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Identifying the Logic to Assign Post-Acute Care Claims and Rehospitalizations to Episodes of Care for Comparing Relative Resource Use Modification 0002

Final Report

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Executive Summary

This goal of this report is to present the RTI V.2 logic for grouping post-acute care (PAC) claims and readmissions to index hospitalizations to support the examination of relative resource use comparisons. The RTI team performed extensive analysis looking at the patterns of PAC utilization using a beneficiary-level episode file constructed in previous work with ASPE. The episode logic used in earlier work with ASPE (RTI V.1 logic) is a variable length episode definition that relies on a window of time between claims to identify services that are *clinically related*. In developing the RTI V.2 logic, RTI used the RTI V.1 logic to learn more about patterns of utilization across an episode of care including number of days between services and types of diagnoses coded across settings. This report outlines the logic that RTI developed and the process and analyses behind the RTI V.2 logic.

In past work in this area, RTI developed a variable length PAC episode definition, RTI V.1, that ended with a 60-day gap in services. In the RTI V.1 logic, the index acute hospitalization initiating an episode is preceded by a 60-day period without acute inpatient or PAC service use. The PAC episode includes all claims after the index acute hospitalization until a 60-day gap in the use of inpatient acute, long-term care hospital (LTCH), inpatient rehabilitation facility (IRF), skilled nursing facility (SNF), home health agency (HHA), or hospital outpatient therapy services. A critique of the RTI V.1 logic is that it may be over-inclusive because it relies on a very wide gap (60 days without services) for identifying related services. For example, any service following a hospitalization but prior to a 60-day gap in services is linked to the episode under the RTI V.1 logic, regardless of the reason for the service. This episode definition relies on the logic of the Medicare spell of illness but may include services no longer related to the index hospitalization or subsequent PAC treatments. Alternative approaches to grouping claims to an episode of care may shorten the gap period or introduce diagnostic criteria to identify related services.

The goal of this work is to refine the RTI V.1 logic based on more in-depth analysis of the Medicare patterns of care. In developing the RTI V.2 logic, RTI examined whether shorter time windows or diagnostic-based approaches were more appropriate for defining related services. To answer this, we examined the number of days between types of PAC services and analyzed diagnosis coding across settings of care. Second, RTI considered the role of acute readmissions in an episode of care. With the readmissions analyses, RTI focused on several questions: When is a subsequent acute admission a *related* readmission? When is a readmission the start of a different episode of care? Are PAC services following a readmission related to the initial index hospitalization? Another goal of this work is to examine how the RTI V.2 logic assigns post-acute and readmission claims to episodes relative to two commercial grouper software products.

The data source for these analyses was the 2006 PAC episode file constructed in earlier work with ASPE. The sample included two types of beneficiaries: those with an index acute admission discharged to PAC in 2006 or those with an index acute admission in 2006 and a readmission to an acute hospital within 6 months.

After completing the initial analysis to develop the logic for grouping PAC and readmission claims to index hospitalizations of care, RTI convened a Technical Expert Panel (TEP) in Washington, DC, on May 19, 2009 and a second panel with many of the same members on September 14, 2009. We presented the first version of the RTI V.2 logic at the May meeting with the goal of soliciting clinical feedback and recommendations for additional analyses. The technical expert panel included 12 clinicians representing each of the PAC settings with experience treating Medicare populations. As a result of this TEP, RTI performed follow-up analyses to address questions raised by the TEP and revised the RTI V.2 logic. At the second TEP meeting, RTI presented the revised RTI V.2 logic and TEP members discussed time-based logic as well as diagnosis-based logic common to many commercial episode grouper products. This report outlines the RTI V.2 logic, presents the analyses of PAC and rehospitalizations supporting the logic, and outlines how the RTI V.2 logic differs from that of two commercial grouper products.

ES.1 RTI V.2 Logic

The goal of the RTI V.2 logic is to assure that post-acute services and related rehospitalizations are grouped with an appropriate index hospitalization. Ideally, one would use diagnostic information to identify related services. However, the reason for admission at subsequent sites of care is typically different than the reason for the previous admission as the primary condition is likely resolved before discharging the patient to the next site of care. Therefore, using diagnoses would require developing an extensive list of "related conditions." Alternatively, "follow-up" care typically occurs within a proximal time, although the length of the time between services may vary depending on whether the subsequent related service involves inpatient nursing (as in hospitalization or skilled nursing facility use) or ambulatory care.

The RTI V.2 logic approaches "related services" largely in terms of time-based criteria, except for rehospitalizations, which also consider the type of diagnoses for the readmission (medical or surgical). Here, we assume any *medical* rehospitalization within the time window is related, or a complication associated with the patient's health status or treatment. Surgical rehospitalizations are distinguished by whether they are planned or more urgent in nature and only the latter are included as part of the episode. The planned follow-up surgical rehospitalizations start a new episode of care in the RTI V.2 logic.

The logic for grouping post-acute care claims and related rehospitalizations to an index hospitalization is broken out into two parts: the first applies to post-acute care claims, and

the second to rehospitalizations. The logic for grouping PAC is described in more detail in **Section 3** and the logic for grouping rehospitalizations is described in more detail in **Section 4**.

RTI V.2. Logic: Post-Acute Care Claims

Post-acute care claims initiating within 20 days of discharge from an index hospitalization or within 20 days of discharge from a prior post-acute care claim or rehospitalization will be **included** as part of the episode.

RTI V.2 Logic: Rehospitalizations

Rehospitalizations are included according to a time-based criteria and the nature of the admission using a 3-step decision rule.

Step 1. Does the rehospitalization meet time-based criteria?

Rehospitalizations meeting one of the following time-based criteria may be considered *related* to the episode of post-acute care:

A. Occurring within 30 days of discharge from an index hospitalization, or from a readmission that is part of an episode

OR

B. Occurring within 20 days of a PAC service that has been linked to an index hospitalization or readmission that is part of an episode.

If NO to both A. AND B., then the rehospitalization is **excluded** from the episode.[1]

If YES to either A. OR B., then proceed to **Step 2**.

Step 2. Is the rehospitalization for a *medical* or *surgical* Medicare Severity Diagnosis Related Groups (MS-DRG)[2]?

If the rehospitalization MS-DRG is *medical* then the rehospitalization is considered related and will be **included** in the episode.

If the rehospitalization MS-DRG is *surgical* then the rehospitalization may be related. Proceed to **Step 3**.

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[1] Note that if a medical rehospitalization occurs more than 30 days following the index hospitalization discharge or discharge from an earlier readmission it will be included in the episode if it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay.

[2] RTI has used CMS's surgical and medical designations. However, we have reclassified one MS-DRG (MS-DRG 004 Tracheostomy with mechanical ventilation 96+ hours or principal diagnosis except face, mouth and neck without major O.R.) that CMS categorizes as surgical to medical, because analysis of patterns of rehospitalization in this MS-DRG are more consistent with a medical MS-DRG.

Step 3.

If the surgical rehospitalization occurs within 30 days of the index hospitalization discharge or discharge for an earlier readmission, then inclusion rules are based on whether rehospitalizations for that Surgical MS-DRG follow patterns that suggest it is related to prior hospitalizations based on acuity[3] (high likelihood of rehospitalization within 30 days) and non-game-ability.[4] **Table ES-1** details the classifications and decision rules for surgical rehospitalizations.

Table ES-1. Surgical Rehospitalization Classifications

Classification	Combined "Acuity" and "Game-ability" Score	Action
Related	2 or higher	**Include** in episode
Indeterminate	1	**Include** only those *within 7 days* of discharge from the index hospitalization or discharge from an earlier readmission
Unrelated	0	**Exclude** from episode

Note that the development of the classification and scoring system are discussed in detail in **Section 4**.

If the surgical rehospitalization occurs after 30 days of the index hospitalization discharge or discharge for an earlier readmission, it is considered related and included in the episode only if it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay.

ES.2 Logic to Assign Post-Acute Care Claims to Index Hospitalizations

The starting point for developing the logic for grouping PAC claims to index acute hospitalizations was the RTI V.1 episode logic which groups all acute and PAC claims prior to a 60-day gap in acute or PAC services to an index acute hospital admission. RTI conducted two types of analyses based on the 60-day gap episode definition. First, using a time-based approach we examined the number of days between services. And second, we conducted analyses looking at the potential for using diagnosis to group PAC claims to index hospital admissions by looking at diagnosis coding across PAC settings.

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[3] Acuity indicates the likelihood that rehospitalizations for an MS-DRG are emergent, urgent or are more prevalent in the period after the prior included service. This measure is based on the proportion of rehospitalizations occurring with 30 days of a prior acute discharge out of all rehospitalizations within 90 days of a prior acute discharge. Please see **Chapter 4** for a more detailed explanation of the development of the "Acuity" and "Game-ability" measures.

[4] Game-ability indicates the risk that rehospitalizations could be delayed or rescheduled to fall on the near or far side of threshold criteria in Step 1.

To define related services using time-based criteria, we looked at the number of days ("gaps") between discharge and admission to different settings of care in the episode. In cases where beneficiaries were admitted to another setting of care prior to discharge from the previous setting, gaps were set equal to zero. This occurred most frequently for beneficiaries readmitted to the acute hospital during a home health episode.[5]

The process of developing the logic for assigning PAC claims to index hospitalizations is summarized as follows:

1. In-depth analysis of the 60-day gap episode logic used in previous work (RTI V.1), specifically looking at the number of days between index acute hospitalizations and subsequent PAC services. This analysis also included consideration of diagnosis-based criteria for grouping PAC claims by examining diagnosis coding across PAC settings.
2. Presentation of the 20-day gap logic for grouping PAC claims to index acute hospitalizations to a technical expert panel (TEP) composed of clinicians from acute and PAC settings.
3. Specific analysis of the patterns of therapy service use and additional analysis based on feedback from the TEP to consider a 30-day gap episode definition for assigning PAC claims to index hospitalizations.
4. Analysis of a 30-day window episode definition given current policy proposals focusing on the 30-day period following hospital discharge.
5. Comparison of results of the 30-day window episode definition, 20-day gap, 30-day gap, and 60-day gap episode definitions.

The results of diagnosis-based analyses suggest that it may be difficult to develop logic to group diagnoses in subsequent PAC settings back to an index acute hospitalization due to limited reliability of coding practices across settings along with the ambiguity of many codes currently used. The results of the diagnosis-based analyses suggest that time-based criteria may be more informative to understanding a trajectory of service use following an index acute hospitalization.

The results of the analysis of the distribution of the number of days between services using the 60-day gap logic showed that across PAC episode patterns, gaps between the acute hospital stay and the first PAC service are less than 20 days at the 95th percentile. The only service type with a gap of greater than 10 days prior to service use is therapy. The results also showed that at the 75th percentile most gaps between the last pair of services in a PAC episode are also less than 20 days. In general, longer gaps between services were observed prior to acute readmission or therapy utilization. These results led to further examination of the 20-day gap episode logic.

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[5] Note that in the implementation of the RTI V.2 logic, we used a more refined method to define gaps based on discharge date (regardless of the position of the claim in the episode). By using this more refined approach in the RTI V.2 logic, we were able to address the issue of overlapping claims.

As part of our evaluation of the 20-day gap episode logic, we examined the types of claims most often "dropped" due to the implementation of a 20-day gap logic rather than a 60-day gap logic. We selected the two most common episode definitions, acute hospital to home health, and acute hospital to skilled nursing facility, and for beneficiaries with these patterns under the 20-day gap episode logic, we looked at what their episode pattern would have been under the less restrictive 60-day gap episode logic. Of the beneficiaries with episode pattern acute hospital to home health under the 20-day episode definition, 86.8 percent of these beneficiaries had the same episode pattern under the 60-day gap episode pattern. Another 3.6 percent would have had an acute hospital readmission under the longer episode definition, and 3.5 percent would have had a therapy claim. Examination of the episode pattern acute hospital to skilled nursing facility yielded similar results. Of beneficiaries with this episode pattern under the 20-day gap episode pattern, 82.8 had the same episode pattern using the 60-day logic. Approximately 6 percent of beneficiaries would have had additional therapy claims, and another 2.2 percent would have an acute rehospitalization included under the less restrictive definition.

Based on the data, the TEP participants confirmed that a 20-day gap criterion appeared to capture most services. Participants agreed that after 20–25 days, it is less likely that a PAC service is related to the index acute admission. Participants at the TEP generally agreed that the 20-day gap definition is clinically reasonable. The TEP did recommend considering a slightly broader 30-day gap episode definition to see if this broader definition might capture more outpatient therapy use. There was no consensus from the panel as to whether a 30-day definition would be over-inclusive or not though there was extensive discussion of the trade-off between sensitivity and specificity in terms of grouping claims, and particularly outpatient therapy claims, to an index acute hospitalization. TEP members concurred with the conclusion that diagnoses codes are not sufficient for grouping PAC claims and readmissions to index hospitalizations based on the analysis of coding across settings.

Based on the feedback from the TEP, we also examined the impact of a shorter 20-day gap episode definition compared to a 30-day gap episode definition. Looking specifically at the two most common episode patterns, hospital discharge to home health and hospital discharge to skilled nursing facility, we found that approximately 95 percent of the time, a beneficiary has the same episode pattern with either the 20-day gap episode logic or the 30-day gap episode logic. For beneficiaries with episode pattern acute hospital to home health under the 20-day gap episode definition, 1.3 percent would also have therapy as part of their episode under the 30-day gap logic, and 2.1 percent of beneficiaries with episode pattern acute hospital to skilled nursing facility would have therapy under a longer episode definition.

TEP members agreed that based on the data presented on the 20-day gap logic versus the 30-day gap logic, there is really very little difference between definitions. TEP members indicated that CMS' intended use of the episode definition might dictate the preference for

one definition over the other due to the specificity versus sensitivity trade-off discussed at the previous TEP. TEP members noted that if the definition will be used for bundled payment, the broader the episode of care, the more at risk providers will be in getting limited payment. For example, using a broader definition, providers may be responsible for paying for a service that is potentially not related. TEP members also expressed that a broader episode may also put the patient at risk due to the incentive of providers to stint on services in the presence of a limited payment. On the other hand, TEP members acknowledged that with a shorter episode the system may overpay providers. In general, the TEP agreed that the 60-day gap episode is far too long for attributing one provider responsibility for all the intervening services, but that there is little difference between the 20-day and 30-day gap episode definitions. Due to the small change in PAC use under the 20-day versus 30-day logic, and the preference for increased specificity given the context of this project in measuring relative resource use and issues related to attribution, the RTI V.2 logic is a 20-day gap definition for grouping PAC services to index hospitalizations.

ES.3 Logic to Assign Rehospitalizations to Index Hospitalizations

As stated previously, the RTI V.2 logic defines related PAC services largely in terms of time-based criteria (i.e., those occurring within xx days of last event). In the case of rehospitalizations, however, RTI also considers whether the primary reason for the rehospitalization is for a medical or surgical procedure. If the rehospitalization is within a certain time since discharge and the reason for admission is medical, we assume the rehospitalization is related. A service is considered clinically "related" to a previous clinical service if it is (a) provided to continue treatment that began (or was itself being continued) during the previous service or (b) provided to treat a complication of the previous service. A service is not related if it is a procedure on a different body part that was not continuation of previous care. For example, reoperation on a failed hip prosthesis is related, but operation to insert a hip prosthesis on the other side is not. In general, rehospitalizations for unplanned medical conditions, such as heart failure, pneumonia, sepsis, etc. are most frequent in the first day or two following discharge and become less frequent with the passage of time. These rehospitalizations which typically result from clinical deterioration tend to decrease exponentially with time after initial acute discharge. The rates of decline vary by reason for rehospitalization but can be tested by plotting the number of readmissions/day by days since the initial acute discharge on a curve for a particular rehospitalization diagnosis and checking its goodness of fit to an exponential curve. Our results show that 90 percent of medical rehospitalizations follow the declining curve of unplanned rehospitalizations just described.

The same is not true of rehospitalizations for surgical procedures, however. Rehospitalization rates for surgical procedures exhibit more varied patterns, suggesting that rehospitalizations for many procedures are planned and the timing of these planned

procedures is frequently discretionary. In the RTI V.2 logic, rehospitalizations for surgical procedures are distinguished by whether they are more discretionary or more urgent in nature. Those readmissions considered discretionary are not included in our definition of an episode of care; instead, they are allowed to start another episode of care although that episode may be complicated by comorbid conditions present in the first episode. Those surgical rehospitalizations occurring more than 30 days after an initial acute discharge generally also start a new episode of care since these treatments are considered independent of those provided in the first episode. The exceptions to this rule are situations where the surgical rehospitalization is initiated on the same day as an included PAC service (or in the case of HHA, a transfer to the hospital without discharge during a stay). Of all rehospitalizations meeting the time-based criteria, only 13 percent were excluded based on diagnosis.

To arrive at rules for identifying related rehospitalizations that occurred after PAC care that has been grouped with an index hospitalization, RTI conducted analyses of the number of days between rehospitalization and the prior acute discharge. For beneficiaries who used PAC services after their initial acute discharge RTI also analyzed the number of days between rehospitalization and discharge from the PAC service preceding rehospitalization. Analyses were stratified by reason for rehospitalization (rather than index acute discharge diagnosis) and based on the 5 percent MedPAR file from 2006.

Means days between index acute discharge and rehospitalization for beneficiaries with no intervening PAC services were around 20 to 25 days, for beneficiaries with PAC service the mean days between index acute discharge and rehospitalization are around 40 to 45 days. For rehospitalizations of beneficiaries with no intervening PAC serviced use, most rehospitalization MS-DRGs show a peak in rehospitalizations per day from days two to five after initial acute discharge, with a declining rate of readmissions that flattens out at around 25 to 30 days. For beneficiaries with intervening PAC services, the majority of rehospitalizations occur on the same day as the last day of PAC service or one day after the last day of PAC service, and mean days between rehospitalization and discharge from the last PAC service range from 8 to 15 days. The rate of rehospitalizations per day by days after last PAC service flattens out around days 11 to 15 after PAC discharge. Based on these findings and input from a TEP held in May, RTI arrived at the following time-based criteria for including rehospitalizations in an episode of PAC care: (1) the rehospitalization occurs within 30 days of discharge from the index hospitalization or from a readmission that is part of the episode, or (2) the rehospitalization occurs within 20 days of an included PAC discharge.

RTI's detailed examination of rehospitalization patterns by reasons for rehospitalization and discussion with the TEP in May resulted in the decision that it would be important to add refinements to the time-based criteria that take into account the reason a patient was rehospitalized when deciding to include or exclude a rehospitalization from an episode.

Distributions of readmissions by days from index acute discharge are generally similar for rehospitalizations for medical MS-DRGs with the median days from index acute discharge falling between 27 to 40 days. Patients who are rehospitalized for medical MS-DRGs are rehospitalized much sooner after a discharge from a prior PAC service than those rehospitalized for a surgical MS-DRG. Analysis of median days since prior PAC to rehospitalization for medical rehospitalizations is almost uniformly zero days, indicating that patients were still receiving PAC the same day they were rehospitalized. The distributions of rehospitalizations for surgical MS-DRGs are more variable than those for medical MS-DRGs, with median days since prior PAC falling across a much larger range than medical MS-DRGs suggesting that it may be inappropriate to assume that all surgical readmissions are related even if they fall within a certain number of days after an included acute or PAC service. These findings indicate that medical rehospitalizations meeting the time-based criteria (within 30 days of a discharge from the index hospitalization or from a readmission that is part of the episode, or within 20 days of an included PAC discharge) should be considered related to the PAC episode and included; however, additional criteria may be necessary for surgical rehospitalizations.

Further analyses were conducted to systematically identify a subset of surgical readmission diagnoses that should be excluded from a 30-day post-discharge readmission rule or a 20-day post-PAC readmission rule.

