. In addition, we always sort claims by end date as well within these beneficiary/start-date categories to create beneficiary/start-date/end-date compilations. The sort order of records within these compilations is an arbitrary decision of the user, and yet changing this order produces different grouping results for a notable number of beneficiaries.
    - In a typical example (Run 8), we show that reordering records within these beneficiary/start-date/end-date compilations leads to a reassignment of 0.4% of Medicare claims to different episodes, implying a 0.6% reallocation of Medicare costs to different episodes of care; 0.2% of claims are reallocated to entirely distinct MEG types.
- Medstat's grouping algorithms can be adapted to bundle all Part B physician and other claims incurred during a hospital stay, as well as SNF claims that immediately follow the stay, into the same episode as the inpatient stay:
    - The MEG grouper does not explicitly incorporate logic that links claims emulating some important patterns of care common to Medicare settings, patterns supported by Medicare's payment policies. This grouper is not designed, for example, to incorporate expectations that an IP stay (paid for by a medical DRG) be associated with near-daily E&M physician claims; nor does it necessarily treat SNF claims as a continuation of inpatient care. The MEG grouper cannot distinguish E&M claims from other PB claims, nor does it distinguish SNF from many other types of non-IP claims.

- For the Baseline run of the MEG grouper, only 40% of SNF claims are grouped to the same episodes as the initiating IP claims. Overall, 69% of IP stays have daily E&M hospital visits, but only 32% have daily visits grouped to the same episode by Medstat.
- Medstat suggested an adaptation of its Admissions Build feature to assist in mimicking aspects of Medicare norms involving IP stays. The All Services Admissions Build changes the concept of an episode: when enabled, it groups all claims concurrent with an IP stay to the same episode, regardless of diagnosis.
- With the All Services Admissions Build, a SNF admission that starts on or near the day of discharge will be included in the same episode as the inpatient stay. Using the All Services Admissions Build increases the fraction of SNF claims grouped to the same episode as an IP claim from 40% to 93%.
- Application of the All Services Admissions Build is effective in linking IP claims to concurrent PB claims: it increases the fraction of linkage PB claims grouped to the same episode as a concurrent IP stay from 40% to 100%. At the same time this All Services Admissions Build is a blunt tool in that it groups claims purely based on timing of service dates.

8 CONCLUSION AND NEXT STEPS

For Medicare, as in other health care systems, evaluating the efficiency of care and other performance requires measures of resource utilization and expenditures for the treatment of medical conditions. Conceptually, episode grouping offers an apparatus for creating such measures by allocating claims to episodes of care and calculating the associated costs. Figure 8.1 outlines the basic steps followed in developing resource utilization measures using episode grouper algorithms. This report evaluates the functionality of the Symmetry ETG and Medstat MEG grouper routines in the construction of episodes, which makes up the first three steps of this process. The subsequent discussion summarizes our key findings, starting with issues encountered in adapting Medicare claims to serve as inputs into the groupers and then addressing the impacts of alternative specifications of input and configuration files used by the software. The majority of this concluding material merely collects the main points already stated in the summaries of Sections 5 and 7.

Figure 8.1: Stylized Episode Grouping Procedure



8.1 A Framework for Comparing the Episodes Created by Symmetry and Medstat Groupers

To relate the outputs of the two groupers, we develop a comprehensive framework and a common set of metrics to report and analyze the results. This framework exploits the fact that both groupers map claims to episodes. Tracking the claims linked to each episode, we define measures of episode length and costs that can be compared for Symmetry and Medstat output.

Differences in how the two groupers calculate episode length necessitates the development of a single measure of episode length for purposes of evaluation. Symmetry uses anchor claims – claims that represent a clinical interaction – to open and close episodes. These anchor claims can be grouped to one episode while still serving as an anchor for another episode. Medstat calculates episode end dates as the start date of the last claim in the episode, rather than the end date, with the exception of IP claims for which the end date is used. Our approach to calculating episode length starts an episode using the earliest start date on any claim(s), regardless of claim type, and ends an episode using the latest end date on any claim in the episode. This episode length assignment also applies to chronic episodes, meaning that even though chronic episodes are grouped annually, an episode length will be calculated from the earliest date and the latest date within a year; the groupers' define episode length for chronic conditions as the chronic episode length set by the user. For an overwhelming majority of acute episodes for both groupers, there is no difference between our length assignment and Symmetry and Medstat's assignments. But since both groupers set chronic episode length according to a fixed 12-month period, our episode length assignments almost always yields shorter chronic episodes than those reported by the groupers.

We calculate an episode's cost based on its assigned claims. The cost of a claim consists of its Medicare payments, excluding the pass-thru payments, deductibles and copayments made by enrollees, and capital PPS payments for IP claims. When a claim is grouped to only one episode, we assign its entire cost to that episode. This situation applies for all of the claims grouped by Medstat, and for all non-institutional claims grouped by Symmetry. However, Symmetry's use of service-level inputs (i.e., pseudo-claims) for inputting information on institutional claims, which commonly links the input records from a single parent claim to more than one episode, requires an allocation rule for distributing the cost of a multiple-assigned institutional claim to its linked episodes. In the analysis reported here, we allocate the entire cost

of an institutional claim to the episode receiving the plurality of its pseudo-claim assignments. (A variety of alternative allocations rules could have been used.)