RTI used three key characteristics to rank surgical rehospitalizations from likely related to unlikely to be related to a prior service included in an episode:

1. **"Acuity":** The concentration of rehospitalizations in the first 30 days after discharge, as a proportion of rehospitalizations in days 0–90 after discharge; or, how much the rate of rehospitalization during the first 30 days exceed the background rate seen in days 31–90. *Rationale: DRGs with higher percentages for this measure are more likely to be urgent/emergent and therefore related.*
2. **"Game-ability":** The proportion of rehospitalizations that might be moved outside the 30-day window for readmissions to be included in the episode by being deferred for a week. RTI calculated the percent of rehospitalizations in the first 30 days after discharge that occur in the last week of those 30 days. *Rationale: DRGs with higher percentages for this measure are more likely to be elective. To avoid negative impacts on patient care, RTI should exclude from the episode rehospitalization diagnoses whose timing is at higher risk for being influenced by the choice of time criteria.*
3. **Rate of Decline in Rehospitalizations:** A more rapid decline in rate of rehospitalizations suggests a stronger association to the index discharge. This is measured by the coefficient when an exponential curve is fitted to the empirical data. *Rationale: DRGs with higher rates of decline (larger "k") are more likely to be emergent/urgent and related to the earlier treatment.*

RTI developed a scoring system based on these three criteria to determine whether or not a surgical readmission should be included in an episode of care. See **Section 4** for further discussion.

ES.4 Commercial Grouper Analysis

After we developed and refined the RTI V.2 logic for grouping post-acute care and readmission claims with index hospitalizations, we applied two commercially available episode groupers to the Medicare claims to examine how the commercial groupers grouped the claims compared with how RTI grouped them. We used (1) Thomson Medstat Medical Episode Grouper (MEG) and (2) Ingenix Symmetry Episode Treatment Groups (ETG). RTI's claim assignment into episodes is based on time duration rather than the presence of a particular ICD-9 or procedure code. In contrast, the commercial groupers' logics are primarily tied to having the related diagnosis codes on subsequent claims. Because past research has shown that diagnosis codes on claims across the episode are frequently different (unpublished runs by RTI), this work explored our hypothesis that these differences will make reliance on using related diagnosis codes to link claims for post-acute care services and for rehospitalizations to hospitalizations within episodes less effective, especially in the Medicare population.

When running the MEG episode grouper, we found that MEG grouped the First PAC claim following an index admission into episodes with the index admission to which RTI grouped it only about 44 percent of the time. First PAC claims that were HHA were slightly more likely to group into MEG episodes with the index admission (48 percent), and First PAC claims that were therapy were less likely to group into MEG episodes with the index admission (24 percent). First PAC claims after an acute index admission for joint replacement were more likely to group with that index admission (72 percent), while First PAC claims after heart failure were less likely (21 percent). Overall, only 20 percent of readmission claims that occurred within 30 days of an index acute admission, according to RTI V.2 logic, were grouped into MEG episodes with that index acute admission. Readmission claims after an index acute admission for pneumonia were slightly more likely to group with that index admission (32 percent), and readmission claims after an index acute admission for joint replacement were far less likely to group with that index admission (5 percent).

When running the ETG episode grouper, we found that ETG grouped First PAC claims into episodes with the index admission to which RTI grouped it only about 43 percent of the time. First PAC claims that were IRF were slightly more likely to group into ETG episodes with the index admission (56 percent), and First PAC claims that were therapy were less likely to group into MEG episodes with the index admission (35 percent). First PAC claims after an acute index admission for stroke were more likely to group with that index admission (74 percent), while First PAC claims after pneumonia were less likely (35 percent). Overall, only 24 percent of readmission claims that occurred within 30 days of an

index acute admission, according to RTI logic, were grouped into ETG episodes with that index acute admission. Readmission claims after an index acute admission for heart failure were slightly more likely to group with that index admission (34 percent), and readmission claims after an index acute admission for joint replacement were far less likely to group with that index admission (16 percent).

In general, we find that the commercial episode groupers create post-acute care episodes using Medicare claims in a far different manner than RTI does. Relying on diagnosis codes to group claims into episodes of care results in relatively few PAC and readmission claims being associated with the index acute admission. Clearly this is because the diagnoses on PAC claims and on the claims for readmissions are not always closely related to the diagnosis on the index hospitalization claim.

Overview of this Report

This report details the analyses undertaken as part of the effort to develop the RTI V.2 logic and the analyses conducted looking at episode assignment under the RTI V.2 logic compared to commercial grouper products. **Section 1** discusses the background for this work including previous work looking at episodes of care. **Section 2** outlines the RTI V.2 logic. **Section 3** presents the analyses conducted to develop the logic for grouping PAC claims to index hospitalizations. **Section 4** details the development of the logic for grouping rehospitalizations to index hospitalizations. **Section 5** provides overall descriptives after the implementation of the RTI V.2 logic by MS-DRG. **Section 6** presents the analyses conducted using the two commercial software projects highlighting how each product groups claims relative to the RTI V.2 logic.

1. Background

The goal of this report is to present the RTI V.2 logic for grouping post-acute care (PAC) claims and readmissions to index hospitalizations to support the examination of relative resource use comparisons. The RTI team performed extensive analysis looking at the patterns of PAC utilization using a beneficiary-level episode file constructed in previous work with ASPE. The episode logic used in earlier work with ASPE (RTI V.1 logic) is a variable length episode definition that relies on a window of time between claims to identify services that are *clinically related*. In developing the RTI V.2 logic, RTI used the RTI V.1 logic to learn more about patterns of utilization across an episode of care including number of days between services and types of diagnoses coded across settings. This report outlines the logic that RTI developed and the process and analyses behind the RTI V.2 logic.

1.1 RTI V.1 Logic for Assigning Post-Acute Care Claims to Index Hospitalizations

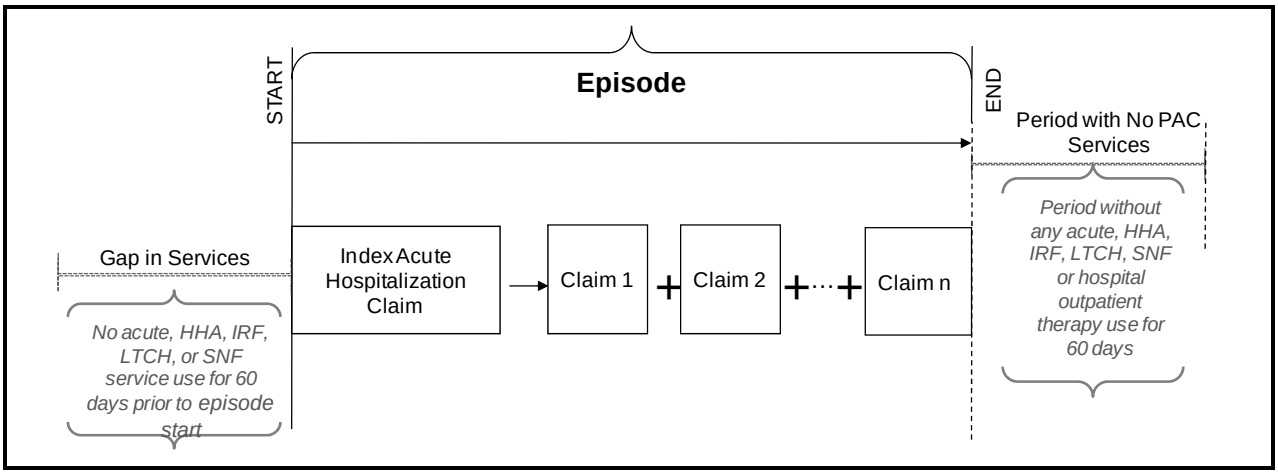
In past work in this area, RTI developed a variable length PAC episode definition, RTI V.1, that ended with a 60-day gap in PAC services or readmissions. In the RTI V.1 logic, the index acute hospitalization initiating an episode is preceded by a 60-day period without acute inpatient or PAC service use. The PAC episode includes all claims after the index acute hospitalization until a 60-day gap in the use of inpatient acute, long-term care hospital (LTCH), inpatient rehabilitation facility (IRF), skilled nursing facility (SNF), home health agency (HHA), or hospital outpatient therapy services (**Figure 1**).

A critique of the RTI V.1 logic is that it may be over-inclusive because it relies on a very wide gap (60 days without services) for identifying related services. For example, any service following a hospitalization but prior to a 60-day gap in services is linked to the episode under the RTI V.1 logic, regardless of the reason for the service. This episode definition relies on the logic of the Medicare spell of illness but may include services no longer related to the index hospitalization or subsequent PAC treatments. Alternative approaches to grouping claims to an episode of care may shorten the gap period or introduce diagnostic criteria to identify related services.

1.2 Developing the RTI V.2 Logic for Assigning Post-Acute Care and Rehospitalization Claims to Index Hospitalizations

The goal of this work is to refine the RTI V.1 logic based on more in-depth analysis of the Medicare patterns of care. In developing the RTI V.2 logic, RTI examined whether shorter time windows or diagnostic-based approaches were more appropriate for defining related services. To answer this, we examined the number of days between types of PAC services and analyzed diagnosis coding across settings of care. Second, RTI considered the role of acute readmissions in an episode of care. With the readmissions analyses, RTI focused on several questions: When is a subsequent acute admission a *related* readmission? When is a

Figure 1. RTI V.1 Episode Logic: Variable Length Episode Ending with a 60-Day Gap in Service Use



readmission the start of a different episode of care? Are PAC services following a readmission related to the initial index hospitalization?

The data source for these analyses was the 2006 PAC episode file constructed in earlier work with ASPE. The sample included two types of beneficiaries: those with an index acute admission using PAC services in 2006 or those with an index acute admission in 2006 and a readmission to an acute hospital within 6 months.[6] The MS-DRGs selected for the analyses included the 80 most frequent MS-DRGs among beneficiaries discharged to PAC and their related MS-DRGs defined as MS-DRGs that were previously assigned to the same DRGs as the top 80 MS-DRGs. The 80 most frequent MS-DRGs account for 70 percent of PAC users and approximately two-thirds of Medicare spending on acute and subsequent PAC services, including all LTCH, IRF, SNF, HHA, hospital outpatient therapy, and acute hospital readmissions that occur prior to a 60-day gap in services (RTI V.1 logic). In addition to these MS-DRGs, we also included MS-DRGs that occur most frequently in 60 percent of beneficiaries discharged to IRF or LTCH. In total, 140 MS-DRGs were included in the study sample.

After completing the initial analysis to develop the logic for grouping PAC and readmission claims to index hospitalizations, RTI convened a Technical Expert Panel (TEP) in Washington, DC, on May 19, 2009, and a second panel with many of the same members on September 14, 2009. We presented the first version of the RTI V.2 logic at the May meeting with the goal of soliciting clinical feedback and recommendations for additional analyses. The technical expert panel included 12 clinicians representing each of the PAC settings with experience treating Medicare populations. **Appendix A** contains a summary of the May

[6] Note that PAC users are defined as beneficiaries discharged to LTCH, IRF, or SNF within 5 days of discharge from an index acute hospitalization, or discharged to HHA or hospital outpatient therapy within 14 days of discharge from an index acute hospitalization.

technical expert panel meeting and participant list. As a result of this TEP, RTI performed follow-up analyses to address questions raised by the TEP and revised the RTI V.2 logic. At the second TEP, RTI presented the revised RTI V.2 logic and TEP members discussed time-based logic as well as diagnosis-based logic that is common to many commercial episode grouper products. **Appendix B** contains a summary of the September technical expert panel meeting a participant list.

The next sections of this report describe the specific analyses that RTI undertook to develop the RTI V.2 logic. **Section 2** presents the final recommendations for the RTI V.2 logic based on analyses and feedback from both the May and September TEPs. **Section 3** details the analysis of the PAC portion of the RTI V.2 logic including both time-based analyses and diagnosis-based analyses, and incorporating the feedback from the TEP members. **Section 4** summarizes the analysis performed by RTI and Dr. Stephen Jencks informing the development of the readmission logic. **Section 5** summarizes the results of the RTI V.2 logic and presents episode length and payment under the logic. **Section 6** presents the results of analysis of the RTI V.2 data compared to the methods used in two commercial episode groupers.

2. RTI V.2 Logic

Purpose. To link related post-acute services and rehospitalizations to index hospitalizations using claims data.

Ideally, one would use diagnostic information to identify related services. However, the reason for admission at subsequent sites of care is typically different than the reason for the index hospital admission as the primary condition is likely resolved before discharge to the next site of care. Therefore, using diagnoses would require developing an extensive list of "related conditions." Alternatively, "follow-up" care typically occurs within a proximal time, although the length of the time between services may vary depending on whether the subsequent related service involves inpatient nursing (as in hospitalization or skilled nursing facility use) or ambulatory care.

The RTI V.2 logic approaches "related services" largely in terms of time-based criteria, except for rehospitalizations, which also consider the type of diagnoses for the readmission (medical or surgical). Here, we assume any *medical* rehospitalization within the time window is related, or a complication associated with the patient's health status or treatment; surgical treatments are distinguished by whether they are discretionary or urgent in nature. Only the latter are grouped with a previous hospitalization if they meet certain time criteria. Those readmissions considered discretionary are not grouped with a previous hospitalization; instead, they are allowed to start another episode of care although that episode may be complicated by comorbid conditions present in the first episode. Rehospitalizations occurring more than 30 days after an initial acute discharge are linked to the episode if it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay. The logic is presented in more detail below.

The Logic. The logic for grouping post-acute care claims and related rehospitalizations to an index hospitalization is broken out into two parts: the first applies to post-acute care claims and the second to rehospitalizations.

2.1 RTI V.2 Logic: Post-Acute Care Claims

Post-acute care claims initiating within 20 days of discharge from an index hospitalization or within 20 days of discharge from a prior post-acute care claim or rehospitalization will be **included** as part of the episode.

2.2 RTI V.2 Logic: Rehospitalizations

Rehospitalizations are included according to a time-based criteria and the nature of the admission using a 3-step decision rule.

Step 1. Does the rehospitalization meet time-based criteria?

Rehospitalizations meeting one of the following time-based criteria may be considered *related* to the episode of post-acute care:

A. Occurring within 30 days of discharge from an index hospitalization, or from a readmission that is part of an episode

   OR

B. Occurring within 20 days of a PAC service that has been linked to an index hospitalization or readmission that is part of an episode.

If NO to both A. AND B., then rehospitalization is **excluded** from the episode.[7]

If YES to either A. OR B., then proceed to **Step 2**.

Step 2. Is the rehospitalization for a *medical* or *surgical* MS-DRG[8]?

If the rehospitalization MS-DRG is *medical* then the rehospitalization is considered related and will be **included** in the episode.

If the rehospitalization MS-DRG is *surgical* then the rehospitalization may be related. Proceed to **Step 3**.

Step 3.

If the surgical rehospitalization occurs within 30 days of the index hospitalization discharge or discharge for an earlier readmission, then inclusion rules are based on whether rehospitalizations for that surgical MS-DRG follow patterns that suggest it is related to prior hospitalizations based on acuity[9] (high likelihood of rehospitalization within 30 days) and non-game-ability.[10] **Table 1** details the classifications and decision rules for surgical rehospitalizations:

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[7] If a medical rehospitalization occurs more than 30 days following the index hospitalization discharge or discharge from an earlier readmission it will be included in the episode if it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay.

[8] RTI has used CMS's surgical and medical designations. However, we have reclassified one MS-DRG (MS-DRG 004 Tracheostomy with mechanical ventilation 96+ hours or principal diagnosis except face, mouth and neck without major O.R.) that CMS categorizes as surgical to medical, because analysis of patterns of rehospitalization in this MS-DRG are more consistent with a medical MS-DRG.

[9] Acuity indicates the likelihood that rehospitalizations for an MS-DRG are emergent, urgent, or are more prevalent in the period after the prior included service. This measure is based on the proportion of rehospitalizations occurring with 30 days of a prior acute discharge out of all rehospitalizations within 90 days of a prior acute discharge. Please see **Chapter 4** for a more detailed explanation of the development of the "Acuity" and "Game-ability" measures.

[10] Game-ability indicates the risk that rehospitalizations could be delayed or rescheduled to fall on the near or far side of threshold criteria in Step 1.

Table 1. Surgical Rehospitalization Classifications

Classification[11]	Combined "Acuity" and "Game-ability" Score	Action
Related	2 or higher	**Include** in episode
Indeterminate	1	**Include** only those *within 7 days* of discharge from the index hospitalization or discharge from an earlier readmission
Unrelated	0	**Exclude** from episode

Note that the development of the classification and scoring system are discussed in detail in **Section 4**.

If the surgical rehospitalization occurs after 30 days of the index hospitalization discharge or discharge for an earlier readmission, it is considered related and included in the episode only if it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay.

[11] See **Table 17** in **Section 4** for the list of surgical rehospitalization MS-DRGs that have classified as "related," "indeterminate," and "unrelated" based on analysis of acuity and game-ability. Note that **Appendix B** is restricted to those rehospitalization MS-DRGs that have at least 100 rehospitalizations within 0–90 days after index acute discharge (77% of surgical diagnoses). For MS-DRGs with fewer than 100 rehospitalizations, we modified our procedure slightly due to concerns about variability. Ten of these MS-DRGs qualified as "related" using the rules from **Table 1**. We examined these individually and reclassified four as indeterminate due to clinical concerns, small cell sizes, and wide confidence intervals. The rest of these MS-DRGs had combined acuity and game-ability scores of 1 or 0 and we classified these as unrelated. See **Appendix C** for a list of these diagnoses and their classifications.

3. Logic to Assign Post-Acute Care Claims to Index Hospitalizations

This chapter examines the development of the RTI V.2 logic for identifying PAC claims related to an index hospitalization. The process of developing the logic began with detailed examination of the RTI V.1 logic for grouping PAC claims to index acute hospitalizations. The RTI V.1 logic has been used in earlier work for CMS and ASPE and defines the end of an episode as the last acute or PAC claim prior to a 60-day gap in acute and PAC services. This variable length episode definition is based on the Medicare "spell of illness" concept. A critique of the RTI V.1 logic is that it may be over-inclusive because it relies on a very wide gap of 60 days without services for identifying related services. For example, this definition includes any PAC service or hospitalization within 60 days of the last service but some of these services may be for treatment of an unrelated injury or illness.

The goal of this work with CMS was to refine the RTI V.1 logic based on more in-depth analysis of the Medicare patterns of PAC. The process of developing the logic for grouping PAC claims to index acute admissions is outlined below. Note that separate analyses were conducted specifically looking at grouping acute rehospitalizations to index acute admissions, both for beneficiaries using PAC services and for beneficiaries not using PAC services. The analyses informing the development of the readmission logic are presented in the next section.

The process of developing the logic for assigning PAC claims to index hospitalizations included the following steps:

1. In depth analysis of the 60-day gap episode logic used in previous work (RTI V.1), specifically looking at the number of days between index acute hospitalizations and subsequent PAC services. This analysis also included consideration of diagnosis-based criteria for grouping PAC claims by examining diagnosis coding across PAC settings.
2. Presentation of a 20-day gap logic for grouping PAC claims to index acute hospitalizations to a Technical Expert Panel (TEP) composed of clinicians from acute and PAC settings.
3. Specific analysis of the patterns of therapy service use and additional analysis based on feedback from the TEP to consider a 30-day gap episode definition for assigning PAC claims to index hospitalizations.
4. Analysis of a 30-day window episode definition given current policy proposals focusing on the 30-day period following hospital discharge.
5. Comparison of results of the 30-day fixed length episode definition, 20-day gap, 30-day gap, and 60-day gap episode definitions.
6. Presentation of updated analyses to a TEP.
7. Development of final RTI V.2 logic for assigning PAC claims to index hospitalizations.

Based on the each of these analyses, the RTI V.2 logic for grouping PAC claims to index acute hospitalizations is defined by a 20-day gap in PAC services. The next sections detail the analyses conducted and feedback from the technical expert panels that helped develop this logic.

3.1 Starting Point: In-Depth Analysis of RTI V.1 60-Day Gap Logic: Time-Based Criteria

The starting point for our logic for grouping PAC claims to index acute hospitalizations was the RTI V.1 episode logic which groups all acute and PAC claims prior to a 60-day gap in acute or PAC services to an index acute hospital admission. RTI conducted two types of analyses based on the 60-day gap episode definition. First, using the time-based approach we examined the number of days between services. And second, we conducted analyses looking at the potential for using diagnosis to group PAC claims to index hospital admissions by looking at diagnosis coding across PAC settings.

To define related services using time-based criteria, we looked at the number of days ("gaps") between discharge and admission to different settings of care in the episode. In cases where beneficiaries were admitted to another setting of care prior to discharge from the previous setting, gaps were set equal to zero. This occurred most frequently for beneficiaries readmitted to the acute hospital during a home health episode.

Tables 2 and **3** show the results of analyses looking at mean number of days between services for different patterns of PAC use under the RTI V.1 60-day gap episode definition. Episode patterns are represented by letters: A=acute hospital, H=home health, S=skilled nursing facility, I=inpatient rehabilitation, L=long-term care acute hospital, O=hospital outpatient therapy, and T=independent therapist. The patterns of PAC use include the most frequent patterns of PAC utilization observed among 75 percent of beneficiaries using PAC services. The table shows the number of days between the first two settings and the last two settings in the episodes, specifically looking at the mean, and the distribution of the number of days between settings by percentile (50th, 75th, 90th, and 95th). Note that for beneficiaries with just one site of PAC following discharge from the acute hospital, the values for the first pair of services and the last pair of services are equal. The analyses in this table were conducted by episode pattern across all study MS-DRGs to show whether the number of days between settings varies by type of subsequent PAC setting. MS-DRG-specific analyses of gaps between PAC settings were also run and are presented in **Appendix D**.

The results in **Table 2** show that the most common pattern of PAC use is acute hospital followed by admission to home health services (AH). This episode is typical of 19.6 percent of beneficiaries discharged to PAC under the 60-day gap episode logic and the mean number of days between discharge from the acute setting and admission to home health is 2.1 days. The median is 1 day and at the 95th percentile, the number of days between

Table 2. Analysis of 60-Day Gap Episode, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean Gap First Pair	Mean Gap Last Pair	Gap First Pair 50th Percentile	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 50th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
AH	16,701	19.6	19.6	2.1	2.1	1	2	4	7	1	2	4	7
AS	10,723	12.6	32.2	0.0	0.0	0	0	0	0	0	0	0	0
ASH	6,149	7.2	39.4	0.0	2.6	0	0	0	0	1	2	4	8
AO	4,544	5.3	44.8	3.9	3.9	3	6	11	13	3	6	11	13
AHA	3,298	3.9	48.7	2.0	9.0	1	2	4	7	0	11	37	48
ASO	2,714	3.2	51.9	0.0	12.1	0	0	0	0	4	19	39	49
AHO	2,239	2.6	54.5	1.9	9.6	1	2	3	6	4	11	30	42
AIH	2,192	2.6	57.1	0.0	2.4	0	0	0	0	1	2	4	6
AHT	2,081	2.4	59.5	1.9	9.8	1	2	3	6	4	11	31	42
ASAS	1,809	2.1	61.6	0.0	0.7	0	0	0	0	0	0	0	1
ASA	1,803	2.1	63.7	0.0	7.5	0	0	0	0	0	7	33	46
AIO	1,183	1.4	65.1	0.0	5.9	0	0	0	0	4	6	12	18
AHAH [b]	1,029	1.2	66.3	2.2	14.4	1	2	5	8	5	25	43	51
ASHO	992	1.2	67.5	0.0	10.2	0	0	0	0	5	13	29	42
ASHT	847	1.0	68.5	0.0	10.0	0	0	0	0	5	12	30	41
AST	762	0.9	69.4	0.0	7.8	0	0	0	0	3	8	28	38
ASHA	749	0.9	70.3	0.0	9.8	0	0	0	0	0	12	40	50
AI	731	0.9	71.1	0.0	0.0	0	0	0	0	0	0	0	0
AIHO	600	0.7	71.8	0.0	8.9	0	0	0	0	5	11	25	33
AOA	523	0.6	72.5	3.5	14.0	2	6	11	12	6	22	41	51
ASASA	460	0.5	73.0	0.0	5.8	0	0	0	0	0	2	22	38
ASASH	456	0.5	73.5	0.0	3.3	0	0	0	0	1	3	5	14
AIHT	410	0.5	74.0	0.0	9.2	0	0	0	0	4	12	27	37
AIT	392	0.5	74.5	0.0	7.8	0	0	0	0	4	7	21	34
AL	391	0.5	74.9	0.0	0.0	0	0	0	0	0	0	0	0

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

[b] Note that the gap between last pair of services was calculated based on discharge from the acute hospital readmission and admission date to the second home health claim. For some beneficiaries, home health services under the first claim may have continued after the readmission claim.

Source: RTI analysis of Medicare claims 5% sample (MM2Y253).

Table 3. Analysis of 60-Day Gap Episode Length, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean Episode Length	50th Percentile	75th Percentile	90th Percentile	95th Percentile
AH	16,701	19.6	19.6	49.5	37.0	58.0	72.0	122.0
AS	10,723	12.6	32.2	41.6	31.0	56.0	93.0	106.0
ASH	6,149	7.2	39.4	77.8	66.0	90.0	130.0	159.0
AO	4,544	5.3	44.8	39.2	31.0	55.0	88.0	111.0
AHA	3,298	3.9	48.7	58.4	43.0	75.0	109.0	137.0
ASO	2,714	3.2	51.9	100.2	87.0	133.0	182.0	216.0
AHO	2,239	2.6	54.5	84.3	75.0	101.0	137.0	169.0
AIH	2,192	2.6	57.1	70.5	56.0	76.0	107.0	150.0
AHT	2,081	2.4	59.5	88.7	78.0	106.0	142.0	180.0
ASAS	1,809	2.1	61.6	79.2	72.0	107.0	124.0	141.0
ASA	1,803	2.1	63.7	50.7	38.0	65.0	102.0	130.0
AIO	1,183	1.4	65.1	76.9	65.0	92.0	130.0	166.0
AHAH	1,029	1.2	66.3	164.7	124.0	182.0	362.0	471.0
ASHO	992	1.2	67.5	115.7	103.0	142.0	191.0	227.0
ASHT	847	1.0	68.5	117.9	101.0	142.0	203.0	249.0
AST	762	0.9	69.4	78.6	65.5	96.0	142.0	184.0
ASHA	749	0.9	70.3	88.3	73.0	112.0	151.0	188.0
AI	731	0.9	71.1	18.0	16.0	22.0	28.0	33.0
AIHO	600	0.7	71.8	115.2	106.0	141.0	186.5	219.5
AOA	523	0.6	72.5	59.3	51.0	83.0	112.0	140.0
ASASA	460	0.5	73.0	87.6	74.0	116.5	152.5	175.5
ASASH	456	0.5	73.5	122.5	104.5	146.0	201.0	252.0
AIHT	410	0.5	74.0	113.5	99.0	130.0	193.5	238.0
AIT	392	0.5	74.5	77.0	66.0	93.0	129.0	152.0
AL	391	0.5	74.9	42.7	34.0	53.0	84.0	96.0

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of Medicare claims 5% sample (MM2Y253).

acute discharge and admission to home health services is 7 days. The second most frequent episode pattern is acute hospital followed by admission to a skilled nursing facility (AS) and this episode pattern is common to 12.6 percent of beneficiaries using PAC under the 60-day gap episode definition. Gap analysis of this episode pattern indicates that in nearly all cases, there is a direct transfer from acute to SNF, and therefore no gap in services. The third most frequent PAC episode pattern is acute hospital discharge to skilled nursing facility (SNF) followed by discharge to home health agency (HHA) which was common to 7.2 percent of beneficiaries using PAC services under the 60-day gap episode logic. Similar patterns in gaps between services were observed; primarily direct transfer from acute to SNF, and a mean of 2.6 days between discharge from SNF and admission to HHA. These three episode patterns account for 39.4 percent of episode patterns for PAC users under the 60-day gap episode definition. **Table 3** shows the corresponding episode length for each of the episode patterns. The average episode length was 49.5 days for episode pattern AH, 41.6 days for episode pattern AS, and 77.8 days for episode pattern ASH. In general, episodes with home health or therapy were longer than episodes without these services.

Table 2 shows that across the episode patterns in the 60-day gap logic, at the 95th percentile gaps between the first pair of services are less than 20 days. The only service type with a gap of greater than 10 days prior to service use is therapy. **Table 2** also shows that at the 75th percentile most gaps between the last pair of services are less than 20 days. The two episode patterns with greater than 20 days between the last two services in an episode at the 75th percentile are AHAH and AOA. In general, longer gaps were observed prior to acute readmission or therapy utilization (either O or T). For example, looking at the PAC episode pattern ASO, the number of days between discharge from SNF and admission to hospital outpatient therapy at the 90th percentile was 39 days, indicating that in 10 percent of episodes with this episode pattern, the gap between SNF and hospital outpatient therapy services was greater than 39 days. The mean number of days between SNF and hospital outpatient therapy for this episode pattern was 12.1 days. Further analyses specific to grouping rehospitalizations are presented in the next section.

In our MS-DRG-specific analyses (**Appendix D**), the gap between acute and first PAC service was less than 20 days in each of the study MS-DRGs at the 95th percentile and the gap between the last two PAC services was less than 20 days in each of the study MS-DRGs at the 75th percentile. Post-surgical cases begin to have gaps between the last two PAC services of 21 days or more at the 90th percentile, for example, in MS-DRG 460 Spinal fusion except cervical without major complication or comorbidity (MCC), the number of days between the last pair of services was 32 days at the 90th percentile.

3.2 Analysis of Diagnosis-Based Criteria

Our analyses also included consideration of diagnosis-based criteria as a means of identifying related services. In examining diagnoses, we mapped International Classification

of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes on PAC claims to Hierarchical Condition Categories (HCCs) which aggregate ICD-9-CM codes into clinically meaningful categories. Using these "aggregated diagnoses" we compared the PAC HCC to the index acute hospitalization MS-DRG. We examined both the relationship between the Index MS-DRG and the PAC primary diagnosis for different MS-DRGs as well as the relationships between the PAC secondary diagnoses and the index MS-DRG. Specifically, these analyses included looking at

a. Frequency of HCCs coded as principal diagnosis (diag 1) on the first PAC claim, by MS-DRG, by first PAC setting (**Tables 4** and **5**; **Appendices E1**–**E5**)
b. Frequency of HCCs coded as secondary diagnoses (diag 2–diag 10) on the first PAC claim, by MS-DRG, by PAC setting (**Appendices F1**–**F5**)

This set of analyses provided valuable information on the types of diagnoses commonly coded in different PAC settings and helped us understand the relationships between PAC diagnoses and index MS-DRG within an episode of care. By examining the diagnoses coded as secondary diagnoses (diag 2–diag 10) we were also able to learn more about common comorbidities in the different PAC populations.

Findings from the diagnosis-based analysis showed that 97 percent of beneficiaries discharged to PAC from index admission MS-DRG 470 Major joint replacement or reattachment of lower extremity without MCC had 1 of 7 HCCs coded on their first PAC claim. HCC 182: Rehabilitation and HCC 179: Post-surgical states/aftercare/elective were the most common codes (38.4 percent and 34.8 percent, respectively). However, these codes do not identify specific conditions. In looking at MS-DRG 194, Simple pneumonia & pleurisy with complication or comorbidity (CC), we see that there is also clustering in terms of the number of HCCs recorded on the first PAC claim. Nearly 80 percent of beneficiaries with MS-DRG 194 in their index acute admission had 1 of 10 HCC codes in the primary position of their first PAC claim and 36.1 percent were in HCC 113: Viral and unspecified pneumonia, pleurisy. Analysis of secondary diagnoses (diag 2–diag 10) indicated common comorbidities by MS-DRG. HCCs related to hypertension, osteoarthritis, and gastrointestinal disorders have relatively high frequency when looking at secondary diagnoses across MS-DRGs. In general, coding on hospital outpatient therapy claims was vague. Codes on these claims were often missing or grouped to a general HCC such as HCC 182: Rehabilitation or HCC 183: Screening/observations/special exams.

The results of our diagnosis-based analyses indicate that many potentially related PAC diagnoses can be identified for index conditions given the clustering we observe within a few diagnoses. However, though the frequency of different diagnoses does vary within conditions there is significant overlap in the coding across MS-DRGs. Similarity in coding across diagnosis is clearly seen in coding for HCC 182: Rehabilitation, which is the most common primary diagnosis coded for beneficiaries in MS-DRG 470 and the second most

Table 4. Frequency of Hierarchical Condition Categories Coded as Principal Diagnosis in First PAC Setting of Care, Index MS-DRG 470: Major Joint Replacement or Reattachment of Lower Extremity without MCC

HCC in Principal Diagnosis of First PAC Claim	Overall N	Overall Percent	LTCH N	LTCH Percent	IRF N	IRF Percent	SNF N	SNF Percent	HHA N	HHA Percent	Hospital Out-patient Therapy N	Hospital Out-patient Therapy Percent
182: Rehabilitation	5,560	38.4	3	9.4	2,000	73.0	1,501	28.4	1,591	29.9	465	42.0
179: Post-surgical states/aftercare/ elective	5,033	34.8	25	78.1	55	2.0	1,539	29.2	3,213	60.4	201	18.1
40: Osteoarthritis of hip or knee	1,431	9.9	2	6.3	482	17.6	701	13.3	93	1.7	153	13.8
43: Other musculoskeletal and connective tissue disorders	892	6.2	0	0.0	40	1.5	624	11.8	84	1.6	144	13.0
158: Hip fracture/dislocation	655	4.5	0	0.0	132	4.8	508	9.6	9	0.2	6	0.5
166: Major symptoms, abnormalities	376	2.6	0	0.0	2	0.1	71	1.3	286	5.4	17	1.5
183: Screening/observation/special exams	103	0.7	0	0.0	1	0.0	0	0.0	0	0.0	102	9.2

MCC=major complication or comobidity; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Table 5. Frequency of Hierarchical Condition Categories Coded as Principal Diagnosis in First PAC Setting of Care, Index MS-DRG 194: Simple Pneumonia & Pleurisy with CC

HCC in Principal Diagnosis of First PAC Claim	Overall N	Overall Percent	LTCH N	LTCH Percent	IRF N	IRF Percent	SNF N	SNF Percent	HHA N	HHA Percent	Hospital Out-patient Therapy N	Hospital Out-patient Therapy Percent
113: Viral and unspecified pneumonia, pleurisy	998	36.1	13	39.4	5	9.4	548	43.2	401	38.1	31	8.7
182: Rehabilitation	343	12.4	0	0.0	31	58.5	161	12.7	131	12.5	20	5.6
108: Chronic obstructive pulmonary disease	250	9.0	3	9.1	4	7.5	69	5.4	159	15.1	15	4.2
183: Screening/observation/special exams	171	6.2	0	0.0	0	0.0	0	0.0	0	0.0	171	47.8
166: Major symptoms, abnormalities	163	5.9	0	0.0	2	3.8	68	5.4	57	5.4	36	10.1
80: Congestive heart failure	83	3.0	0	0.0	0	0.0	35	2.8	48	4.6	0	0.0
43: Other musculoskeletal and connective tissue disorders	55	2.0	0	0.0	0	0.0	16	1.3	8	0.8	31	8.7
19: Diabetes without complication	46	1.7	0	0.0	0	0.0	11	0.9	35	3.3	0	0.0
167: Minor symptoms, signs, findings	40	1.4	0	0.0	0	0.0	19	1.5	15	1.4	6	1.7
49: Dementia/cerebral degeneration	37	1.3	0	0.0	0	0.0	27	2.1	5	0.5	5	1.4
111: Aspiration and specified bacterial pneumonias	34	1.2	7	21.2	0	0.0	19	1.5	8	0.8	0	0.0
135: Urinary tract infection	32	1.2	0	0.0	0	0.0	27	2.1	4	0.4	1	0.3
179: Post-surgical states/aftercare/ elective	31	1.1	0	0.0	0	0.0	15	1.2	15	1.4	1	0.3
112: Pneumococcal pneumonia, emphysema, lung abscess	30	1.1	0	0.0	0	0.0	18	1.4	12	1.1	0	0.0
115: Other lung disorders	29	1.0	1	3.0	0	0.0	13	1.0	12	1.1	3	0.8
96: Ischemic or unspecified stroke	24	0.9	0	0.0	1	1.9	17	1.3	4	0.4	2	0.6
91: Hypertension	23	0.8	0	0.0	0	0.0	11	0.9	12	1.1	0	0.0
92: Specified heart arrhythmias	23	0.8	0	0.0	0	0.0	14	1.1	9	0.9	0	0.0
8: Lung, upper digestive tract, and other severe cancers	19	0.7	0	0.0	0	0.0	8	0.6	11	1.0	0	0.0
100: Hemiplegia/hemiparesis	16	0.6	0	0.0	1	1.9	10	0.8	4	0.4	1	0.3
73: Parkinson's and Huntington's Diseases	16	0.6	0	0.0	1	1.9	10	0.8	4	0.4	1	0.3

CC=complication or comobidity; HCC=hierarchical condition categories; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

common diagnosis for MS-DRG 194. This finding suggests that it may be difficult to develop a decision logic based on diagnosis criteria alone because PAC diagnoses could potentially be linked to more than one hospitalization in the absence of the use of time-based criteria. Even with logic that combined time-based and diagnosis criteria, in situations involving multiple hospitalizations for MS-DRGs whose subsequent PAC services have overlapping diagnosis codes, it is the time criteria that would determine the assignment of the PAC services to the appropriate hospitalization rather than the PAC diagnosis.

This analysis also revealed that coding practices may vary in different settings. Coding for HCC 182: Rehabilitation is especially common for beneficiaries discharged to IRF because it is the coding practice in this setting to code the reason for admission rather than for the underlying condition. Also, certain secondary diagnoses are common regardless of the primary diagnoses; many of these are general codes rather than specific diagnoses suggesting claims data may be limited in their usefulness for basing related services on diagnoses. The commonly occurring diagnoses appear to be those related to a patient's constellation of conditions, rather than specifically tied to a current acute event. The results of these analyses suggest that it may be difficult to develop logic to group diagnoses in subsequent PAC settings back to an index acute hospitalization due to limited reliability of coding practices across settings along with the ambiguity of may codes currently used. The results suggest that time-based criteria may be more informative to understanding a trajectory of service use following an index acute hospitalization.

The TEP concurred with RTI's recommendation to rely on time-based criteria rather than on claims- and diagnosis-based criteria. One TEP participant noted that a patient may have multiple diagnoses making it difficult to know what the underlying condition is based on codes. Another participant, in agreement with the time-based logic, remarked that diagnosis coding is reimbursement driven and therefore is not reliably clinically meaningful.

3.3 RTI V.2 Logic: 20-Day Gap

As a result of the time-based analyses and diagnosis-based analysis using the 60-day gap episode definition, RTI initially examined the impact of a 20-day gap episode logic for grouping PAC claims and rehospitalizations to index acute hospitalization and to prior PAC claims. The findings from the time-based analyses indicated that the majority of PAC services following discharge from the index acute hospital stay were initiated prior to a 20-day gap in services at the 95th percentile across 75 percent of the episode patterns examined. The results of these analyses were presented to the TEP and the results of this shorter 20-day gap episode logic are presented in **Tables 6** and **7**.

Table 6. Analysis of 20-Day Gap Episode Definition, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean Gap First Pair	Mean Gap Last Pair	Gap First Pair 50th Percentile	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 50th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
AH	19,232	22.6	22.6	2.1	2.1	1	2	4	7	1	2	4	7
AS	12,955	15.2	37.8	0.0	0.0	0	0	0	0	0	0	0	0
ASH	6,986	8.2	46.0	0.0	2.0	0	0	0	0	1	2	4	6
AO	5,131	6.0	52.1	3.9	3.9	2	6	11	13	2	6	11	13
AHA	3,729	4.4	56.4	2.1	1.6	1	2	5	7	0	1	6	12
AIH	2,496	2.9	59.4	0.0	1.8	0	0	0	0	1	2	3	5
ASO	2,321	2.7	62.1	0.0	4.2	0	0	0	0	2	6	13	17
AHO	2,094	2.5	64.6	1.9	4.7	1	2	3	6	3	6	12	15
AHT	1,994	2.3	66.9	1.9	4.6	1	2	3	6	3	6	12	15
ASAS	1,887	2.2	69.1	0.0	0.2	0	0	0	0	0	0	0	0
ASA	1,607	1.9	71.0	0.0	2.0	0	0	0	0	0	1	9	13
AIO	1,238	1.5	72.5	0.0	4.6	0	0	0	0	4	6	10	12
AI	1,007	1.2	73.6	0.0	0.0	0	0	0	0	0	0	0	0
ASHO	892	1.0	74.7	0.0	5.2	0	0	0	0	4	7	13	15

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y254).