8.1.1 Comparisons of Grouping Results for a Medicare Population

Table 8.1 presents summary statistics using our measures of episode costs and lengths for a sample comprised of 20% of the Medicare beneficiaries residing in Colorado in 2003, the main sample used throughout our analysis. Medicare paid $585.5 million for 5.05 million claims on behalf of these beneficiaries between 2002 and 2004. The ETG grouper creates 672,600 episodes leaving 15% of claims and 5% of costs ungrouped, whereas the MEG grouper produces 661,053 episodes with 23% of claims and 8% of costs left ungrouped. Beneficiaries experienced 6 episodes on average for both groupers; a large share of episodes last only 1 day: 45% for Symmetry and 48% for Medstat. Each grouper classifies slightly more than a third of their episode categories as chronic conditions, but these definitions of these chronic and acute categories differ distinctly across the groupers. Within this sample of complete episodes ending

Table 8.1: Comparison of Symmetry and Medstat Results for a Sample Population
All 2002-2004 claims for a 20% Sample of Colorado Beneficiaries

Statistic	Symmetry	Medstat
Total # Claims	5,049,696	
% Ungrouped	15%	23%
Total # Episodes	672,600	661,053
% Chronic Episodes	50%	40%
% Acute Episodes	50%	60%
Average # per beneficiary	6	6
Total Cost of Claims	$585,447,839	
% Cost of Chronic Episodes	65%	43%
% Cost of Acute Episodes	30%	48%
% Cost of Ungrouped Claims	5%	8%
Chronic Episodes		
Average Cost per Episode	$1,071	$871
Average Length of Episode (days)	113	123
Acute Episodes		
Average Cost per Episode	$498	$690
Average Length of Episode (days)	22	24

in 2003, we see that ETG chronic episodes are slightly shorter and they are 23% more costly on average than MEG chronic episodes. Conversely, acute episodes produced by Symmetry are 28% less costly than Medstat-produced acute episodes, and are slightly shorter on average.

Even though both groupers map claims to episodes of care, each has its own system for classifying episodes into categories of medical care which are often not comparable across groupers. For Symmetry, its software assigns each episode to an ETG combined with a severity level, with there being essentially 679 such classifications ignoring the residual ungrouped categories. Medstat's grouper assigns each episode to a MEG (disease classifications) along with a main and detailed disease stages. There are a total of 560 MEG classifications. Often an ETG cannot be matched to a MEG designation, and attempting to compare groups of ETGs to groups of MEG typically yields dissimilar classifications as well.

8.1.2 Comparisons of Grouping Results for an Illustrative Individual Beneficiary

To highlight the challenge of directly comparing outcomes from the two groupers, Tables 8.2 and 8.3 present grouping results for an individual beneficiary selected for illustrative purposes. According to Table 2, this selected beneficiary filed 133 claims accounting for $31,705 in costs during the period 2002-2004. Further, we see that Symmetry assigned 80% of this patient's claims into 24 episodes, and Medstat allocated 64% of claims into 21 episodes. Even though both groupers assign nearly all claim costs to constructed episodes for this beneficiary, Symmetry nearly evenly splits costs across its chronic and acute episode designations, whereas Medstat allocates almost three quarters of cost to its acute episode categories.

Table 8.2: Summary Statistics for Claims, Episodes, and Costs
All 2002-2004 claims for an Example Beneficiary

Statistic	All Claims 2002-2004	
	Symmetry	Medstat
Total # Claims	133	
% Ungrouped	20%	36%
Total # Episodes	24	21
% Chronic Episodes	46%	29%
% Acute Episodes	54%	71%
Total Cost of Claims	$31,705	
% Cost of Ungrouped Claims	2%	4%

The difficulty in comparing the groupers' outputs can be seen in Table 3, which presents a detailed breakdown listing several of the ETG and MEG assignments for our illustrative beneficiary. The top set of rows of this table shows examples of "similar" episodes constructed by the groupers. These episodes have somewhat parallel clinical interpretations, and their assigned costs are close. If all grouping results looked like these, one might be indifferent about which grouper to use in allocating claims into episodes of care. However, the lower set of rows in Table 3 shows the examples of "dissimilar" episodes produced by the two groupers for this beneficiary. In the first of these rows, the occurrence of a bacterial lung infection ETG and a bacterial pneumonia MEG suggests an overlap in the beneficiary's assessed clinical circumstances, but Symmetry assigned a cost of $203 to this episode and Medstat allotted a cost of $14,626 which is hardly comparable. Moving to the last rows, whereas both groupers have an episode classification for Alzheimer's, only Symmetry identified this beneficiary has having this chronic neurological condition, with costs totaling $14,897. The only neurological condition assessed by Medstat was an acute psychosis episode, with costs totaling $266. Finally, Medstat created a chronic obstructive pulmonary disorder episode for this beneficiary and Symmetry identified congestive heart failure, but neither groupers produced respective episodes for the two chronic conditions. The findings for this illustrative patient are representative of what we found for many Medicare enrollees: the outputs produced by the Symmetry and Medstat software commonly present different pictures of the health status and medical treatment circumstances of the same person. The differences become more pronounced the greater the complications of a beneficiary's medical circumstances and the higher the costs

8.2 Applying the Symmetry and Medstat Groupers to Medicare Data

As the Symmetry ETG and Medstat MEG are designed to generate episodes of care using private insurance claims, the specific structure of Medicare claims data poses several challenges that must be addressed in order for these programs to generate valid and reliable episodes of care for Medicare beneficiaries. Our analysis highlights a number of issues specific to using the grouper packages with Medicare claims data. The following discussion first addresses considerations in using the ETG grouper software, and then identifies issues pertinent to using the MEG grouper.

Table 8.3: Comparison of Symmetry and Medstat Grouping Results

Selected 2003 Episodes, Example Beneficiary

Symmetry				Medstat			
ETG	**# of Assigned Claims**	**# of Episodes**	**Total Cost**	**MEG**	**# of Assigned Claims**	**# of Episodes**	**Total Cost**
Similar Episodes							
Closed fracture or dislocation - thigh, hip & pelvis, SL2 (ETG 713103L2 - Acute)	13	1	$9,554	**Fracture: Femur, Head or Neck (MEG 348 - Acute)**	8	1	$9,288
Hypo-functioning thyroid gland, SL1 (ETG 162200L1 - Chronic)	7	1	$138	**Hypothyroidism (MEG 55 - Chronic)**	9	1	$176
Other skin disorders, SL1 (ETG 669100L1 - Acute)	1	1	$41	**Other Inflammations and Infections of Skin and Subcutaneous Tissue (MEG 545 - Acute)**	1	1	$41
Dissimilar Episodes							
Bacterial lung infections, SL4 (ETG 437400L4 - Acute)	8	1	$203	**Pneumonia: Bacterial (MEG 510 - Acute)**	11	1	$14,626
Alzheimer's disease, SL1 (ETG 316400L1 - Chronic)	10	2	$14,897	--	--	--	--
--	--	--	--	**Other Psychoses (MEG 494 - Acute)**	4	1	$266

8.2.1 Key Findings for Symmetry's ETG Grouper

Our summary of Symmetry's functionality noted nine characteristics of the software to keep in mind when applying the grouper to Medicare claims. Five involve features of the basic operation of the ETG grouper in constructing episodes and associated costs from Medicare data, including two that give rise to significant challenges when using this grouper in a Medicare setting:

- Depending on the type of Medicare claim, Symmetry relies on revenue center codes, procedure codes or a combination in its grouping process: The availability of these codes on different types of claims is principally dictated by Medicare payment rules.
    - For institutional claims in Medicare, only revenue center codes are universally reported, with each code designating a particular medical service. We create service-level input records for the ETG grouper, which we term pseudo-claims, using a single revenue center code as the designator of the service. In some instances, a revenue center code on a claim has an associated HCPCS/CPT procedure code (which typically conveys more detail about the form of the service), and when available, we include this accompanying procedure code on the corresponding input record as well. Whereas all institutional pseudo-claims have a revenue center code, many do not have an accompanying procedure code. Of pseudo-claims constructed from IP claims, 2% have a HCPCS or CPT code; 7% of pseudo-claims from SNF claims have a HCPCS/CPT code; and 6% of input records from HS claims have a procedure code. In contrast to these types of claims, OP and HH claims typically have a procedure code accompanying their revenue center codes; 72% of pseudo-claims from OP claims and 88% from HH claims have a HCPCS/CPT code.
    - Constructing input records for OP claims ignoring revenue center codes and using only information supplied by HCPCS/CPT procedure codes results in slightly more ungrouped claims, most of them being OP claims, and induces 7% of costs to shift across episodes.
    - For non-institutional Medicare services, PB and DME claims are readily separated into line items associated with a single HCPCS or CPT code; these claim types have no revenue center codes. Input records for PB and DME claims include the line-item procedure code as their indicator of the medical service performed.
- The ETG software inputs each claim as a set of service-level records, with each record individually assigned to an episode. This can lead to a parent institutional claim being linked to multiple episodes:
    - Each pseudo-claim (i.e., input record) constructed from an IP, OP, SNF, HH or HS claim consists of a revenue center code, the corresponding HCPCS/CPT

procedure code when present, and up to four diagnoses associated with the parent claim.

  - While Symmetry allows for up to 4 ICD-9 procedure codes to be input with each pseudo-claim, Symmetry's algorithm does not use ICD-9 procedure codes in its grouping process. Medicare uses these codes to identify DRG classifications which determine payments.

  - Each pseudo-claim constructed from a PB and DME claim consists of a single HCPCS/CPT procedure code and the line-item diagnosis code.

  - Symmetry's grouper often links pseudo-claims from a single parent claim to different episodes. This results in one (aggregate) Medicare claim being grouped into more than one episode. Over 52% of SNF claims are split across episodes, as are 23% of IP claims, 40% of HH claims, 13% of OP claims, and 15% of HS claims.

- Medicare claims data commonly have more diagnosis codes than are accepted in Symmetry input records:

  - The ETG grouper's input records can incorporate up to 4 diagnosis codes. 82% of IP claims, 70% of SNF claims, and 38% of HH claims have more than 4 codes.