Table 7. Analysis of 20-Day Gap Episode Length, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean 20-Day Gap	Mean 60-Day Gap	Percent Change in Mean Episode Length [b]	20-Day Gap 50th Percentile	20-Day Gap 75th Percentile	20-Day Gap 90th Percentile	20-Day Gap 95th Percentile	60-Day Gap 50th Percentile	60-Day Gap 75th Percentile	60-Day Gap 90th Percentile	60-Day Gap 95th Percentile
AH	19,232	22.6	22.6	47.6	62.8	24.2	37	57	70	114	41	66	125	184
AS	12,955	15.2	37.8	42.1	60.5	30.4	32	57	93	106	39	81	122	175
ASH	6,986	8.2	46.0	74.6	92.2	19.1	64	88	123	150	72	107	164	223
AO	5,131	6.0	52.1	34.5	51.2	32.6	28	48	74	96	35	66	111	156
AHA	3,729	4.4	56.4	46.3	103.1	55.1	34	50	82	112	52	120	261	401
AIH	2,496	2.9	59.4	68.0	85.0	20.0	55	75	100	141	61	85	157	227
ASO	2,321	2.7	62.1	81.7	103.5	21.1	69	114	149	174	82	135	196	245
AHO	2,094	2.5	64.6	74.1	94.0	21.2	67.5	89	115	141	74	103	160	216
AHT	1,994	2.3	66.9	72.0	101.7	29.2	65	91	121	141	78.5	114	176	249
ASAS	1,887	2.2	69.1	75.5	93.7	19.4	68	104	118	128	76	114	166	217
ASA	1,607	1.9	71.0	42.3	50.7	16.6	34	51	81	108	35	56	99	134
AIO	1,238	1.5	72.5	70.5	85.6	17.6	60	83	120	145	68	99	147	203
AI	1,007	1.2	73.6	18.3	48.8	62.5	17	22	28	32	20	53	121	181
ASHO	892	1.0	74.7	102.4	121.2	15.5	93	124	159	194	100.5	145.5	209	248

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

[b] Calculated as percent decrease in episode length between the 60-day gap episode definition to the 20-day gap episode definition.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y254).

Using the 20-day gap episode definition, a higher proportion of beneficiaries have an episode pattern AH compared to the 60-day gap episode definitions due to the fact that services occurring after a 20-day period without services are no longer part of the episode. In general, analysis of the gaps between PAC services using the 20-day gap episode definition indicates that most gaps generally do not approach 20 days. In separate analyses by MS-DRG (**Appendix G**), only a few MS-DRGs had gaps at the 95th percentile between 17 and 20 days which might suggest potential episode truncation due to the use of the 20-day gap episode definition. Observed gaps of less than 20 days under the episode definition indicate that the episodes may not be truncated due to the choice of the 20-day gap episode definition. Overall, the gaps between the last pair of services were much lower than 20 days at the 95th percentile across episode patterns and MS-DRGs indicating that the 20-day gap criterion may apply across different diagnoses and utilization patterns. As expected, the average episode length decreases under the more restrictive definition and this decrease was between 20 percent and 30 percent in most cases.

As part of our evaluation of the 20-day gap episode logic, we examined the types of claims most often "dropped" when moving from the 60-day episode logic to the 20-day gap episode logic. We selected the two most common episode definitions, AH and AS, and for beneficiaries with this pattern under the 20-day gap episode logic, we looked at what their episode pattern would have been under the less restrictive 60-day gap episode logic (**Table 8**). Of the beneficiaries with episode pattern AH under the 20-day episode definition, 86.8 percent of these beneficiaries had the same episode pattern under the 60-day gap episode pattern (see last two columns of **Table 8**). Another 3.6 percent would have had an acute hospital readmission under the longer episode definition (indicated by "+A"), and 3.5 percent would have had a therapy claim. Examination of the episode pattern AS yielded similar results. Of beneficiaries with this episode pattern under the 20-day gap episode pattern, 82.8 had the same episode pattern using the 60-day logic. Approximately 6 percent of beneficiaries would have had additional therapy claims, and another 2.2 percent would have an acute rehospitalization included under the less restrictive definition.

Another analysis looking at the services that "dropped" as a result of using a 20-day gap instead of a 60-day gap examined the number of days between the "dropped" claim and the prior PAC service. Across all MS-DRGs, 21.4 percent of beneficiaries had a PAC claim that would be included under a 60-day gap episode definition, but not captured by a 20-day gap episode definition (**Table 9**). Approximately 20 percent of these occurred between 21 and 25 days after the prior PAC service, 16.6 percent occurred between 26 and 30 days, 26 percent within 31 and 40 days, and 37.3 percent more than 40 days after the prior PAC service.

Table 8. Effect of Change in Episode Definition Moving from 20-Day Gap Definition to 30-Day Gap Definition and to 60-Day Gap Definition, Selected 20-Day Gap Episode Patterns [a]

20-Day Gap Episode Pattern	Additional PAC Services Under 30-Day Gap Episode Pattern	Percent of 20-Day Gap Pattern	Additional PAC Services Under 60-Day Gap Episode Pattern	Percent of 20-Day Gap Pattern
AH [b]	-	95.9	-	86.8
AH [b]	+A	1.1	+A	3.6
AH [b]	+T	0.7	+O	1.8
AH [b]	+O	0.6	+T	1.7
AH [b]	+AH	0.4	+AH	1.3
AS [c]	-	94.5	-	82.8
AS [c]	+O	1.8	+O	5.3
AS [c]	+A	0.7	+A	2.2
AS [c]	+AS	0.6	+AS	1.7
AS [c]	+H	0.5	+H	0.9
AS [c]	+T	0.3	+T	0.8

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

[b] All Study MS-DRGS, N=19,232.

[c] All Study MS-DRGS, N=12,955.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y260).

Table 9. Number of Days Between Discharge from Last Claim within 20-Day Gap Episode Definition and Next Claim Falling Outside of the 20-Day Gap

MS-DRG	N	Beneficiaries with Claims Outside of 20-Day Gap N	Beneficiaries with Claims Outside of 20-Day Gap %	Of Claims Outside 20-Day Gap, Percent Occurring on Days 21–25	Of Claims Outside 20-Day Gap, Percent Occurring on Days 26–30	Of Claims Outside 20-Day Gap, Percent Occurring on Days 31–40	Of Claims Outside 20-Day Gap, Percent Occurring After Day 40
All study MS-DRGs	88,317	18,908	21.4	20.1	16.6	26.0	37.3
470: Major joint replacement or reattachment of lower extremity without MCC	14,484	2,181	15.1	24.2	16.7	25.7	33.4
194: Simple pneumonia & pleurisy with CC	2,765	579	20.9	21.2	16.4	24.2	38.2
065: Intracranial hemorrhage or cerebral infarction with CC	2,420	550	22.7	21.8	17.8	26.4	34.0
481: Hip & femur procedures except major joint with CC	2,206	483	21.9	24.6	17.6	21.7	36.0
690: Kidney & urinary tract infections without MCC	2,197	478	21.8	16.1	16.5	26.8	40.6
292: Heart failure & shock with CC	1,704	435	25.5	18.4	17.0	29.0	35.6
641: Nutritional & miscellaneous metabolic disorders without MCC	1,699	376	22.1	16.2	19.1	29.0	35.6
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	1,698	335	19.7	21.8	14.9	20.6	42.7
299: Peripheral vascular disorders with MCC	1,578	356	22.6	16.0	15.4	28.9	39.6
482: Hip & femur procedures except major joint without CC/MCC	1,470	286	19.5	19.2	13.6	30.1	37.1

MCC=major complication or comorbidity, CC=complication or comorbidity.

Source: RTI analysis of Medicare claims 5% sample (MM2Y215).

Based on the data, the TEP participants confirmed that a 20-day gap criterion appeared to capture most services. Participants agreed that after 20 to 25 days, it is less likely that a PAC service is related to the index acute admission. Though one participant suggested considering a shorter gap, others thought that a shorter gap would be problematic for capturing outpatient therapy given the longer gaps observed prior to this type of service use. Participants at the TEP generally agreed that the 20-day gap definition is clinically reasonable. The TEP did recommend considering a slightly broader 30-day gap episode definition to see if this broader definition might capture more outpatient therapy use. There was no consensus from the panel as to whether a 30-day definition would be over-inclusive or not though there was extensive discussion of the trade-off between sensitivity and specificity in terms of grouping claims, and particularly outpatient therapy claims, to an index acute hospitalization.

3.4 Therapy-Specific Analyses

Therapy claims tended to occur more than 14 days after the last prior claim so we performed specific analyses to learn more about the relationship between therapy claims and prior services and how this relationship varied by index MS-DRG. These therapy-specific analyses were also presented to the TEP to inform the discussion of the 20-day gap logic. First, we selected all episode patterns in the RTI V.1 60-day gap logic and the 20-day gap logic that contained either a hospital outpatient therapy claim or a Part B therapy claim and examined the episode length for episodes containing a therapy claim compared to episodes without a therapy claim (**Appendix D**). Second, for therapy claims occurring after a 20-day gap from the previous episode claim, we examined the number of days between admission date on the therapy claim and discharge from the PAC service immediately preceding the therapy claim.

Findings from the therapy specific analysis indicate that episodes with therapy claims are longer than episodes without therapy claims under both the 60-day gap and the 20-day gap episode definitions. For example, in the 60-day gap logic, 36.8 percent of PAC users had at least one therapy claim and the average episode length was 129.5 days compared to 74.1 days for PAC users without a therapy claim. The proportion of episodes with at least one therapy claim decreases in the 20-day gap episode definition compared to the 60-day gap episode definition. The average episode length also decreases in the more restrictive 20-day gap definition. Under the 20-day gap logic, 30.1 percent of beneficiaries had at least one therapy claim and the average episode length for PAC users with a therapy claim was 85.5 days compared to 59.5 days for beneficiaries without a therapy claim.

RTI also examined cases with therapy claims occurring 21 to 60 days after the last PAC service. Across all MS-DRGs, 11.9 percent of beneficiaries had a therapy claim 21 to 60 days after the last PAC service. Of these, the majority (48.3 percent) occurred more than 40 days after the last prior PAC service. TEP members indicated that claims occurring up to 30

days after the prior PAC service may be related. TEP members suggested that difficulties getting an appointment or arranging transportation to outpatient therapy services may lead to a gap in services of up to 30 days. The TEP agreed that the therapy services occurring more than 30 days after a prior PAC service are unlikely to be related to a PAC episode.

3.5 Analysis of the 30-Day Gap Logic

Based on the feedback from the May TEP, RTI looked at the impact of implementing the 30-day gap logic for grouping PAC claims to index hospitalizations (**Table 10** and **Table 11**). The results of this analysis indicated very slight differences between the 20-day and the 30-day gap logic. In general, episode patterns with acute readmissions "A" or therapy "O" or "T" had more days between PAC services and a wider distribution in the number of days between PAC services compared with under the 20-day gap episode definition. For example, under the 30-day gap episode definition for episode pattern ASO, the gap between SNF and outpatient therapy was 24 days at the 95th percentile compared with 17 under the 20-day gap episode definition (mean gap of 6.0 days versus 4.2 days). MS–DRG-specific analysis of the 30-day gap logic can be found in **Appendix H**.

We also examined the impact of a shorter episode definition. Looking specifically, at the two largest groups: AH and AS, we see that approximately 95 percent of the time a beneficiary has the same episode assignment with either the 20-day gap episode logic or the 30-day gap episode logic (see columns 2 and 3 of **Table 8**). For beneficiaries with episode pattern AH under the 20-day gap episode definition, 1.3 percent would also have therapy as part of their episode under the 30-day gap logic, and 2.1 percent of beneficiaries with episode pattern AS would have therapy under a longer episode definition.

TEP members agreed that based on the data presented on the 20-day gap logic versus the 30-day gap logic, there is really very little difference between definitions. TEP members indicated that CMS' use of the episode definition might dictate the preference for one definition over the other due to the specificity versus sensitivity trade-off discussed at the previous TEP. TEP members noted that if the definition will be used for bundled payment, the broader the episode of care, the more at risk providers will be in getting limited payment. For example, using a broader definition, providers may be responsible for paying for a service that is potentially not related. TEP members also expressed that a broader episode may also put the patient at risk due to the incentive of providers to stint on services in the presence of a limited payment. On the other hand, TEP members acknowledged that with a shorter episode the system may overpay providers. In general, the TEP agreed that the 60-day gap episode is far too long, but that there is little difference between the 20-day and 30-day gap episode definitions. Though there is significant overlap in the 20-day gap and the 30-day gap episode definitions, the RTI V.2 logic is defined by a 20-day gap for grouping PAC service due to the preference for increased specificity given the context of this project in measuring relative resource use and informing issues related to attribution.

Table 10. Analysis of 30-Day Gap Episode Definition, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean Gap First Pair	Mean Gap Last Pair	Gap First Pair 50th Percentile	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 50th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
AH	18,448	21.7	21.7	2.1	2.1	1	2	4	7	1	2	4	7
AS	12,250	14.4	36.1	0.0	0.0	0	0	0	0	0	0	0	0
ASH	6,732	7.9	44.0	0.0	2.2	0	0	0	0	1	2	4	7
AO	4,948	5.8	49.8	3.9	3.9	3	6	11	13	3	6	11	13
AHA	3,567	4.2	54.0	2.1	2.9	1	2	5	7	0	1	12	21
ASO	2,462	2.9	56.9	0.0	6.0	0	0	0	0	3	8	20	24
AIH	2,384	2.8	59.7	0.0	2.0	0	0	0	0	1	2	4	5
AHO	2,159	2.5	62.2	1.9	5.9	1	2	4	6	4	7	16	21
AHT	2,039	2.4	64.6	1.9	5.9	1	2	3	7	4	7	15	22
ASAS	1,869	2.2	66.8	0.0	0.3	0	0	0	0	0	0	0	0
ASA	1,666	2.0	68.8	0.0	3.1	0	0	0	0	0	1	13	20
AIO	1,226	1.4	70.2	0.0	5.0	0	0	0	0	4	6	10	14
ASHO	943	1.1	71.3	0.0	6.5	0	0	0	0	4	9	18	22
AI	894	1.1	72.4	0.0	0.0	0	0	0	0	0	0	0	0
ASHT	821	1.0	73.3	0.0	6.4	0	0	0	0	4	8	17	24
AST	809	1.0	74.3	0.0	4.6	0	0	0	0	2	6	14	21
ASHA	773	0.9	75.2	0.0	3.2	0	0	0	0	0	2	13	22

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y256).

Table 11. Analysis of 30-Day Gap Episode Length, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean 30-day Gap	Mean 20-day Gap	Percent Change in Mean Episode Length [b]	30-Day Gap 50th Percentile	30-Day Gap 75th Percentile	30-Day Gap 90th Percentile	30-Day Gap 95th Percentile	20-Day Gap 50th Percentile	20-Day Gap 75th Percentile	20-Day Gap 90th Percentile	20-Day Gap 95th Percentile
AH	18,448	21.7	21.7	48.1	47.8	0.6	37	57	71	117	37	57	70	115
AS	12,250	14.4	36.1	42.2	41.9	0.7	32	57	94	106	32	57	93	106
ASH	6,732	7.9	44.0	75.5	74.4	1.5	65	89	125	152	64	88	123	150
AO	4,948	5.8	49.8	35.8	34.7	3.1	29	50	77	98	29	48.5	74	96
AHA	3,567	4.2	54.0	48.3	45.3	6.2	35	55	87	116	33	50	80	110
ASO	2,462	2.9	56.9	86.1	79.0	8.2	73	119	156	186	67	109	146	170
AIH	2,384	2.8	59.7	68.7	67.7	1.5	56	75	100	141	55	75	98	139
AHO	2,159	2.5	62.2	76.9	72.1	6.2	71	93	121	147	66	87	113	137
AHT	2,039	2.4	64.6	77.2	69.9	9.5	69	95	128	154	64	89	118	136
ASAS	1,869	2.2	66.8	76.0	73.6	3.2	69	105	119	129	66	101	117	128
ASA	1,666	2.0	68.8	43.9	42.0	4.3	35	53	85	111	33	51	82	108
AIO	1,226	1.4	70.2	72.6	69.9	3.7	63	86	122	155	60	83	119	145
ASHO	943	1.1	71.3	105.8	99.3	6.1	95	130	166	197	90	122	158	188
AI	894	1.1	72.4	18.4	18.4	0.0	17	22	28	33	17	22	28	33
ASHT	821	1.0	73.3	105.4	95.8	9.1	94	127	176	204	86	116	159	187
AST	809	1.0	74.3	68.6	62.6	8.7	59	85	128	151	55	79	121	138
ASHA	773	0.9	75.2	76.5	72.7	5.0	63	91	134	163	59	86	131	162

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

[b] Calculated as percent decrease in episode length between the 30-day gap episode definition to the 20-day gap episode definition.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y256).

Table 12. Analysis of 30-Day Window Episode Definition, By Episode Pattern, All Study-MS-DRGs

Pattern [a]	N	Percent	Cumulative Percent	Mean Gap First Pair	Mean Gap Last Pair	Gap First Pair 50th Percentile	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 50th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
AH	23,333	27.4	27.4	2.2	2.2	1	2	5	8	1	2	5	8
AS	19,552	23.0	50.4	0.0	0.0	0	0	0	0	0	0	0	0
ASH	6,953	8.2	58.6	0.0	1.8	0	0	0	0	1	2	4	5
AO	5,420	6.4	64.9	4.0	4.0	3	7	11	13	3	7	11	13
AIH	3,696	4.3	69.3	0.0	1.7	0	0	0	0	1	2	3	4
AHA	3,126	3.7	72.9	1.9	0.9	1	2	4	6	0	0	2	7
ASAS	2,439	2.9	75.8	0.0	0.1	0	0	0	0	0	0	0	0
ASA	1,835	2.2	78.0	0.0	1.6	0	0	0	0	0	1	6	12
AHT	1,446	1.7	79.7	1.6	3.5	1	2	3	5	3	5	7	11
ASO	1,446	1.7	81.4	0.0	3.7	0	0	0	0	3	5	9	13
AHO	1,424	1.7	83.0	1.6	3.6	1	2	3	4	3	5	7	11
AIO	1,351	1.6	84.6	0.0	4.6	0	0	0	0	4	6	9	12

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y258).

Table 13. Analysis of 30-Day Window Episode Length, By Episode Pattern, All Study-MS-DRGs

Pattern[a]	N	Percent	Cumulative Percent	Mean 30-Day Window	Mean 30-Day Gap	30-Day Window 50th Percentile	30-Day Window 75th Percentile	30-Day Window 90th Percentile	30-Day Window 95th Percentile	30-Day Gap 50th Percentile	30-Day Gap 75th Percentile	30-Day Gap 90th Percentile	30-Day Gap 95th Percentile
AH	23,333	27.4	27.4	42.7	66.8	39	62	68	72	44	69	128	196
AS	19,552	23.0	50.4	49.5	74.7	42	65	102	107	58	105	149	193
ASH	6,953	8.2	58.6	57.4	83.0	54	74	86	91	65	94	148	198
AO	5,420	6.4	64.9	27.4	43.1	30	40	50	56	32	59	92	122
AIH	3,696	4.3	69.3	57.9	94.1	55	75	84	90	71	110	174	235
AHA	3,126	3.7	72.9	30.6	52.9	29	38	46	53	32	53	118	168
ASAS	2,439	2.9	75.8	62.5	101.9	55	78	109	116	84	125	187	233
ASA	1,835	2.2	78.0	35.7	62.1	36	44	53	63	38	80	133	175
AHT	1,446	1.7	79.7	31.9	74.8	33	35	38	41	64	91	128	157
ASO	1,446	1.7	81.4	39.9	65.7	39	49	56	60	56	80	115	150
AHO	1,424	1.7	83.0	41.9	71.9	42	50	56	59	61	85	113	141
AIO	1,351	1.6	84.6	43.8	81.5	44	51	57	62	66	94	141	188

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of 2006 Medicare claims 5% sample (MM2Y258).