  - Our investigations suggest that the inclusion of extra diagnoses on input records is unlikely to alter the number and distributional characteristics of episodes, but it could induce appreciable shifts in claims across episode types. Using just the primary diagnosis code leads to only a 5% decrease in the number of episodes, small changes in the distributions of their costs and lengths, and only a 1.8 percentage point rise in the cost of ungrouped claims compared to using the first 4 codes. However, without any secondary diagnoses, 21% of claims either change ETGs or episode dates (implying episode shifts), which results in 35% of claim costs being redistributed to other episodes.

- Symmetry does not state how to allocate the cost of a Medicare claim to its pseudo-claims, leaving questions about how to apportion the cost of the claim across its linked episodes:

  - When Symmetry assigns the pseudo-claims of a single Medicare claim to multiple episodes, one faces the challenge of how to distribute the cost of this claim across these episodes. Our analysis allocates the entire claim payment to only one of its episodes based on a majority rule, with all remaining episodes receiving none of the claim's cost. Like any such allocation rule, ours may be inappropriate for assessing the costs of episodes.

  - An alternative way to resolve the cost allocation problem is to input each institutional claim as a single record. Symmetry limits this record to include at most one revenue center code and one procedure code from the original claim. With many codes appearing on claims, the choice of which single revenue and/or procedure code to include on the single input record may be subjective.

(Selecting the room and board revenue center code is a popular option, but many institutional claims lack this code.) The choice will affect the way Symmetry groups claims to episodes (a logical inference because pseudo-claims, which differ only by revenue/procedure codes, do get grouped into different episodes).

- The ETG grouping algorithms are not designed to follow the flow of services expected under Medicare's benefit structures, and episodes constructed by Symmetry do not fully emulate some of the practice patterns seen in Medicare data.
    - Medicare's payment polices promote medical care that link IP stays to post-acute care and to physician services. For post-acute care, this concept is embedded in the Medicare benefit rules; SNF stays are only paid when they are a continuation of inpatient care. For physician claims, Medicare pays for E&M services during IP stays (e.g., daily visits during an admission for a medical condition). Near daily PB visits are, in fact, the norm for IP stays in Medicare data.
    - The ETG grouper does not explicitly incorporate these Medicare policies and practices and thus does not fully capture them in its construction of episodes. Only 48% of SNF claims are grouped to the same episodes as the initiating IP claims. Overall, 69% of IP stays show daily E&M hospital visits, but only 42% have daily visits grouped to the same episode by Symmetry. Moreover, the ETG grouper often assigns components of a single IP claim to multiple episodes, which raises the issue of how to allocate the various SNF and IP-affiliated PB claims to the candidate episodes.
    - In an attempt to strengthen agreement with Medicare policies, we expanded the number of diagnoses on PB claims by adding "header" diagnoses. Including these additional diagnoses only slightly increases the fraction of PB claims assigned to the same episode as a concurrent IP stay, from 56% to 58%. This approach also slightly decreases the fraction of SNF claims grouped to the same episode as an IP claim from 48% to 47.5%. While this modification significantly changes the number and composition of episodes, it fails to regroup claims in a manner more consistent with Medicare's concept of treatment episodes.

Four additional properties of Symmetry's grouping results should be kept in mind when using its episode outputs to create attribution rules and resource utilization measures:

- The construction of Complete Episodes generally approximates the annual cost of claims assigned to the different ETG categories: Complete episodes include all chronic episodes ending in 2003, and only those acute episodes that begin at least one clean period after the beginning of 2002 and end in 2003.
    - The costs of claims grouped to 2003 Complete Episodes for an ETG closely approximate the annual costs assignable to ETGs within a calendar year. The cost of 2003 Complete Chronic Episodes equals 99% of the annual claims costs assigned to chronic episodes in the year 2003; and the corresponding figure for all acute episodes is 93% of annual claims cost.

- Symmetry divides acute conditions into complete episodes using clean periods. For the top ten highest-cost acute ETGs, episodes of the same type sometimes occur within the designated clean period when the dates of claims are used to identify the beginnings and ends of episodes. In particular, depending on the type of ETG, between 0.6% and 35.4% of the same-type episodes take place within clean periods. In some rare instances, these episodes can even overlap, meaning that one episode starts before the prior one ends.

- Symmetry starts and terminates chronic episodes in fixed 12-month periods. For the vast majority of afflicted individuals, one chronic episode immediately follows another. For the top ten highest-cost chronic ETGs, chronic episodes of the same ETG run as continuous events for individuals between 18% and 81% of the time depending on the type of chronic condition.

- Considerable variation exists in the costs of individual episodes within an ETG:

  - The distributions of costs across episodes within an ETG exhibit substantial dispersion. For instance, for each of the top five highest-cost acute and chronic ETGs, the level of cost demarking the most expensive 10% of episodes always exceeds the level demarking the cheapest 10% by at least a factor of four, and in most instances it is far more than two orders of magnitude larger.

  - These distributions also reveal that the highest-cost episodes account for large shares of total ETG costs. For the top five acute ETGs, the top 5% of episodes alone account for 15% to 42% of total annual cost for the ETG, and for the top five chronic ETGs this range is 26% to 50%.

  - This large amount of cost variation suggests that developing a reliable method of risk adjustment for episodes and beneficiary costs necessary for profiling providers in Medicare settings requires approaches not yet available in the existing ETG software. With multiple comorbidities often present and patients that tend to be much more complex, the risk and severity models developed for commercial populations are unlikely to work effectively in the Medicare population.

- Symmetry's grouping results depend on the order in which records are input into the grouper:

  - The ETG grouper requires input records be sorted by beneficiary as well as claim start and end dates. The sort order of records within these beneficiary/start-date/end-date compilations is arbitrary, and yet changing this order produces different grouping results for a notable number of beneficiaries.

  - In a typical example, we show that reordering within these beneficiary/start-date/end-date compilations leads to a change in the assigned ETG type for 0.4% of Medicare claims. More significantly, 0.9% of Medicare claims change their assigned ETGs or episode dates, implying a 1.1% reallocation of Medicare costs to different episodes of care.

- Symmetry's groupings of 2003 Complete Episodes depend on the time horizons used to include claims in 2004:
    - Even after including claims from the first half of 2004, adding claims for the second 6 months of 2004 produces changes in the formulation of 2003 Complete Episodes. In particular, 2.5% of claims accounting for 3.5% of costs are moved to a different 2003 episode by adding the 6-month extension of the time horizon in 2004. While this shift is not large, one might expect an even smaller impact on 2003 Complete Episodes since the first 6 months of 2004 already well exceeds the longest clean period of any acute ETG and chronic ETGs are truncated on an annual basis.
    - In a Medicare policy setting, this finding implies that 2003 grouping results will depend on the horizon specified in 2004 when claims will no longer be counted; counting claims with service dates up until mid-year 2004 will produce somewhat different findings than waiting for all claims in 2004.

8.2.2 Key Findings for the Medstat MEG Grouper

Medstat takes a somewhat different approach to the same data. We highlight three main features that are important considerations when using Medstat's software to group Medicare claims into episodes. The last two represent significant challenges when using this grouper in a Medicare setting:

- Medstat's grouping relies almost solely on diagnosis information**:** In the vast majority of cases Medstat's software relies on the diagnosis information from a claim to perform its grouping process. Information about procedures is primarily used to determine whether a claim represents an x-ray/lab event, and in some instances to allow the grouper to decide between more than one valid diagnosis on a given claim.
    - Although Medstat's input records allow for up to 15 procedure codes, blanking all these codes makes only a marginal difference in grouping outcomes. Only 1.8% of claims shift across episodes as a result of blanking out procedure costs, resulting in a shift in 3.4% of costs across episodes.
    - The grouping process entirely ignores any information about DRGs.
    - Medstat's software distinguishes IP and PB claims from other types of Medicare claims, but it does not differentiate among other types of claims. Switching claims from one of these sources to another results in no change in constructed episodes.
- Medstat's grouper does not offer the capacity to treat a claim as an aggregate of services possibly linkable to more than one episode:
    - Institutional Medicare claims typically cover a number of medical services. Each of these claims is allocated to one and only one episode, and the entire cost associated with this claim is attributed to this single health event.

- Most Medicare institutional claims are paid with prospective payment systems. Prospective payments not only depend on diagnoses, but also on procedures and the likelihood of comorbidities. The presence of comorbidities can imply existence of multiple episodes of care open at the same time. The inability to associate the cost of any such claim with more than one episode represents a challenge in applying Medstat's grouper software to a Medicare population.

- Medstat's grouping algorithms can be adapted to bundle all Part B physician and other claims incurred during a hospital stay, as well as SNF claims that immediately follow the stay, into the same episode as the inpatient stay:

  - The MEG grouper does not explicitly incorporate logic that links claims emulating some important patterns of care common to Medicare settings, patterns supported by Medicare's payment policies. This grouper is not designed, for example, to incorporate expectations that an IP stay (paid for by a medical DRG) be associated with near-daily E&M physician claims; nor does it necessarily treat SNF claims as a continuation of inpatient care. The MEG grouper cannot distinguish E&M claims from other PB claims, nor does it distinguish SNF from many other types of non-IP claims.

  - For the Baseline run of the MEG grouper, only 40% of SNF claims are grouped to the same episodes as the initiating IP claims. Overall, 69% of IP stays show daily E&M hospital visits, but only 32% have daily visits grouped to the same episode by Medstat.

  - Medstat suggested an adaptation of its Admissions Build feature to assist in mimicking aspects of Medicare norms involving IP stays. The All Services Admissions Build changes the concept of an episode: when enabled, it groups all claims concurrent with an IP stay to the same episode, regardless of diagnosis.

  - With the All Services Admissions Build, a SNF claim that starts on or near the day of discharge will be included in the same episode as the inpatient stay. The All Services Admissions Build increases the fraction of SNF claims grouped to the same episode as an IP stay from 40% to 93%.

  - Application of the All Services Admissions Build is effective in linking IP claims to concurrent PB claims: it increases the fraction of linkage PB claims grouped to the same episode as a concurrent IP claim from 40% to 100%. At the same time the All Services Admissions Build is a blunt tool in that it groups claims purely based on timing of service dates.

Three additional traits of Medstat's grouping results should be considered when utilizing its episode outputs to formulate attribution rules and resource utilization measures:

- The construction of Complete Episodes generally approximates the annual cost of claims assigned to the different MEG categories: Complete episodes include all chronic episodes ending in 2003, and only those acute episodes that begin at least one clean period after the beginning of 2002 and end in 2003.