3.6 Analysis of the 30-Day Window Logic

To inform current policy proposals focusing on the first 30 days following hospital discharge, RTI also ran the data using a 30-day window length episode definition. Under this definition, any PAC or readmission claim initiating within 30 days of index acute hospital discharge is included in the episode. As expected, the results varied significantly compared to analysis using the gap-based episode definitions. Under the 30-day window episode definition, a higher proportion of beneficiaries have the limited episode patterns AH and AS than under the longer variable length episode definitions due to the fact that services initiating beyond 30 days following acute hospital discharge are no longer considered to be part of the episode. Under the 30-day window episode definition, 50.4 percent of PAC users have episode patterns AH or AS compared to 37.8 percent under the 20-day gap episode definition (**Table 12** and **Table 13**).

Episode length under the 30-day window episode definition is also significantly shorter. The total episode length includes the index hospital stay which varies across beneficiaries as well as all services initiating within the 30-day period following discharge; therefore the episode lengths of stay do vary by episode pattern and MS-DRG. Beneficiaries with the PAC utilization pattern AH have a mean episode length of 42.7 days under the 30-day window episode definition and a mean episode length of 47.6 days under the 20-day gap episode definition.

4. Logic to Assign Rehospitalizations to Index Hospitalizations

This chapter focuses on the RTI V.2 logic to identify acute readmissions that are related to an episode of acute or post-acute care. The logic to group rehospitalization builds on the initial development of the RTI V.2 logic described in the previous chapter and on work done by Jencks et al. in a recent *New England Journal of Medicine* article analyzing patterns of rehospitalizations in the Medicare population. One in five Medicare beneficiaries discharged from an acute hospital are subsequently rehospitalized within 30 days and almost a third are rehospitalized within 90 days.[12]

In this part of the V.2 logic development, RTI considered whether hospital readmissions should be treated differently than other post-discharge services when constructing an episode of care. As with the identification of related PAC services, RTI considered whether *relatedness* for readmissions should be defined by time, diagnosis, or some combination of both. A second issue concerns the time criterion. If the logic is time-based, should relatedness be based on days since *index discharge* or days since *discharge from last service* in the episode, including a PAC service? The process of developing the logic for grouping rehospitalizations to index hospitalizations is outlined below.

RTI developed the RTI V.2 logic based on the following steps[13]:

1. Development of a conceptual framework to identify related hospitalizations. This work was done with the 100 percent MedPAR (2004) and based on Jencks et al.[14] The foundation for the conceptual framework is the observation that hospital readmissions/day for related (whether, planned or unplanned) services tend to have a distinct declining pattern when looking at days since acute discharge.
2. Analyses of gaps between acute readmission and *index acute discharge* by reason for readmission to determine if the 20-day gap logic developed for PAC claims is appropriate for grouping readmissions to index hospitalizations.
3. Analyses of gaps between acute readmission and discharge from *prior PAC* to determine if the 20-day gap logic developed for PAC claims is appropriate for grouping readmissions to index hospitalizations.

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[12] Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med* 2009; 360:1418–1428.

[13] The analyses in this section are based on two data sources. Conceptual framework and methodology were developed using the CY 2004 (100%) MedPAR file. This dataset allows greater power to look at diagnoses with fewer readmissions. However, this file has DRGs rather than MS-DRGs, and does not have post-acute care information. Additional analyses were conducted using the CY 2006 MedPAR (5% sample) to evaluate the impact of PAC services on time to readmission and to develop rules that apply to MS-DRGs.

[14] Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med* 2009; 360:1418–1428.

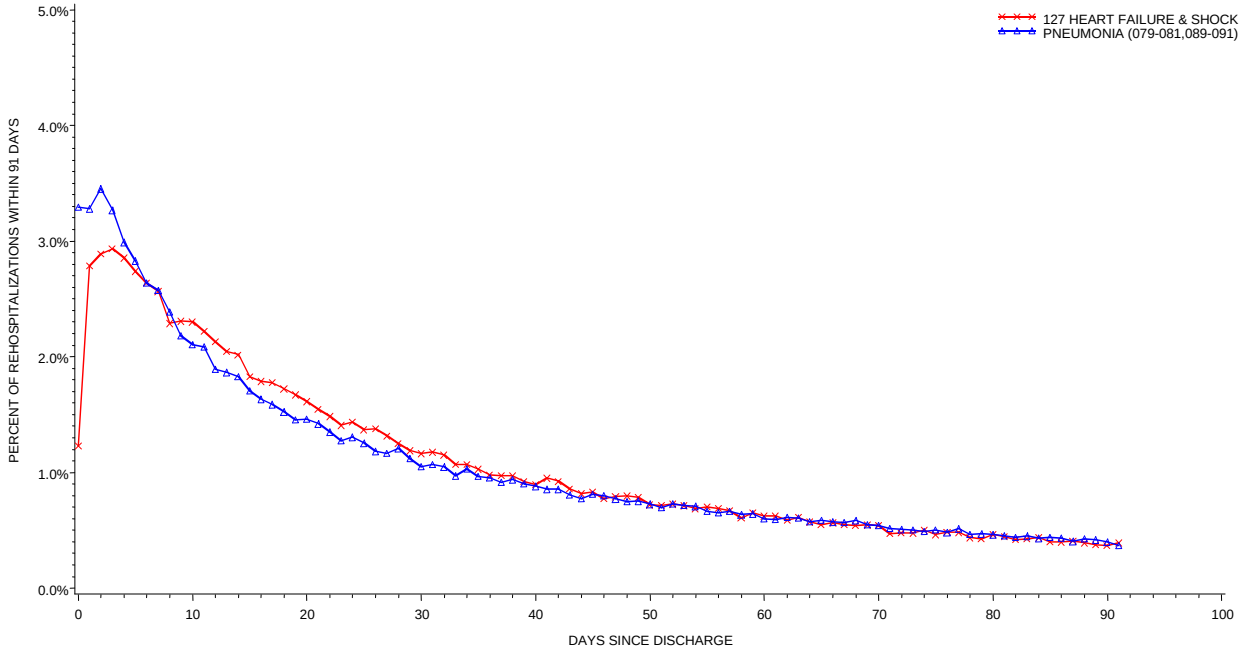
4. Presentation of a 20-day gap logic for grouping rehospitalization claims to index acute hospitalizations to a Technical Expert Panel (TEP) composed of clinicians from acute and PAC settings.
5. Additional analysis based on feedback from the TEP to consider a *30-day gap* between index acute discharge and acute readmission rule.
6. Analysis of a 20-day gap between acute readmission and prior PAC discharge rule to include acute readmissions if the readmission falls more than 30 days after an included acute readmission, but within 20 days of PAC.
7. Analysis to identify systematic MS-DRG exceptions to criteria.

4.1 Conceptual Framework

Our approach to group acute readmissions to an episode of PAC care is to include unplanned hospitalizations, and planned hospitalizations that appear to be urgent or emergent, occurring within a certain period of time as part of the patient's episode of care. The starting point for our analyses to group acute readmissions to index acute hospitalizations was the Jencks et al. analysis of readmissions patterns over time by reason for readmission. Dr. Jencks laid out a basic framework for considering whether readmissions are planned or unplanned.

In general, unplanned rehospitalizations are most frequent in the first day or two after the last discharge and become less frequent with the passage of time. Dr. Jencks demonstrated that rehospitalizations typically resulting from clinical deterioration (e.g., heart failure, pneumonia, sepsis, etc.), decrease exponentially with time after discharge. These rates of decline vary by the rehospitalization DRG and can be tested by plotting the number of readmissions per day by days since the initial acute discharge on a curve and checking its goodness of fit to an exponential curve. **Figure 2** plots the number of rehospitalizations against the interval between the index discharge, for any DRG, and rehospitalization for pneumonia and heart failure to illustrate this pattern of exponential decline; about 90 percent of all the rehospitalizations in the 100 percent Medicare claims file are for rehospitalization DRGs that follow this pattern. This exponential decay curve fits with the clinical reality that rehospitalizations for pneumonia and heart failure typically are unplanned. A large share of the readmissions occur within 20 to 30 days since discharge from the index hospitalization and the exponentially declining curve suggests a period of elevated risk that is likely related to the index acute hospitalization, and which subsides towards a baseline rate after a period of time following the initial acute discharge. A service is clinically related to a previous clinical service if it is (1) provided to continue treatment that began (or was itself being continued) during the previous service or (2) provided to treat a complication of the previous service. A service is not related if it is a procedure on a different body part that was not continuation of previous care. For example, reoperation on a failed hip prosthesis is related, but operation to insert a hip prosthesis on the other side is not.

Figure 2. Example of Rehospitalization Curves Fitting an Exponential Decay Curve: Rehospitalization for Pneumonia and for Heart Failure

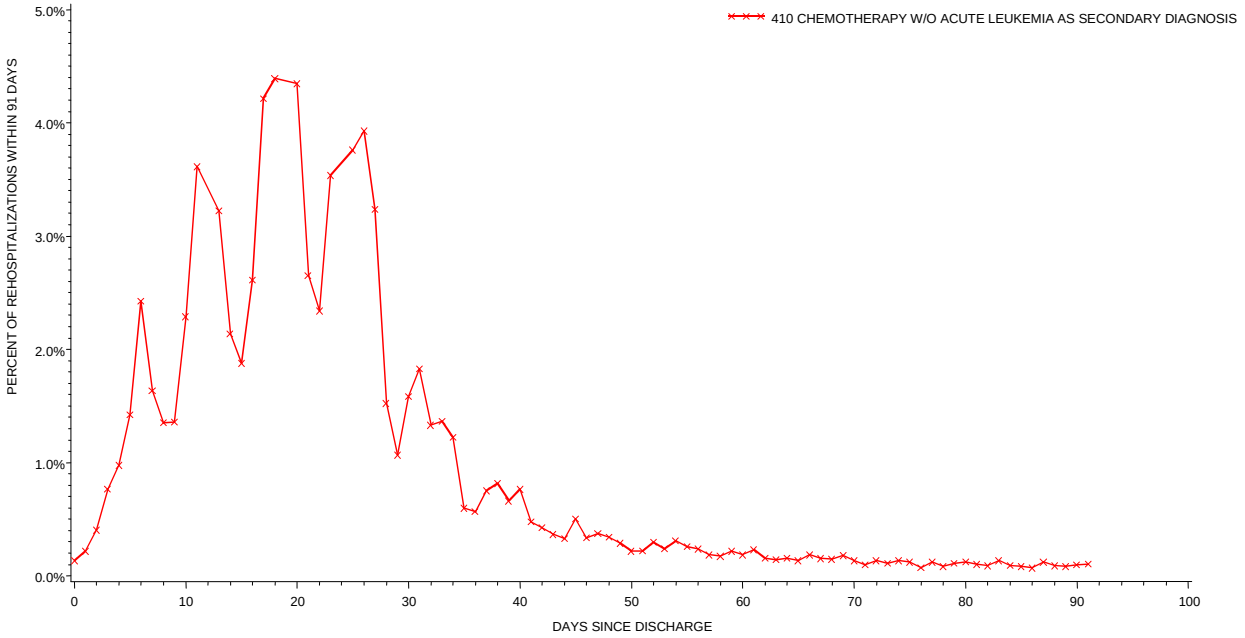


Source: Steve Jencks analysis of 2004 100% Medicare claims data.

Figure 3, however, shows the pattern for rehospitalizations for chemotherapy. These are typically related to the index hospitalization (peaking around 20 days) but the regularity of the peaks suggests that these rehospitalizations are planned. These types of distinctions are important for understanding the different types of hospitalizations that fall under a "readmission." RTI can classify each rehospitalization diagnosis as either related-unplanned or something else (related-planned, and unrelated) based on the expected time from discharge to rehospitalization for each DRG or MS-DRG.

In these analyses, we examined readmission rates for two groups of beneficiaries: those occurring in episodes which ended after a 60-day gap in services and those occurring within 180 days of an index acute discharge.

Figure 3. Example of Rehospitalization Curve for a Largely Planned Reason: Rehospitalization for Chemotherapy



Source: Steve Jencks analysis of 2004 100% Medicare claims data.

4.2 Relationship Between Index Discharge Diagnoses and Reason for Readmission[15]

One approach to identifying related and avoidable readmissions is to focus only on rehospitalizations that were for diagnoses that match the index acute discharge diagnosis, or attempt to identify pairs of diagnoses by inventorying large numbers of potential combinations between index and rehospitalization diagnoses. These methods have received criticism for neglecting rehospitalizations that were likely related (e.g., rehospitalization for exacerbation of heart failure for a patient whose initial admission was for hip replacement but who had a comorbid heart condition) or for relying too heavily on potentially subjective judgment.

Prior work by Jencks et al. shows the index acute discharge diagnoses that account for the largest proportion of total rehospitalizations tend not to be concordant with the reason for rehospitalization.[16] The article includes an analysis that focuses on the top medical and surgical index discharge diagnoses and the top 10 reasons for rehospitalization associated with each index discharge diagnosis. With the exception of "Other hip or femur surgery" beneficiaries tend to be rehospitalized most often for the same reason as the initial discharge, however, for any medical index hospitalization diagnosis listed, rehospitalizations

[15] See **Appendix I**, which shows readmissions by index DRG from the 100% MedPAR.
[16] See Jencks et al., *NEJM*, 2009, http://content.nejm.org/cgi/content/full/360/14/1418.

for the same diagnosis account for only 30 percent to 40 percent of all rehospitalizations for that index diagnoses. For example, 37 percent of patients with an index hospitalization of heart failure who were subsequently rehospitalized were readmitted for heart failure. Similarly, 36 percent of rehospitalizations for chronic obstructive pulmonary disease (COPD) patients are for COPD and 29 percent of pneumonia rehospitalizations are for pneumonia. It is important to note that the second most frequent reasons for rehospitalization appear to have strong clinical associations with the index hospitalization diagnoses and are common comorbid or complicating conditions. For example, the second most common rehospitalization reason among COPD patients and among heart failure patients is pneumonia; for pneumonia the second and third most common reasons for rehospitalization are heart failure and COPD. For surgical readmissions, the concordance with index discharge diagnoses is even weaker, with only 6 percent to 20 percent agreement for the top index discharge surgical procedures accounting for readmissions, which include cardiac stent placement, major hip or knee surgery, and other vascular surgery. A grouping rule that required concordance between index acute diagnosis and rehospitalization diagnosis would miss a large proportion of rehospitalizations that are probably related to the index acute hospitalization.

4.3 Time-Based Criteria

Building on the conceptual framework above, RTI examined readmissions by time since acute discharge and diagnosis. Using the index hospital MS-DRG, RTI presented information on the number of days between discharge from last service and rehospitalization date. These data are presented in **Table 14** by index MS-DRG to compare how the patterns may differ across diagnoses. The data are also stratified by whether the beneficiary used PAC services prior to the hospital readmission. This allows examination of the readmission relative to the last service in the episode. For PAC users, we also present days between index hospital discharge and readmission.

Table 14 shows the index MS-DRGs with the highest volume readmissions in 2006. Using the 60-day gap in service episode definition, RTI first examined the mean number of days between discharge from the index hospitalization and rehospitalization for beneficiaries with no PAC services between index discharge and rehospitalization and the mean number of days to rehospitalization when beneficiaries did receive PAC services. The table shows the proportion of readmission cases for each index discharge MS-DRG that used PAC prior to the readmission as well as the days since index discharge. For PAC users, the table shows the percent rehospitalized within 30 days of discharge, and the mean days between discharge from last PAC service and readmission. *For non-PAC users, who were rehospitalized without any intervening PAC use, all of the study index MS-DRGs have means days to readmissions within 30 days of the hospital discharge.* The overall mean for all non-PAC users regardless of MS-DRG was 25.5 days. *PAC users tend to be readmitted within 20 days or less of*

Table 14. Percent of Total Rehospitalization and Days Between Prior Services and Acute Readmission by Index Acute Discharge MS-DRG: Days Between Index Acute Discharge and Rehospitalization, and Days Between Discharge from Prior PAC Setting and Discharge for Any Rehospitalization Prior to a 60-Day Gap in Services

Index Acute Discharge MS-DRG	Total *All* Rehospitalizations	Percent MS-DRG Using PAC Prior to Rehosp	Non-PAC Users: Mean Days Between Index Acute Discharge and Rehospitalization	Non-PAC Users: Percent Rehospitalized within 30 Days of Index Acute Discharge	PAC Users: Mean Days Between Index Acute Discharge and Rehospitalization	PAC Users: Percent Rehospitalized within 30 Days of Index Acute Discharge	PAC Users: Mean Days Between Prior PAC Discharge and Rehospitalization
470: Major joint replacement or reattachment of lower extremity without MCC	2,160	92.0	15.5	81.5	46.3	44.8	10.8
194: Simple pneumonia & pleurisy with CC	1,913	48.8	22.5	69.2	42.8	48.9	9.0
392: Esophagitis, gastroenteritis & miscellaneous digest disorders without MCC	1,732	27.4	22.7	66.4	48.8	40.4	10.1
247: Percutaneous cardiovascular procedures with drug-eluting stent without MCC	1,650	10.6	23.1	66.4	39.9	49.7	11.7
292: Heart failure & shock with CC	1,593	48.4	23.5	67.3	45.7	46.8	8.9
690: Kidney & urinary tract infections without MCC	1,380	56.3	22.9	67.2	48.1	44.4	9.3
192: Chronic obstructive pulmonary disease without CC/MCC	1,331	32.8	24.0	64.0	49.4	40.7	10.2
293: Heart failure & shock without CC/MCC	1,293	40.4	23.5	66.7	45.4	43.9	8.5
291: Heart failure & shock with MCC	1,217	54.1	21.3	71.0	44.5	49.0	7.2
641: Nutritional & miscellaneous metabolic disorders without MCC	1,211	47.6	21.1	69.7	45.9	44.9	9.4
287: Circulatory disorders except acute myocardial infarction, with cardiac catheterization without MCC	1,069	14.7	21.3	71.8	40.9	51.0	10.4
313: Chest pain	1,058	19.8	24.3	63.7	55.3	30.0	13.2
310: Cardiac arrhythmia & conduction disorders without CC/MCC	992	23.9	24.1	63.3	45.3	46.0	10.1
065: Intracranial hemorrhage or cerebral infarction with CC	980	81.8	19.6	70.8	49.6	42.0	6.8
312: Syncope & collapse	962	43.3	23.8	66.1	54.8	33.6	12.8
191: Chronic obstructive pulmonary disease with CC	948	39.1	23.0	67.4	42.2	48.2	8.4
195: Simple pneumonia & pleurisy without CC/MCC	928	46.9	22.2	67.1	47.7	40.9	12.6
299: Peripheral vascular disorders with MCC	905	63.4	21.0	71.9	43.9	49.1	8.8
683: Renal failure with CC	890	54.9	22.2	69.8	45.2	44.6	8.5
552: Medical back problems without MCC	799	63.7	20.0	72.8	44.2	46.2	10.3
603: Cellulitis without MCC	784	51.4	23.9	64.3	45.8	43.7	8.4

(continued)

Table 14. Percent of Total Rehospitalization and Days Between Prior Services and Acute Readmission by Index Acute Discharge MS-DRG: Days Between Index Acute Discharge and Rehospitalization, and Days Between Discharge from Prior PAC Setting and Discharge for Any Rehospitalization Prior to a 60-Day Gap in Services (continued)

Index Acute Discharge MS-DRG	Total *All* Rehospital-izations	Percent MS-DRG Using PAC Prior to Rehosp	Non-PAC Users: Mean Days Between Index Acute Discharge and Rehospital-ization	Non-PAC Users: Percent Rehospital-ized within 30 Days of Index Acute Discharge	PAC Users: Mean Days Between Index Acute Discharge and Rehospital-ization	PAC Users: Percent Rehospital-ized within 30 Days of Index Acute Discharge	PAC Users: Mean Days Between Prior PAC Discharge and Rehospital-ization
378: G.I. hemorrhage with CC	726	39.3	21.2	70.3	42.5	47.7	9.1
481: Hip & femur procedures except major joint with CC	714	93.6	18.3	78.3	49.6	43.6	6.2
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	688	70.8	22.5	68.2	49.8	41.1	8.4
069: Transient ischemia	656	43.9	23.2	66.0	50.2	41.3	9.9
280: Acute myocardial infarction, discharged alive with MCC	617	66.8	17.9	78.0	40.9	53.4	6.4
309: Cardiac arrhythmia & conduction disorders with CC	616	37.0	22.3	69.1	42.2	51.8	8.2
189: Pulmonary edema & respiratory failure	578	53.1	22.5	67.5	44.5	46.9	9.2
193: Simple pneumonia & pleurisy with MCC	577	60.1	21.6	70.0	42.6	49.9	8.9
812: Red blood cell disorders without MCC	530	31.1	25.1	62.7	47.6	43.6	10.9
330: Major small & large bowel procedures with CC	526	65.0	18.3	75.0	38.2	52.0	8.0
281: Acute myocardial infarction, discharged alive with CC	498	48.2	20.0	76.0	40.6	53.8	9.0
379: G.I. hemorrhage without CC/MCC	476	24.2	21.9	67.9	42.4	49.6	9.9
682: Renal failure with MCC	460	54.1	20.7	71.6	39.8	53.8	7.3
064: Intracranial hemorrhage or cerebral infarction with MCC	438	89.0	18.4	72.9	41.6	50.5	5.0
234: Coronary bypass with cardiac catheterization without MCC	400	67.8	15.6	83.7	30.2	62.7	9.9
190: Chronic obstructive pulmonary disease with MCC	399	51.1	22.7	66.2	44.9	46.6	10.3
314: Other circulatory system diagnoses with MCC	395	43.8	23.2	65.8	43.4	43.4	10.4
253: Other vascular procedures with CC	393	55.7	24.1	63.8	45.3	50.7	7.8
300: Peripheral vascular disorders with CC	391	57.8	20.1	72.7	50.4	45.1	9.0
282: Acute myocardia infarction, discharged alive without CC/MCC	387	35.4	18.1	77.6	39.2	51.1	8.2
482: Hip & femur procedures except major joint without CC/MCC	381	92.7	15.9	85.7	46.2	48.4	7.0
Total	374,602	45.5	25.5	65.3	43.2	41.8	8.3

MCC=major complication or comorbidity; CC=complication or comorbidity; G.I.=gastrointestinal.

Source: RTI analysis of Medicare claims 5% sample (LSMI084).

discharge from the last PAC service, which is consistent with the final logic. The overall mean for PAC users was 8.3 days regardless of MS-DRG. Looking at index acute discharge MS-DRGs for non-PAC users who were subsequently rehospitalized, the mean number of days between the index discharge and rehospitalization ranges from 15.5 days for MS-DRG 470: Major joint replacement to 24.3 days for MS-DRG 313: Chest pain when looking at 35 MS-DRGs most frequently readmitted.

Among PAC users, a much lower proportion of cases is readmitted within 30 days of discharge from the index hospitalization because of the intervening PAC days. Note that this is not comparable to the non-PAC users' days since index discharge. By definition, the non-PAC users were limited to those cases that were rehospitalized within 60 days of discharge whereas the PAC cases can continue much longer based on the same criteria of 60 days since last service. PAC users tend to be readmitted within 15 days of discharge from the last PAC service, on average.

As part of our analysis of the feasibility of time-based criteria for grouping rehospitalization to index hospitalizations, we examined readmission rates, this time looking by *rehospitalization* MS-DRG over time to see if we could observe periods of elevated rehospitalizations in the period immediately following the index acute discharge. We considered PAC users and non-PAC users separately, hypothesizing that the timing of readmissions relative to index acute discharge would be different for these two groups based on the results from **Table 14**. We stratified by MS-DRG and looked at the standardized rehospitalization rate per day in different time windows.[17] For example, rehospitalizations for MS-DRG 247: Percutaneous cardiovascular procedures with drug-eluting stent without major complications or comorbidities occurred at a rate of 51.5 per day during days 2 to 5 after index acute discharge, and a rate of 40 per day during days 6 to 10 after acute discharge. Looking across the intervals since index discharge, rates of readmission are highest in the days following discharge with a large drop off in rates over the following intervals. When rates of readmission smooth out varies across MS-DRGs. A few MS-DRGs have little change after the 15th day, but most have rates that continue to drop markedly through the 20th or 30th day out from discharge from the index acute stay. From additional analyses, also not shown, about 20 percent to 35 percent of the non-PAC users who are readmitted within 60 days of index discharge are readmitted after 30 days or more without service, although the exact proportion varies by MS-DRG. Cardiac and rehabilitation cases tend to have two-thirds of their readmissions within the first 20 days since hospital discharge.

[17] See **Appendix K** for a table detailing the data described in this section: for non-PAC users, rehospitalizations per day by days between index acute discharge and rehospitalization.

We analyzed the timing of readmissions for PAC users stratifying readmissions by whether the readmission MS-DRG was surgical or medical according to CMS's classifications.[18] We observed the standardized rehospitalization rate per day for the most common readmission MS-DRGs[19, 20]; however, the time windows for PAC users here were measured in days from discharge from the PAC service preceding the rehospitalziation. Among the beneficiaries who have intervening PAC before being readmitted to the hospital, for both surgical and medical readmissions, the vast majority of cases are transferred on the same day from PAC discharge. Once you adjust for the number of days in the period, days 2 to 5 tend to have higher rates of readmissions, while days 31 to 60 have very low readmission rates; however, these trends are not uniform across readmission MS-DRG. It is difficult to discern any systematic difference among surgical and medical readmissions. As reflected by the low mean days to readmission, *the PAC cases readmitted tend to be readmitted in the first 1 to 5 days after their last service* suggesting these are related readmissions.

Based on these analyses RTI made an initial proposal to the TEP, described below, that all readmissions from last service should be included, regardless of whether the discharge is from the acute hospital or a PAC setting, if they occurred within 20 days of the last service. RTI based this on the logic that the majority of PAC readmissions occur fairly soon after discharge from the PAC setting suggesting the readmission is related to their prior health condition, not the start of a new episode of care.

4.4 Presentation to the TEP

RTI presented the conceptual framework described above and analyses of gaps between acute readmission and prior acute discharge and between acute readmission and discharge from prior PAC services to a TEP composed of clinicians from acute and PAC settings. The foundation of this discussion was to see if the RTI V.2 20-day gap logic for grouping both PAC and rehospitalizations would be appropriate to use as a rule for grouping rehospitalization claims to index acute hospitalizations. *RTI proposed to the TEP that a related readmission is defined as any readmission within 20 days of the last service (index acute or PAC).* This assumes the condition being treated in the rehospitalization is related to those in the initial hospitalization and subsequent settings. *Participants repeated that a 30-day interval might be worth considering given the majority of non-PAC users were rehospitalized closer to 30 days from index discharge.*

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[18] RTI has used CMS's surgical and medical designations for these two tables. However, in the final classification of rehospitalizations we reclassified one MS-DRG (MS-DRG 004: Tracheostomy with mechanical ventilation 96+ hours or principal diagnosis except face, mouth and neck without major O.R.) that CMS categorizes as surgical to medical, because analysis of patterns of rehospitalization in this MS-DRG are more consistent with a Medical MS-DRG.

[19] See **Appendixes J1** and **J2** for tables showing rehospitalizations per day by days between prior PAC discharge and rehospitalization for the full sets of surgical (J1) and medical MS-DRGs (J2).

[20] See **Appendixes L1** and **L2** for tables showing percentiles for the full sets of surgical and medical MS-DRGs.

4.4.1 Unplanned Versus Planned Readmissions

To further consider characteristics of readmitted non-PAC users, TEP participants reviewed the data described above. Participants noted that most diagnoses appeared to demonstrate the declining readmission curve shown in **Figure 2** as reflective of unplanned rehospitalizations.

However, TEP participants commented that, despite the data given, it is still difficult to distinguish between planned and unplanned care. Concerns about grouping unrelated, unplanned events, such as a car accident where the patient is a passenger, to the index acute stay were countered by the observation that the hospital-level rate of these types of readmission events should generally be independent of the characteristics of the hospital and should not introduce bias into the different potential uses of the episode definition. TEP members felt that it would be difficult to define a readmission without considering both time and diagnosis.

RTI posed the question of whether more complicated cases were likely to be rehospitalized later, and would the panel consider readmissions occurring after a long series of services to be related to the index acute stay; or related to the total trajectory of service use? There was debate over whether 20 days is as relevant to the index acute discharge as it is from discharge from an intervening PAC service. An example was given of a pneumonia patient found to have arthritis during their PAC services, who was sent to outpatient therapy, and in their third month they go into heart failure. The rehospitalization occurred soon after the PAC service (outpatient therapy) but does not relate to the initial acute stay. It was pointed out though that this example could be interpreted as supporting multiple points of view, it could be argued that it *is appropriate* to group the example readmission to the full set of services because, for a complicated patient, that heart failure was probably being treated in some way during the index acute stay and played a role in the services being received post-discharge. Given this example, a TEP participant suggested utilizing the patient's condition to resolve this issue, suggesting that conditions should be incorporated into the logic for assigning readmissions.

Time versus Diagnosis Criteria

After considering diagnosis, several TEP participants agreed that time-based criteria are more applicable than solely diagnosis based criteria though they conceded that sometimes a time-based logic could be arbitrary. The data suggest that the majority of related cases are captured by a time-based window however. TEP members emphasized that there is a trade off of sensitivity and specificity depending on how long the gap is; they noted also that diagnostic criteria may lead providers astray and encourage "gaming."

The TEP did not reach a consensus on the rehospitalization logic. After much discussion most of the group was in favor of some use of a *time-based definition using the last service*

(either acute or PAC) as the point of reference, combined with some use of readmission diagnoses. The TEP recommended exploring the patterns of readmission over time between the last PAC discharge and readmission by the type of PAC provider, expecting larger gaps for patients who were receiving therapy prior to readmission. RTI also investigated the impact of using a 30-day gap in services to define an episode of readmissions patterns. This was suggested as an alternative interval to the 20-day gap. Most TEP members found grouping readmissions occurring within 30 days of index discharge acceptable.

4.5 Examination of 30-Day Gap from Index Acute Discharge for Inclusion of Readmissions

Following up on the TEP's recommendation to use a 30-day gap from index acute discharge instead of a 20-day gap, RTI examined the consequences among PAC users. Specifically, we examined the days since hospital discharge for readmissions following PAC use (see **Figure 4**) and found that 94 percent of readmissions in episodes defined by a 30-day gap occur within 30 days of an index acute discharge and within 20 days of a prior PAC service. *These results suggest that a readmission rule that grouped readmissions occurring within 30 days of an acute discharge or within 20 days of a PAC service would account for most readmissions among PAC users. It is also important to note that twenty percent of readmissions among PAC users occur more than 30 days after an index acute discharge but within 20 days of a PAC service, meaning that the timing of readmissions occurring after a PAC service as a part of the criteria for including readmissions, not just timing relative to acute discharge, needs to be considered.*

4.6 Should Readmissions After PAC Services be Treated the Same as Readmissions After Acute Services?

RTI constructed curves analogous to **Figures 1** and **2** for readmissions occurring after a PAC service to assess whether the same timing could be used for a post-PAC readmission rule as for the post-hospital readmission rule. We examined readmissions occurring within 30 days of a prior PAC service given this would be analogous to a rule that includes readmissions occurring within 30 days of a prior included acute discharge. **Figures 5** and **6** show readmissions per day by days since discharge from prior PAC services for MS-DRGs for Heart failure (291, 292, 293) and for Pneumonia (177, 178, 179, 193, 194, 195) as examples of patterns for medical readmissions. There are steep declines in readmissions starting at day one after discharge, consistent with unplanned readmissions, and flattening out at about day 15 to 20.

Figure 4. Gap Between Index Acute Discharge and Readmission by Gap Between Discharge from Prior PAC Setting and Acute Readmission, Readmissions in Episodes Defined by a 30-Day Gap

		Days Since Index Acute Discharge									
Days Since Discharge from Prior PAC	**Total Readmissions**	**0–1 Days**	**2–5 Days**	**6–10 Days**	**11–15 Days**	**16–20 Days**	**21–30 Days**	**31–60 Days**	**61 or More Days**	**Readmissions / Day by Days Since PAC *(all PAC readmissions):***	**Readmissions / Day by Days Since PAC *(post-30 days from index only):***
0–1 days	21,582	500	3,070	3,200	2,609	1,940	2,792	4,267	3,204	1,0791	3,735.5
2–5 days	2,632		167	254	254	236	361	666	694	526.4	340.0
6–10 days	1,714			84	138	133	269	543	547	342.8	218.0
11–15 days	1,271				70	97	193	466	445	254.2	182.2
16–20 days	1,009					44	110	424	431	201.8	171.0
21–30 days	1,824						144	791	889	182.4	168.0
Readmissions/day by days since index acute:		250.0	809.3	707.6	614.2	490.0	386.9	238.6			
						Readmissions after 30 days from index AND more than 2 days from PAC:					5896
						Total readmissions:					30,032

Readmissions that would be included if rule was: a) For NON-PAC users only, 30 days from index, OR b) for PAC users only, 20 days from prior PAC:

Dotted Line: 28,208 (93.9% of all PAC user readmissions in episodes defined by a 30-day gap in services)

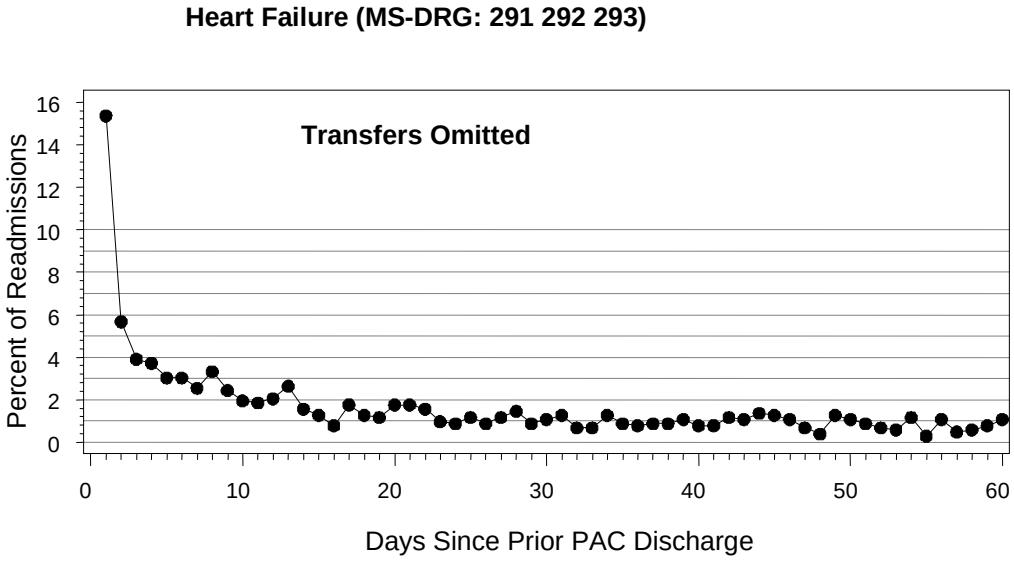
Readmissions of PAC users that would be included in an episode 30 days from index OR 20 days from prior PAC rule:

Highlighted: 28,318 (94.4% of all PAC user readmissions in episodes defined by a 30-day gap in services)

Only a difference of 110 readmissions or less than 1%

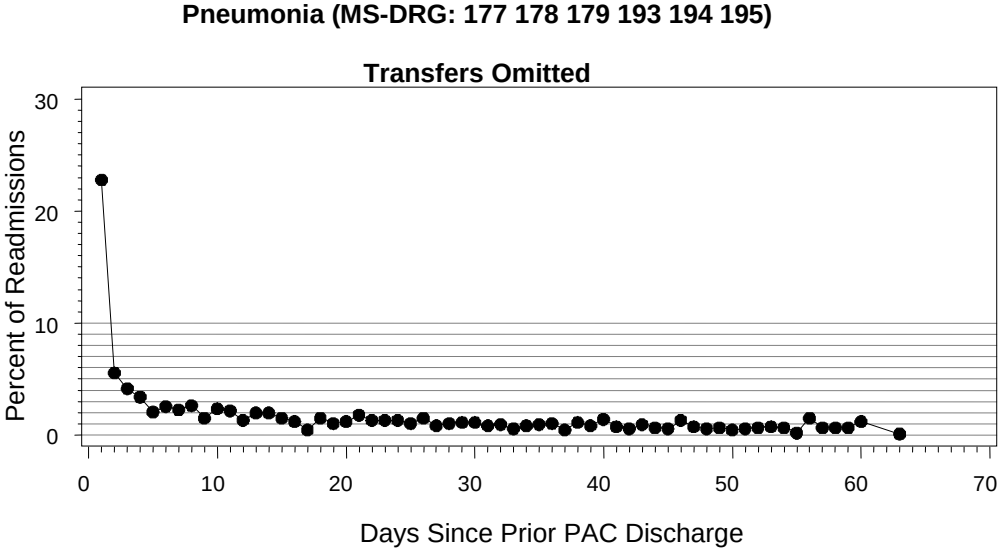
Source: RTI analysis of Medicare claims 5% MedPAR, 2006 (Program: LSMI137).

Figure 5. PAC Users, Percent of Readmissions Occurring Each Day After a Prior PAC Discharge, Heart Failure (MS-DRGs: 291, 292, and 293)



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS58 DATED: 06/21/2009 RECEIVED: 06/22/2009 - PROGRAM LSMI148
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

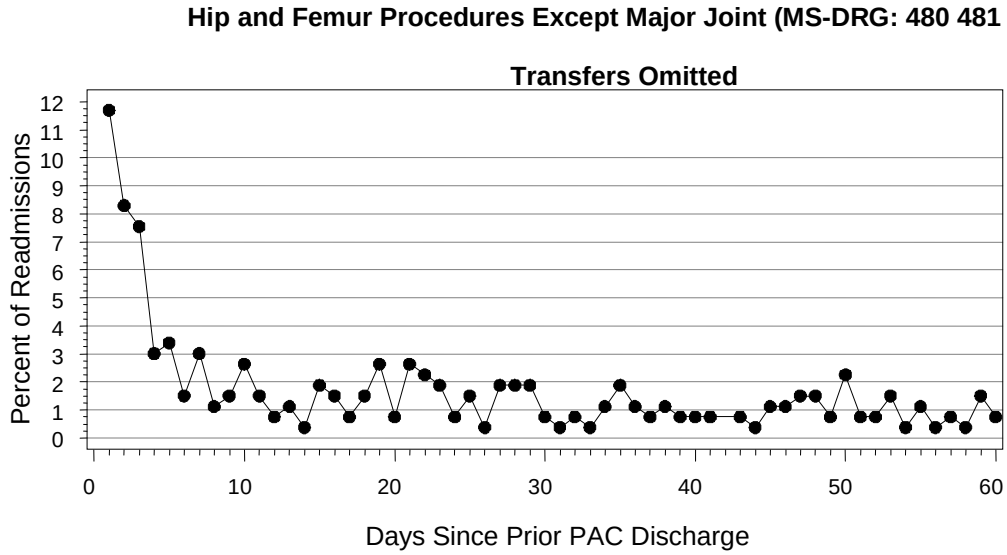
Figure 6. PAC Users, Percent of Readmissions Occurring Each Day After a Prior PAC Discharge, Pneumonia (MS-DRGs: 177, 178, 179, 193, 194, and 195)



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS58 DATED: 06/21/2009 RECEIVED: 06/22/2009 - PROGRAM LSMI148
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

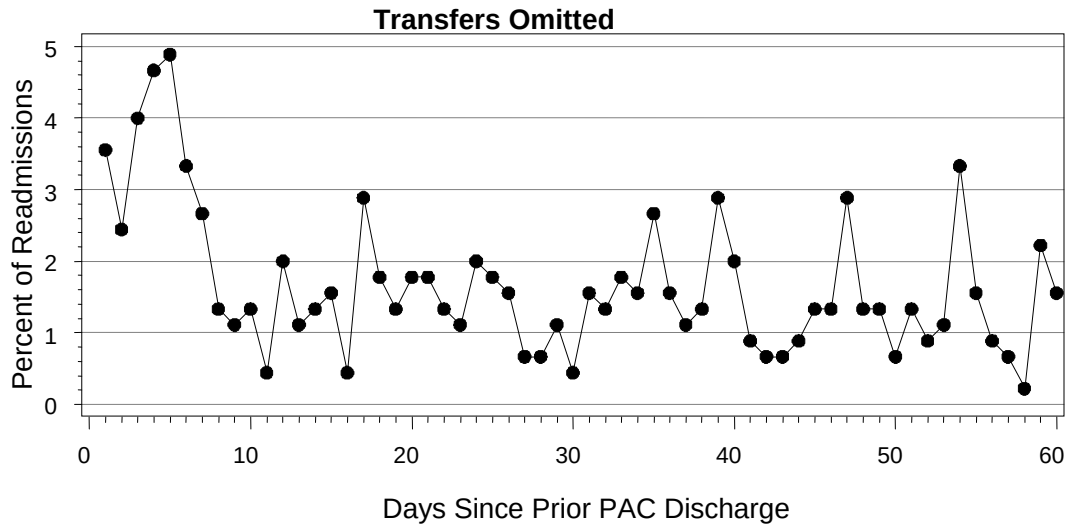
Figures 7 and **8** show readmissions for surgical procedures: Hip and femur procedures except major joint (480, 481, 482) and Major joint replacement (460, 470). These graphs do not show a clear declining trend in the first days after PAC discharge and are much more variable (though in part due to smaller numbers). In contrast to **Figures 5** and **6**, these figures show the differences in readmissions patterns for diagnoses that are largely planned and those that are unplanned.