- The costs of claims grouped to 2003 Complete Episodes for a MEG closely approximate the annual costs assignable to MEGs within a calendar year. The cost of 2003 Complete Chronic Episodes equals 98% of the annual claims costs assigned to chronic episodes in the year 2003; and the corresponding figure for all acute episodes is 94% of annual claims cost

- Medstat divides acute conditions into complete episodes using clean periods. For the top ten highest-cost acute MEGs, episodes of the same type sometimes occur within the designated clean period when the dates of claims are used to identify the beginnings and ends of episodes. In particular, depending on the type of MEG, between 0.1% and 20.3% of the same-type episodes take place within clean periods. In some rare instances, these episodes even overlap, meaning that one episode starts before the prior one ends.

- Medstat starts and terminates chronic episodes using 12-month periods. For the vast majority of afflicted individuals, one chronic episode immediately follows another. For the top ten highest-cost chronic MEGs, chronic episodes of the same MEG run as uninterrupted events for individuals between 53% and 87% of the time depending on the type of chronic condition. In rare cases, chronic episode of the same time sometimes even overlap.

- Considerable variation exists in the costs of individual episodes within a MEG:

  - The distributions of costs across episodes within a MEG exhibit substantial dispersion. For instance, for each of the top five highest-cost acute and chronic MEGs, the level of cost demarking the most expensive 10% of episodes always exceeds the level demarking the cheapest 10% by at least an order of magnitude, and in most instances it is more than two orders of magnitude larger.

  - These distributions also reveal that the highest-cost episodes account for large shares of total MEG costs. For the top five acute MEGs, the top 5% of episodes alone account for 25% to 48% of total annual cost for the MEG, and for chronic MEGs this range is 35% to 64%.

  - This large amount of cost variation suggests that developing a reliable method of risk adjustment for episodes and beneficiary costs necessary for profiling providers in Medicare settings requires approaches not yet available in the existing MEG software. With the common presence of multiple comorbidities and the complexity of the patients, the risk and severity models developed for commercial populations are unlikely to work as effectively in the Medicare population.

- Medstat's grouping results depend on the order in which records are input into the grouper:

  - The MEG grouper requires that input records be sorted by beneficiary and claim start dates. In addition, we always sort claims by end date as well to create beneficiary/start date/end date compilations. The sort order of records within

these compilations is arbitrary, and yet changing this order produces different grouping results for a notable number of beneficiaries.

- In a typical example, we show that reordering records within these beneficiary/start-date/end-date compilations leads to a reassignment of 0.4% of Medicare claims to different episodes, implying a 0.6% reallocation of Medicare costs to different episodes of care; 0.2% of claims are reallocated to entirely distinct MEG types.

8.2.3 Influence of Altering Software Configurations and Forms of Input Files

Implementing the grouper packages requires choices in selecting the form of the input file drawn from the Medicare claims and the settings of configuration options. The features summarized above rely primarily on results from "Baseline" specifications. Our analysis also compares this Baseline to alternative choices in the input file creation and configuration settings. These alternative specifications both identify the representativeness of the Baseline findings and the sensitivity of the results to these choices.

For Symmetry, we find the results are sensitive to including available secondary diagnoses when inputting institutional claims, to switching between revenue center and procedure codes, and to extending the episode length limit. More specifically, altering options in running the ETG grouper revealed the following main results:

- Not including secondary diagnoses in input records decreases the number of episodes by 5% and increases the share of ungrouped claims from 14.6% to 16.4%. More significant, eliminating all but the primary diagnosis induces more than a 20% reassignment of claims to different episodes, representing over 34% of costs shifted across episodes.
- Switching from using both revenue center and HCPCS/CPT codes to HCPCS/CPT codes alone for OP claims barely affects most of the summary statistics on episode grouping, but causes 3% more OP claims to remain ungrouped and produces a 5% reassignment of claims to different episodes resulting in a corresponding 7% reallocation of costs.
- Extending the episode length limit from 365 to unlimited decreases the number of episodes by nearly 25%, increases the average length of chronic episodes, and produces almost a 9% reassignment of claims and costs to different ETGs.
- Other adjustments of Symmetry's configuration – first diagnosis as primary, track comorbidity, link facility records, days between facility records, and custom clean periods – generate only marginal differences in the summary statistics describing episodes.

We find that Medstat's results are sensitive to the x-ray/lab flag and to increases in the episode length limit. In particular, the major results of different choices in running the MEG grouper include:

- Eliminating all secondary diagnosis codes in all of Medstat's input records (Run 2) leads to virtually no changes in the fraction of claims grouped into episodes, the number of created episodes, the compositional breakdown of episodes into acute and chronic classifications, or the distributional properties of the number and costs of chronic and acute episodes per person. Moreover, it reassigns just over a 1% of claims and nearly 6% of costs to different MEGs. When considering both MEG reassignment and episode date changes, 2.7% of claims shift across episodes, accounting for a shift of 8.7% in costs.
- Although Medstat's input records allow for up to 15 procedure codes, these codes are essentially not used in grouping outcomes. Blanking out all procedure codes decreases the number of episodes by merely 0.3%, and 1.8% of claims and 3.4% of their corresponding costs shift episodes. In sharp contrast, Medstat's use of procedure codes to set the x-ray/lab flag significantly influences grouping results. This flag prevents records from starting episodes. Turning this flag off for all claims decreases the fraction of ungrouped claims from 23.2% to 0.4%. Additionally, 38.5% of claims and 28.9% of the claims' corresponding costs shift across episodes. Turning the flag on for all SNF and HS claims only marginally affects grouping outcomes. Only 0.4% of claims shift across episodes, resulting in a shift of 3.7% of costs across episodes.
- Extending the acute episode length limit from 1 day to 9999 days significantly decreases the number of episodes and increases the average length of acute episodes. It also can lead to as much as 6-30% reassignment of claims and 4-40% of costs to different MEGs.
- Conversely, other modifications of Medstat's configuration – Facility Admissions Build stratifying chronic episodes, and altering the look-back period – produce minor effects on grouping outcomes.

8.3 Discussion

This study reveals several fundamental challenges in using the ETG and MEG software packages in a Medicare setting. One critical issue concerns assigning costs from aggregate payments for institutional claims. In this study, the aggregate costs for institutional payments are assigned to only one episode, even if the services within the claim cover different health issues. Medstat has no strategy to divide costs across these services. Symmetry has the ability to assign costs of different services using pseudo-claims, but this would require an allocation method that uses revenue center codes to apportion payments across services aggregated in the same prospective payment. Without such an allocation method, the cost from an institutional claim – from a SNF or an IP admission – is assigned to only one episode, even though multiple

diagnoses may be involved. This dilemma – between the Medicare prospective payment approach to aggregate payments and the need to divide payments for episode costs – is a basic challenge in using the episode grouper software in the Medicare setting.

Another challenge concerns the capability of the grouping algorithms to emulate common practice patterns observed in the Medicare system. Through its benefit structure, Medicare guides the flows of services and treatment norms that influence patterns of care across the different claim types. In essence, Medicare has it own concepts of episodes of care in several prominent situations, most notably ones that relate IP stays to post-acute care and physician services. For post-acute care, this concept is formally embedded in Medicare benefit rules by expecting SNF claims to be directly linked to proceeding IP stays. For physician services, the episode concept is supported by Medicare's payment authorization for daily visits by a physician during a hospital admission. One sees direct evidence of practice pattern consistent with these norms of care in Medicare data, and the application of the groupers in this study raise some questions regarding the ability of the groupers to perform the linkage of claims expected by Medicare practitioners. For a grouper to work well within a Medicare setting, it would be advantageous for its constructed episodes to emulate expected practice patterns. In this way, practitioners, whose costs may be profiled by a grouper, would have a logical framework for interpreting results.

Nevertheless, this review of the functionality of the Symmetry ETG and Medstat MEG software packages explores only the first steps involved in utilizing the episode groupers to develop measures of resource utilization by Medicare providers. The next steps are left for future analyses. One formidable task must tackle the problem of devising a reliable method of risk adjustment for the Medicare population. The evidence in this study showing the high variation in costs across episodes and the high frequency of individual beneficiaries experiencing many different episodes suggests that this will require additional studies and new solutions in Medicare populations. Another challenging task consists of creating an approach for attributing episode costs to providers. The Symmetry and Medstat software packages are silent about attribution rules, but clearly development of any approach must recognize how the various options of the groupers alter their construction of episodes, which is the subject of this study.

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APPENDIX A: SYMMETRY RESPONSE

Below are the comments from Ingenix mentioned in the Acknowledgements of this report.

VIA EMAIL

August 29, 2008

Mr. Fred Thomas
Project Officer
Department of Health and Human Services
Centers for Medicaid and Medicare Services

Dear Fred,

On behalf of our Ingenix/Symmetry, I wanted to extend our most sincere congratulations for your efforts in this project which is aimed primarily at the evaluation of different approaches to grouping Medicare claims data to create episodes of care. We especially congratulate you for producing this final comparative report. We have been happy to collaborate with your team on this project for the past two years and appreciate the careful work undertaken by CMS and Acumen in preparing the report.

We have formulated some specific, technical comments that we would appreciate being added to an appendix to the final, public report. These comments have been previously communicated to you and your team and center on some fundamental and foundational issues that we have with some of the approaches taken in the project. You have our formal authorization to include the comments, along with this letter, into your publicly available document.

We look forward to continued collaboration on the proposed next Phase of this comparison study which will revolve around the clinical accuracy of the groupers. Until that time, we wish you continued success!

Best regards,

Dan Dunn, PhD
Senior Vice President, Business Solutions
Health Management Solutions
Ingenix

Ingenix Formal Response
Specific Technical Notes

On the issue of Acumen resetting episode start and end dates:

In an effort to compare the results of the two groupers, this study recalculates the key dates describing an ETG episode. As part of standard outputs, ETG identifies a start and end date for each episode, taking into account the clinical and service information relevant to the episode. For example, as part of this logic, ETG uses medical services called anchor records. Anchor records are services provided by a clinician where a definitive diagnosis has been made. Anchor records exclude ancillary services such as drug, diagnostic imaging and laboratory, and medical services and supplies. Given their nature, ETG does not use ancillary services in defining episode start and end dates. Further, ETG uses special logic for chronic conditions, using annual periods of time. The study recomputed episode start and end dates using non-anchor services and did not treat chronic episodes in a standard manner. Thus, in the study, drugs and ancillary claims can determine the start or end of a clinical episode, and, in some cases, an anchor service would not extend the episode's dates. This recalculation can lead to episode overlaps, truncated or extended episode lengths, and misleading statistics. We do not recommend using this method to analyze ETG results.