Figure 7. PAC Users, Percent of Readmissions Occurring Each Day After a Prior PAC Discharge, Hip and Femur Procedures Except Major Joint (MS-DRGs: 480, 481, and 842)



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS58 DATED: 06/21/2009 RECEIVED: 06/22/2009 - PROGRAM LSMI148
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

Figure 8. PAC Users, Percent of Readmissions Occurring Each Day After a Prior PAC Discharge, Major Joint Replacement (MS-DRGs: 460 and 470)



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS58 DATED: 06/21/2009 RECEIVED: 06/22/2009 - PROGRAM LSMI148
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

On the basis of these plots and prior analyses, RTI concluded that the same time window should not be used for readmissions after PAC discharge as those occurring after an acute discharge. *Readmissions that occur more than 30 days after an index acute discharge should only be included in the episode if they occur within 20 days of a prior PAC discharge, not within 30 days.* It should be noted that based on these plots it could be argued that a shorter time interval after PAC could have been used; however, the choice was made to make the rule consistent with the logic for grouping PAC claims within 20 days to episodes, as described in **Section 2**.

These plots and subsequent analyses also suggest that any readmission criteria should consider in more detail whether surgical diagnoses are planned and if planned, whether it is appropriate to group them to the PAC episode. Additional analyses by percentile of the days between index acute discharge and readmission for surgical and for medical readmission MS-DRGs as well as days between discharge from prior PAC and readmission[21] show readmissions for medical MS-DRGs appear to occur much closer to prior PAC services and to prior acute discharge. The distributions of readmissions by days from index acute discharge are generally similar for medical rehospitalizations with the median days from index

[21] See **Appendixes L1** and **L2** for tables showing percentiles for the full sets of surgical and medical MS-DRGs.

between 27 to 40 days. However, the distributions appear to more variable looking at the surgical MS-DRGs, with a much larger range across MS-DRGs at the median for surgical MS-DRGs than medical MS-DRGs suggesting that it may be inappropriate to assume that all surgical readmissions are related if they fall within a certain number of days after an included acute or PAC service.

4.7 Diagnosis-Based Criteria

4.7.1 Exclusions: Refinement of the Days since Discharge Rule for Identifying Related Surgical[22] Rehospitalizations

Further analyses were conducted to systematically identify a subset of surgical readmission diagnoses that should be excluded from a 30-day post-discharge readmission rule or a 20-day post-PAC readmission rule. RTI and Dr. Jencks used three key characteristics[23] to rank rehospitalizations from likely related to unlikely to be related[24]. The following measures were examined.

Measures

1. **"Acuity":** The concentration of rehospitalizations in the first 30 days after discharge, as a proportion of rehospitalizations in days 0–90 after discharge; or, how much the rate of rehospitalization during the first 30 days exceed the background rate seen in days 31–90. *Rationale: DRGs with higher percentages for this measure are more likely to be urgent/emergent and therefore related.*

2. **"Game-ability":** The proportion of rehospitalizations that might be moved outside the 30-day window for readmissions to be included in the episode by being deferred for a week. We calculated the percent of rehospitalizations in the first 30 days after discharge that occur in the last week of those 30 days. *Rationale: DRGs with higher percentages for this measure are more likely to be elective. To avoid negative impacts on patient care, we should exclude from the episode rehospitalization diagnoses whose timing is at higher risk for being influenced by the choice of time criteria.*

3. **Rate of Decline in Rehospitalizations:** A more rapid decline in the rate of rehospitalizations suggests a stronger association to the index discharge. This is measured by the coefficient "k" when an exponential curve is fitted to the empirical data. *Rationale: DRGs with higher rates of decline (i.e. a larger magnitude "k") are more likely to be emergent/urgent and related to the earlier treatment.*

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[22] RTI has used CMS's surgical and medical designations. However, we have reclassified one MS-DRG (MS-DRG 004 Tracheostomy with mechanical ventilation 96+ hours or principal diagnosis except face, mouth and neck without major O.R.) that CMS categorizes as surgical to medical, because analysis of patterns of rehospitalization in this MS-DRG are more consistent with a medical MS-DRG.

[23] This analysis used the 100% 2004 Medicare inpatient claims file.

[24] See **Tables 16a, 16b,** and **16c** to see how DRGs were ranked.

Initial Test Ranking. Members of the RTI team examined these measures and distribution curves for the most frequent 25 surgical readmission DRGs[25] and independently ranked them from most likely to least likely related to the episode. Resulting rankings were highly correlated, though there was no explicit formula for ranking, suggesting that these measures might be used to develop a more systematic method for classifying DRGs as related. See **Table 15**[26] for the scores for these readmission DRGs on the above measures and test rankings in the far right columns.

Cut Point Selection (Related/Unrelated). We then drew cut points in our ranked DRGs to designate those with the best cases for (1) inclusion and (2) exclusion and (3) a group that is more indeterminate. These groupings are split out into three separate tables in **Tables 16a** through **16c**.[27]

Summary Score Development. To more systematically apply these principles to the wider data set and to RTI's episode file; we developed a method to classify rehospitalizations using a composite score. For each measure we gave 1 point for a value *moderately* consistent with a decision to include the rehospitalization in the PAC episode and 2 points for a value *highly* consistent with inclusion. **Table 15** displays the different cut-points for our scoring. The result is a composite score ranging from 0 (strongly favors exclusion) to 6 (strongly favors inclusion).

Table 15. Summary Score Components

Measure	Confidence Limit	1 Point Assigned	2 Points Assigned
Acuity (0–30/0–90)	Lower	>50%	>60%
Game-ability (24–30/0–30)	Upper	<20%	<14%
Rate of change in risk	Upper	k <–0.020	k <–0.040

We used the 95 percent confidence limits rather than point estimates in order to account for variation in the amount of uncertainty in our estimates, particularly for less frequent readmission DRGs.

[25] These account for two-thirds of surgical rehospitalizations we calculated the three measures described above.

[26] See **Appendix N** for distribution curves and corresponding index DRGs for these top 25 surgical readmission DRGs.

[27] See **Appendix M** for the full set of Surgical Readmission DRGs and their rankings. There are 24.2% in the "related" group, 41.5% in the "indeterminate," and 34.3% in the "unrelated" group.

Table 16a. Related Surgical Readmissions by Readmission DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Readmission DRG	Readm 0–30 Days	PCT of 0–30 Surg Readm	CUM PCT of Surg Readm	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0–30 / 0–90 UCL	Acuity: PCT 0–30 / 0–90 LCL	Game-ability: PCT 24–30 / 0–30	Game-ability: PCT 24–30 / 0–30 UCL	Game-ability: PCT 24–30 / 0–30 LCL	Rate of Decline: K TIME	Rate of Decline: UCL K TIME	Rate of Decline: LCL K TIME	Rank 1	Rank 2	Sum Score
442 Other O.R. procedures for injuries with CC	4,589	1.4%	1.4%	70.6%	71.7%	69.4%	10.8%	13.5%	8.0%	−0.066	−0.060	−0.072	1	1	6
109 Coronary bypass without cardiac catheterization	6,097	1.8%	3.2%	66.8%	67.8%	65.9%	12.4%	14.7%	10.0%	−0.055	−0.042	−0.068	2	4	6
483 No longer valid	7,255	2.2%	5.3%	64.5%	65.4%	63.6%	12.4%	14.5%	10.2%	−0.054	−0.050	−0.059	3	6	6
170 Other digestive system O.R. procedures with CC	3,966	1.2%	6.5%	65.4%	66.6%	64.2%	12.7%	15.6%	9.8%	−0.051	−0.046	−0.056	4	3	6
475 Respiratory system diagnosis with ventilator support	24,646	7.3%	13.8%	63.1%	63.5%	62.6%	13.0%	14.2%	11.8%	−0.050	−0.047	−0.054	5	2	6
076 Other respiratory system O.R. procedures with CC	8,699	2.6%	16.4%	62.9%	63.7%	62.1%	13.9%	15.9%	12.0%	−0.044	−0.042	−0.047	6	7	6
154 Stomach, esophageal & duodenal procedures age >17 with CC	3,863	1.1%	17.5%	61.4%	62.6%	60.2%	13.4%	16.3%	10.5%	−0.052	−0.046	−0.058	7	8	5
415 O.R. procedure for infectious & parasitic diseases	14,820	4.4%	21.9%	68.0%	68.6%	67.4%	14.2%	15.7%	12.7%	−0.035	−0.028	−0.043	8	5	5

Readm=Readmissions; PCT=Percent; Surg=Surgical; CUM=Cumulative; UCL=Upper Confidence Limit; LCL=Lower Confidence Limit; K TIME=rate of change in rehospitalizations over time; O.R.=operating room; CC=complication or comorbidity.

Table 16b. Indeterminate Surgical Readmissions by Readmission DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Readmission DRG	Readm 0–30 Days	PCT of 0–30 Surg Readm	CUM PCT of Surg Readm	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0–30 / 0–90 UCL	Acuity: PCT 0–30 / 0–90 LCL	Gameability: PCT 24–30 / 0–30	Gameability: PCT 24–30 / 0–30 UCL	Gameability: PCT 24–30 / 0–30 LCL	Rate of Decline: K TIME	Rate of Decline: UCL K TIME	Rate of Decline: LCL K TIME	Rank 1	Rank 2	Sum Score
148 Major small & large bowel procedures with CC	15,052	4.5%	26.4%	57.5%	58.1%	56.9%	14.6%	16.0%	13.1%	−0.045	−0.04	−0.050	9	11	3
105 Cardiac valve & other major cardiothoracic procedures without cardiac catheterization	4,402	1.3%	27.7%	61.0%	62.1%	59.8%	15.0%	17.8%	12.3%	−0.035	−0.023	−0.046	10	9	3
517 Percutaneous cardiovascular procedures with non-drug eluting stent without AMI	7,006	2.1%	29.7%	60.8%	61.7%	59.9%	15.1%	17.2%	12.9%	−0.037	−0.029	−0.045	11	10	3
110 Major cardiovascular procedures with CC	5,972	1.8%	31.5%	53.2%	54.1%	52.2%	15.1%	17.4%	12.7%	−0.040	−0.033	−0.047	12	18	3
493 Laparoscopic cholecystectomy without C.D.E. with CC	5,782	1.7%	33.2%	56.9%	57.9%	55.9%	15.5%	17.9%	13.2%	−0.039	−0.035	−0.044	13	12	3
116 Other permanent cardiac pacemaker implant	10,594	3.1%	36.4%	55.4%	56.1%	54.7%	15.6%	17.3%	13.8%	−0.036	−0.032	−0.04	14	13	3
518 Percutaneous cardiovascular procedures without coronary artery stent or AMI	4,902	1.5%	37.8%	54.3%	55.3%	53.2%	16.0%	18.5%	13.4%	−0.037	−0.031	−0.042	15	15	3
120 Other Circulatory system O.R. procedures	7,314	2.2%	40.0%	55.0%	55.9%	54.2%	16.8%	18.9%	14.7%	−0.030	−0.026	−0.034	16	14	3
478 Other vascular procedures with CC	18,971	5.6%	45.6%	54.0%	54.5%	53.5%	16.9%	18.2%	15.6%	−0.028	−0.022	−0.034	17	16	3
527 Percutaneous cardiovascular procedures with drug-eluting stent without AMI	16,179	4.8%	50.4%	55.3%	55.9%	54.7%	18.0%	19.4%	16.6%	−0.026	−0.017	−0.034	18	17	2

Readm=Readmissions; PCT=Percent; Surg=Surgical; CUM=Cumulative; UCL=Upper Confidence Limit; LCL=Lower Confidence Limit; K TIME=rate of change in rehospitalizations over time; CC=complication or comorbidity; AMI=acute myocardial infarction; C.D.E.=common duct exploration; O.R.=operating room.

Table 16c. Unrelated Surgical Readmissions by Readmission DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Readmission DRG	Readm 0–30 Days	PCT of 0–30 Surg Readm	CUM PCT of Surg Readm	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0–30 / 0–90 UCL	Acuity: PCT 0–30 / 0–90 LCL	Gameability: PCT 24–30 / 0–30	Gameability: PCT 24–30 / 0–30 UCL	Gameability: PCT 24–30 / 0–30 LCL	Rate of Decline: K TIME	Rate of Decline: UCL K TIME	Rate of Decline: LCL K TIME	Rank 1	Rank 2	Sum Score
515 Cardiac defibrillator implant without cardiac catheterization	3,459	1.0%	51.4%	51.4%	52.6%	50.2%	18.0%	21.0%	15.0%	−0.025	−0.018	−0.032	19	—	1
113 Amputation for circulatory system disorders except upper limb & toe	8,806	2.6%	54.0%	56.0%	56.8%	55.3%	19.1%	21.0%	17.2%	−0.014	−0.006	−0.022	20	19	1
210 Hip & femur procedures except major joint age >17 with CC	8,661	2.6%	56.6%	46.5%	47.2%	45.8%	18.4%	20.3%	16.5%	−0.023	−0.021	−0.026	21	20	1
315 Other kidney & urinary tract procedures	5,967	1.8%	58.4%	52.6%	53.5%	51.7%	18.5%	20.8%	16.2%	−0.019	−0.012	−0.027	22	21	1
336 Transurethral prostatectomy with CC	3,482	1.0%	59.4%	53.9%	55.1%	52.6%	19.0%	22.0%	16.0%	−0.014	−0.004	−0.023	23	—	1
075 Major chest procedures	4,572	1.4%	60.7%	49.6%	50.6%	48.5%	19.5%	22.1%	16.9%	−0.017	−0.010	−0.024	24	22	0
263 Skin graft &/or debridements for skin ulcer or cellulitis with CC	3,625	1.1%	61.8%	49.0%	50.1%	47.8%	21.3%	24.2%	18.4%	0.000	0.009	−0.008	25	23	0
533 Extracranial procedures with CC	4,288	1.3%	63.1%	43.5%	44.4%	42.5%	23.1%	25.8%	20.5%	−0.006	0.002	−0.014	26	24	0
209 Major joint & limb reattachment procedures of lower extremity	12,069	3.6%	66.7%	35.0%	35.5%	34.5%	20.3%	21.9%	18.7%	−0.014	−0.009	−0.019	27	25	0

Readm=Readmissions; PCT=Percent; Surg=Surgical; CUM=Cumulative; UCL=Upper Confidence Limit; LCL=Lower Confidence Limit; K TIME=rate of change in rehospitalizations over time; CC=complication or comorbidity.

Application of Measures to the RTI Episode File to Identify Related Readmissions

The small cell sizes in the RTI file attributable to the 5 percent sample, but also to the more subdivided MS-DRG system, make it difficult to estimate the goodness of fit of the plotted readmissions curves to an exponential curve. RTI tested the impact of only using *acuity* and *game-ability* measures on the 100 percent MedPAR DRG rankings and "related" classifications and found that only 25 of the DRGs changed classification, and only two switched from "related" to "indeterminate" suggesting that the scoring system is reasonably robust using just the two measures. The two different scoring systems yielded the following results.

Original Ranking System (3 Measures). 24.2 percent in 13 DRGs were classified as related (of all rehospitalizations), 34.3 percent of readmissions were unrelated, and 41.5 percent indeterminate.

Two-Measure Ranking System. Only 25 of 233 DRGs had a change in classification. Two DRGs changed from "related" to "indeterminate" (150: Peritoneal adhesiolysis with CC; 526 Percutaneous cardiovascular procedure with drug-eluting stent with AMI) and 2 changed from "indeterminate" to "related" (461: O.R. procedure with diagnoses of other contact with health services; 440: Wound debridements for injuries). The rest were shifts from "indeterminate" to "unrelated."

RTI calculated analogous scores for acuity and game-ability by MS-DRG using data on days since index acute discharge for all surgical MS-DRGs with 100 or more rehospitalizations within 90 days of index acute discharge, regardless of PAC use, and examined the classifications that resulted from using the scoring system as shown in **Tables 17a–17c** and **18**. The new score ranges were: 0–4, relatedness categories: (related: 4, 3, 2), (indeterminate: 1), and (not related: 0).

Tables 17a through **17c** show all readmission MS-DRGs with more than 100 readmissions occurring within 90 days of index acute discharge, the proportion by MS-DRG of these readmissions that occur within the first 30 days after index discharge, and the proportion that occur within days 24 to 30 out of the first 30 days[28] split out into the different tables by relatedness classification of the rehospitalization MS-DRG. The MS-DRGs with 100 or more readmissions within 90 days of index acute discharge end up with roughly similar rankings to their corresponding DRGs from the 100 percent MedPAR. Only two MS-DRGs (004: Tracheotomy with mechanical ventilation 96+ hours or PDX excluding face, mouth and neck without major O.R. and 234: Coronary bypass with cardiac catheterization without MCC) are very discordant from their placement in the 100 percent MedPAR rankings likely due to small cell sizes in the RTI file and differences in the sample selection.

[28] See **Appendix C** for acuity and game-ability scores for MS-DRGs with fewer than 100 rehospitalizations within 90 days of index discharge.

Table 17a. Related Surgical Readmissions by Readmission MS-DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Ranked in order of score (Acuity + Game-ability), MS-DRGs with at least 100 readmissions in days 0 to 90 after index discharge.