On the issue of Acumen adding six months of data and comparing episode results:

In section 5 of the grouper comparison report, Acumen runs an experiment in which the data is run twice with the second run excluding the last 6 months of available data. Table 5.26 reports that even for complete episodes, 1.8 % of claims change their ETG assignment. The report admits that this is a small variation, but is alarmed because their expectation was that 0 of the claims would have changed ETG result.

The result of adding data to a grouping impacting ETG results is not surprising. As a condition progresses for a patient or further information is made available, ETG takes advantage of that data to improve the accuracy of the grouping. Further, the interpretation of the true impact of adding six months of data to the grouping is further challenged by the study's approach to reassigning the start and end date of an episode and their own definition of complete episodes, using a different method from the method used by the ETG software. This artifact also contributes to the observed change. In particular, ETG Episodes are changing when Acumen measures them to be complete, but the grouper itself does not consider them to be complete. Caution should be used in generalizing the findings to other applications of ETG.

APPENDIX B: MEDSTAT RESPONSE

Below are the comments from Thomson/Reuters mentioned in the Acknowledgements of this report.

THOMSON REUTERS

Scott B. McCracken
777 E Eisenhower Pkwy
Ann Arbor, MI 48108
734.913.3426
scott.mccracken@thomsonreuters.com

September 4, 2008

Fredrick Thomas
Project Officer
Centers for Medicare and Medicaid Services
7500 Security Boulevard
Baltimore, MD 21244-1850

Dear Fred,

Thank you for the opportunity to offer our comments on the comparative study of episode groupers; "Evaluating the Functionality of the Symmetry ETG and Medstat MEG Software in Forming Episodes of Care Using Medicare Data." We recognize that a thorough examination and discussion of episodes of care claims grouping methodologies was beyond the scope of this study and view the report as a competent overview of the mechanical workings of the profiled software packages.

We suggest that future investigations look beyond software functionality and focus on the fundamental issues, constraints and inherent trade-offs involved in the grouping of administrative data into episodes of care. For example:

> An evaluation of the differences in approaches to the underlying definitions of episode-of-cares – i.e., clinical or resource-based approaches – in light of the intended uses of the groupings would facilitate a better understanding of the differences between the MEG and ETG grouping results but more importantly help guide CMS in the development of an episode grouping algorithm for the Medicare population.
>
> An assessment of the constraints placed on episode grouping algorithms by CMS and industry billing practices and guidelines is recommended. For example, given current billing and coding protocols, could services on an institutional claim be reliably disaggregated and assigned to appropriate episodes of care or would reasonable approximations be acceptable?
>
> A discussion of "ungroupable" claims is warranted. The percent of claims not assigned to an episode is directly related to the decisions made by the user of the software based on assumptions regarding the reliability of information found on certain claims. For example should rule-out diagnoses on the claims submitted by freestanding lab and imaging centers or the diagnosis reported by an ambulance service be allowed to start an episode? As the report documents, it is possible for MEG to assign all claims to episodes but this is at the risk of creating false episodes.

Finally, it is not clear to us why the ETG severity stratification scheme was profiled in the report and the MEG severity levels were not. Since the introduction of the Disease Staging severity-stratified case mix methodology in the *Journal of the American Medical Association* in 1984, the clinically-defined biological progression of severity stages within

a disease have been the foundation of the classification system; the MEG software and episode group definitions; and integral to the analyses performed by the users of MEG. It has also been the subject of over 100 peer reviewed journal articles, discussed in the MEG user documentation and profiled in recent Medicare Payment Advisory Commission (MedPAC) studies referenced in this report. The MEG severity stages were introduced to Acumen in a presentation in March 2006 and in subsequent critiques of draft reports in November 2006 and March 2008.

The rationale for using the severity levels of one grouper and not the other is also confusing to me. On pages 25-26, the report states:

> "Symmetry recommends interpreting Base ETGs plus its assessed severity level as the episode categories for comparing costs. Consequently, when we use the term ETG in this report, we interpret this designation of an episode type to be the Base ETG plus an associated severity level."
>
> "A primary use of the disease stages [severity levels] arises in adjusting episode costs within a MEG for risk factors, a topic not covered in this report. So when we use the term MEG in the subsequent discussion, we interpret this designation of an episode type to be a simple MEG without distinguishing disease stages."

If risk adjustment can be thought of as a "generic reference to accounting for patient-related factors before examining outcomes of care, regardless of context"[79] and severity of illness is a generally accepted risk factor then there would seem to be no difference between two statements.

We make this point so that the readers of this report and the many users of MEG will not interpret the omission of the MEG episode group severity stages from the analysis to be an implicit comment on their value but simply an analytic decision made by Acumen.

Sincerely,

Scott B. McCracken
Manager, Healthcare Analytics

[79] Iezzoni, L.I., editor, *Risk Adjustment for Measuring Health Care Outcomes, Third Edition*, Health Administration Press, Chicago, IL, 2003, page 17.