Readmission MS-DRG	CUM %	Counts: Readm 0–90	Counts: Readm 0–30	Counts: Readm 24–30	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0-30 / 0-90: (LCL)	Acuity: PCT 0-30 / 0-90: (UCL)	Acuity: Score	Game-ability: PCT 24–30 / 0–30	Game-ability: PCT 24–30 / 0–30: (LCL)	Game-ability: PCT 24–30 / 0–30: (UCL)	Game-ability: Score	Sum Scores
329: Major small & large bowel procedures with MCC	2%	363	215	24	59.2%	54.1%	64.3%	1	11.2%	6.9%	15.4%	2	3
326: Stomach, esophageal & duodenal procedures with MCC	2%	104	64	5	61.5%	52.0%	71.0%	1	7.8%	1.1%	14.6%	2	3
166: Other respiratory system O.R. procedures with MCC	4%	315	207	31	65.7%	60.4%	71.0%	2	15.0%	10.1%	19.9%	1	3
236: Coronary bypass without cardiac catheterization without MCC	5%	263	180	24	68.4%	62.8%	74.1%	2	13.3%	8.3%	18.3%	1	3
857: Postoperative or post-traumatic infections with O.R. procedures with CC	6%	168	129	15	76.8%	70.3%	83.2%	2	11.6%	6.0%	17.2%	1	3
856: Postoperative or post-traumatic infections with O.R. procedures with MCC	6%	110	85	10	77.3%	69.3%	85.2%	2	11.8%	4.8%	18.8%	1	3
003: ECMO or tracheotomy with mechanical ventilation 96+ hours or principal diagnosis excluding face, mouth & neck with major O.R.	7%	187	107	10	57.2%	50.1%	64.4%	0	9.3%	3.7%	15.0%	2	2
853: Infectious & parasitic diseases with O.R. procedures with MCC	8%	105	55	1	52.4%	42.7%	62.1%	0	1.8%	-1.8%	5.5%	2	2
219: Cardiac valve & other major cardiothoracic procedures without cardiac catheterization with MCC	8%	100	52	4	52.0%	42.0%	62.0%	0	7.7%	0.2%	15.2%	2	2
167: Other respiratory system O.R. procedures with CC	10%	317	200	26	63.1%	57.8%	68.4%	1	13.0%	8.3%	17.7%	1	2
981: Extensive O.R. procedures unrelated to principal diagnosis with MCC	11%	312	195	24	62.5%	57.1%	67.9%	1	12.3%	7.7%	17.0%	1	2
237: Major cardiovascular procedures with MCC or thoracic aortic aneurysm repair	12%	157	97	10	61.8%	54.1%	69.5%	1	10.3%	4.1%	16.5%	1	2
494: Lower extremity & humerous procedures except hip, foot, femur without CC/MCC	12%	104	66	7	63.5%	54.1%	72.9%	1	10.6%	3.0%	18.2%	1	2

CUM=Cumulative; Readm=Readmissions; PCT=Percent; LCL=Lower Confidence Limit; UCL=Upper Confidence Limit; MCC=major complication or comorbidity; O.R.=operating room; CC=complication or comorbidity.

Table 17b. Indeterminate Surgical Readmissions by Readmission MS-DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Ranked in order of score (Acuity + Game-ability), MS-DRGs with at least 100 readmissions in days 0–90 after index discharge.

Readmission MS-DRG	CUM %	Counts: Readm 0–90	Counts: Readm 0–30	Counts: Readm 24–30	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0-30 / 0-90: (LCL)	Acuity: PCT 0-30 / 0-90: (UCL)	Acuity: Score	Game-ability: PCT 24–30 / 0–30	Game-ability: PCT 24–30 / 0–30: (LCL)	Game-ability: PCT 24–30 / 0–30: (UCL)	Game-ability: Score	Sum Scores
253: Other vascular procedures with CC	15%	423	227	33	53.7%	48.9%	58.4%	0	14.5%	9.9%	19.2%	1	1
252: Other vascular procedures with MCC	16%	391	207	27	52.9%	48.0%	57.9%	0	13.0%	8.4%	17.7%	1	1
243: Permanent cardiac pacemaker implant with CC	18%	316	168	20	53.2%	47.6%	58.7%	0	11.9%	7.0%	16.9%	1	1
249: Percutaneous cardiovascular procedures with non-drug-eluting stent without MCC	19%	237	131	16	55.3%	48.9%	61.7%	0	12.2%	6.5%	17.9%	1	1
242: Permanent cardiac pacemaker implant with MCC	20%	157	83	10	52.9%	45.0%	60.8%	0	12.0%	4.9%	19.2%	1	1
247: Percutaneous cardiovascular procedures with drug-eluting stent without MCC	27%	1579	916	171	58.0%	55.6%	60.4%	1	18.7%	16.1%	21.2%	0	1
264: Other circulatory system O.R. procedures	29%	378	216	33	57.1%	52.1%	62.2%	1	15.3%	10.4%	20.1%	0	1
982: Extensive O.R. procedures unrelated to principal diagnosis with CC	30%	254	147	22	57.9%	51.8%	64.0%	1	15.0%	9.1%	20.8%	0	1
026: Craniotomy & endovascular intracranial procedures with CC	31%	136	82	11	60.3%	52.0%	68.6%	1	13.4%	5.9%	20.9%	0	1
220: Cardiac valve & other major cardiothoracic procedures without cardiac catheterization with CC	32%	114	71	11	62.3%	53.2%	71.3%	1	15.5%	6.9%	24.1%	0	1
713: Transurethral prostatectomy with CC/MCC	32%	111	70	9	63.1%	53.9%	72.2%	1	12.9%	4.8%	20.9%	0	1

CUM=Cumulative; Readm=Readmissions; PCT=Percent; LCL=Lower Confidence Limit; UCL=Upper Confidence Limit; CC=complication or comorbidity; MCC=major complication or comorbidity; O.R.=operating room.

Table 17c. Unrelated Surgical Readmissions by Readmission MS-DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30

Ranked in order of score (Acuity + Game-ability), MS-DRGs with at least 100 readmissions in days 0–90 after index discharge.

Readmission MS-DRG	CUM %	Counts: Readm 0–90	Counts: Readm 0–30	Counts: Readm 24–30	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0-30 / 0-90: (LCL)	Acuity: PCT 0-30 / 0-90: (UCL)	Acuity: Score	Game-ability: PCT 24–30 / 0–30	Game-ability: PCT 24–30 / 0–30: (LCL)	Game-ability: PCT 24–30 / 0–30: (UCL)	Game-ability: Score	Sum Scores
470: Major joint replacement or reattachment of lower extremity without MCC	37%	955	276	67	28.9%	26.0%	31.8%	0	24.3%	19.2%	29.4%	0	0
330: Major small & large bowel procedures with CC	39%	509	243	47	47.7%	43.4%	52.1%	0	19.3%	14.3%	24.3%	0	0
254: Other vascular procedures without CC/MCC	41%	407	175	36	43.0%	38.2%	47.8%	0	20.6%	14.5%	26.6%	0	0
039: Extracranial procedures without CC/MCC	43%	396	177	43	44.7%	39.8%	49.6%	0	24.3%	17.9%	30.7%	0	0
244: Permanent cardiac pacemaker implant without CC/MCC	45%	390	190	30	48.7%	43.7%	53.7%	0	15.8%	10.6%	21.0%	0	0
227: Cardiac defibrillator implant without cardiac catheterization without MCC	47%	385	184	32	47.8%	42.8%	52.8%	0	17.4%	11.9%	22.9%	0	0
481: Hip & femur procedures except major joint with CC	48%	317	139	21	43.8%	38.4%	49.3%	0	15.1%	9.1%	21.1%	0	0
238: Major cardiovascular procedures without MCC	50%	295	121	22	41.0%	35.4%	46.7%	0	18.2%	11.2%	25.2%	0	0
246: Percutaneous cardiovascular procedures with drug-eluting stent with MCC or 4+ vessels/stents	51%	280	156	30	55.7%	49.9%	61.6%	0	19.2%	13.0%	25.5%	0	0
251: Percutaneous cardiovascular procedures without coronary artery stent or AMI without MCC	52%	268	126	23	47.0%	41.0%	53.0%	0	18.3%	11.4%	25.1%	0	0
419: Laparoscopic cholecystectomy without C.D.E. without CC/MCC	53%	201	110	21	54.7%	47.8%	61.7%	0	19.1%	11.6%	26.6%	0	0
714: Transurethral prostatectomy without CC/MCC	54%	199	105	19	52.8%	45.8%	59.8%	0	18.1%	10.6%	25.6%	0	0
482: Hip & femur procedures except major joint without CC/MCC	55%	180	78	17	43.3%	36.0%	50.6%	0	21.8%	12.4%	31.2%	0	0
418: Laparoscopic cholecystectomy without C.D.E. with CC	56%	175	97	13	55.4%	48.0%	62.9%	0	13.4%	6.5%	20.3%	0	0
480: Hip & femur procedures except major joint with MCC	57%	163	68	13	41.7%	34.1%	49.4%	0	19.1%	9.5%	28.7%	0	0
004: Tracheotomy with mechanical ventilation 96+ hours or PDX excluding face, mouth & neck without major O.R.	57%	155	89	13	57.4%	49.5%	65.3%	0	14.6%	7.1%	22.1%	0	0
491: Back & neck procedures excluding spinal fusion without CC/MCC	58%	153	56	10	36.6%	28.9%	44.3%	0	17.9%	7.5%	28.2%	0	0

(continued)

Table 17c. Unrelated Surgical Readmissions by Readmission MS-DRG, Proportion within 30 Days of Index Acute Discharge, Proportion in Days 24–30 (continued)

Readmission MS-DRG	CUM %	Counts: Readm 0–90	Counts: Readm 0–30	Counts: Readm 24–30	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0-30 / 0-90: (LCL)	Acuity: PCT 0-30 / 0-90: (UCL)	Acuity: Score	Game-ability: PCT 24–30 / 0–30	Game-ability: PCT 24–30 / 0–30: (LCL)	Game-ability: PCT 24–30 / 0–30: (UCL)	Game-ability: Score	Sum Scores
460: Spinal fusion except cervical without MCC	59%	147	53	10	36.1%	28.2%	43.9%	0	18.9%	8.0%	29.8%	0	0
038: Extracranial procedures with CC	60%	146	69	15	47.3%	39.1%	55.5%	0	21.7%	11.8%	31.7%	0	0
331: Major small & large bowel procedures without CC/MCC	60%	144	52	7	36.1%	28.2%	44.1%	0	13.5%	3.9%	23.1%	0	0
164: Major chest procedures with CC	61%	133	57	11	42.9%	34.3%	51.4%	0	19.3%	8.7%	29.9%	0	0
988: Non-extensive O.R. procedures unrelated to principal diagnosis with CC	62%	121	68	10	56.2%	47.2%	65.2%	0	14.7%	6.1%	23.3%	0	0
517: Other musculoskeletal system & connective tissue O.R. procedures without CC/MCC	62%	120	56	9	46.7%	37.6%	55.7%	0	16.1%	6.1%	26.0%	0	0
239: Amputation for circulatory system disorders excluding upper limb & toe with MCC	63%	119	57	11	47.9%	38.8%	57.0%	0	19.3%	8.7%	29.9%	0	0
234: Coronary bypass with cardiac catheterization without MCC	63%	119	61	10	51.3%	42.1%	60.4%	0	16.4%	6.8%	26.0%	0	0
468: Revision of hip or knee replacement without CC/MCC	64%	116	37	8	31.9%	23.3%	40.5%	0	21.6%	7.7%	35.5%	0	0
469: Major joint replacement or reattachment of lower extremity with MCC	64%	114	42	6	36.8%	27.9%	45.8%	0	14.3%	3.2%	25.3%	0	0
673: Other kidney & urinary tract procedures with MCC	65%	114	63	10	55.3%	46.0%	64.5%	0	15.9%	6.6%	25.2%	0	0
027: Craniotomy & endovascular intracranial procedures without CC/MCC	65%	112	63	9	56.3%	46.9%	65.6%	0	14.3%	5.4%	23.2%	0	0
240: Amputation for circulatory system disorders excluding upper limb & toe with CC	66%	111	59	9	53.2%	43.7%	62.6%	0	15.3%	5.8%	24.7%	0	0
163: Major chest procedures with MCC	66%	100	53	11	53.0%	43.0%	63.0%	0	20.8%	9.5%	32.0%	0	0

CUM=Cumulative; Readm=Readmissions; PCT=Percent; LCL=Lower Confidence Limit; UCL=Upper Confidence Limit; MCC=major complication or comorbidity; CC=complication or comorbidity; AMI=acute myocardial infarction; C.D.E.=common duct exploration; PDX=principal diagnosis.

Based on the findings from the analysis detailed in **Tables 17a–17c,** RTI applied the following rules described in **Table 18**, to classify *surgical rehospitalizations that occur within 30 days of an included acute discharge*[29]:

Table 18. Surgical Rehospitalization Classifications for Readmissions within 30 Days of Discharge From an Index Hospitalization or From a Readmission that is Part of the Episode

Classification	Action	Combined "Acuity" and "Game-ability" Score	Percent Surgical Readmissions
Related	**Include** in episode	2 or higher	12%
Indeterminate	**Include** only those with within 7 days of included acute discharge	1	20%
Unrelated	**Exclude** from episode	0	34%

Some surgical MS-DRGs do not follow a clear pattern that suggests relatedness, which we are classifying as "indeterminate." These readmission MS-DRGs appear to have an elevated risk of rehospitalization during the first month after discharge, but the rate of decline over the month is less systematic suggesting that some of the later admissions may have discretionary timing. For these indeterminate MS-DRGs, RTI chose a more conservative rule, to include rehospitalizations for these MS-DRGs only if the rehospitalization occurs within 7 days of the initial acute discharge; otherwise it will be excluded and will start a new episode of care (unless it is initiated on the same day as PAC discharge, or a transfer without discharge during a HHA stay).

For rehospitalizations occurring more than 30 days after acute discharge, RTI and Dr. Jencks conducted additional analyses to evaluate whether the scoring based on distributions of surgical rehospitalizations within 30 days of acute discharge would be appropriate when looking at readmissions occurring outside of that window. Using the RTI 5 percent MedPAR file, there were 1,327 (10 percent) surgical readmissions identified that would potentially qualify as part of an episode only because they were within 20 days of an included post-acute care discharge. We examined the readmissions patterns across all MS-DRGs applying the classifications identified using the full set of surgical readmissions. Looking at rehospitalization curves for MS-DRGs in groupings of related compared to indeterminate or unrelated suggest that the relationship between surgical readmissions and prior PAC services is different than with index admissions. *We did not see sufficient differences in the readmission curves (shown in **Figures 9–11**), or in the acuity and game-ability measures*

[29] For surgical rehospitalization MS-DRGs with fewer than 100 readmissions within 0–90 days after index acute discharge (33% of surgical diagnoses), we modified our procedure due to concerns about variability. We reviewed the 10 MS-DRGs that qualified as "related" individually and reclassified 4 as indeterminant due to small cell sizes and wide confidence intervals. The 6 additional MS-DRGs that we kept classified as related from this set account for 2% of surgical readmissions. The rest of these MS-DRGs with fewer than 100 readmissions had scores of 1 or 0 and were classified unrelated.

Table 19. PAC Users with Surgical Readmissions More Than 30 Days After Index Acute Discharge, within 1–90 Days of Prior PAC Discharge

Grouped by MS-DRG designation as related, indeterminate, or unrelated as developed using the composite scores for readmissions within 30 days of index.

Classification Based on MS-DRG	Count: Readmissions 0–90	Count: Readmissions 0–30	Acuity: PCT 0–30 / 0–90	Acuity: PCT 0–30 / 0–90 (LCL)	Acuity: PCT 0–30 / 0–90 (UCL)	Acuity: Score	Count: Readmissions 0–20	Count: Readmissions 14–20	Gameability: PCT 14–20 / 0–20	Gameability: PCT 24–30 / 0–30 (LCL)	Gameability: PCT 24–30 / 0–30 (UCL)	Gameability: Score
Related	492	265	53.9%	49.4%	58.3%	0	213	54	25.4%	19.5%	31.2%	0
Indeterminate	653	343	52.5%	48.7%	56.4%	0	262	56	21.4%	16.4%	26.4%	0
Unrelated	2,331	1,125	48.3%	46.2%	50.3%	0	852	215	25.2%	22.3%	28.2%	0

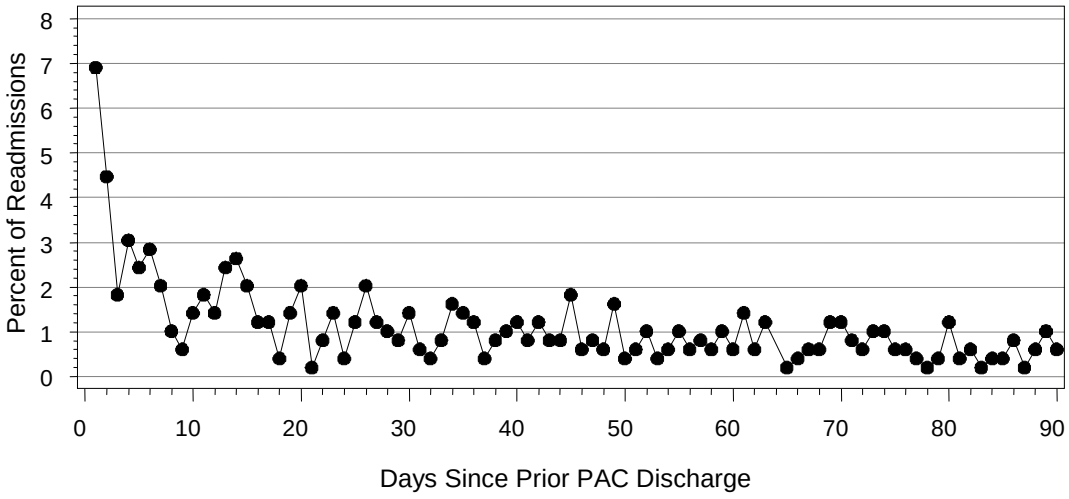
PCT=Percent; LCL=Lower Confidence Limit; UCL=Upper Confidence Limit.

*shown in **Table 19** above to justify identifying some surgical readmissions occurring within 20 days of prior PAC as related and others as not.*[30]

While there is a slight elevation in readmission risk through the first 7 days after PAC discharge shown in all three figures below, *RTI concluded that excluding surgical readmissions occurring more than 30 days after an acute hospitalization that is part of an episode, even if the readmission is within 20 days of a PAC claim that is part of the episode is most appropriate. The only exception to this rule is: rehospitalizations occurring on the same day as a PAC service that has been included as part of the episode will also be considered part of the episode.*

Figure 9. PAC Users, Percent of Readmissions Occurring Each Day, "Related" Surgical Readmissions Occurring More than 30 Days After Index Acute Discharge

Related based on MS-DRG (MS-DRG: 329 326 166 236 857 856 003 853 219 167 981 237 494 417 908 235 907 909 858)

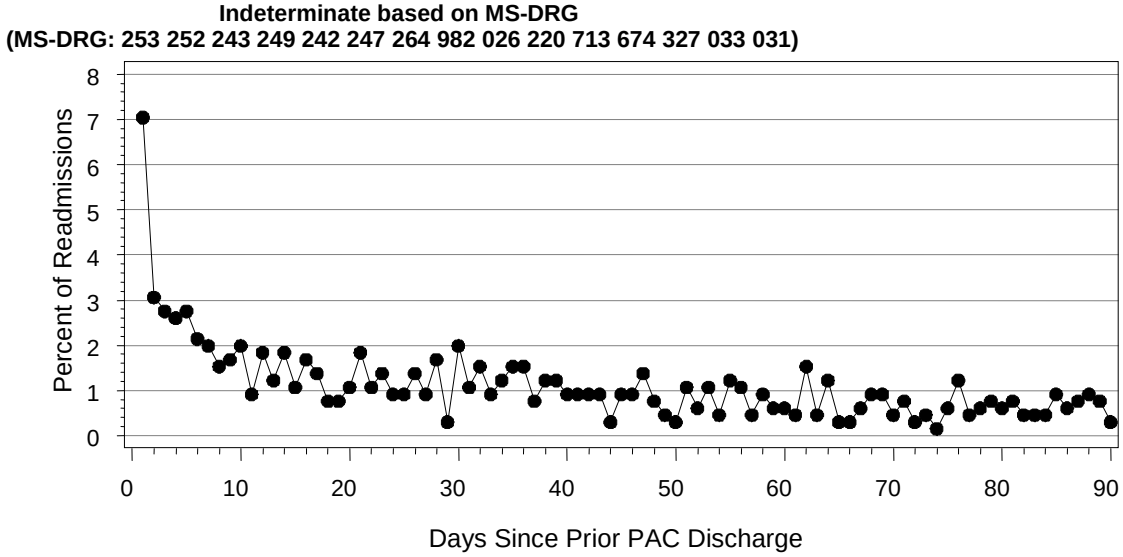


0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS74 DATED: 07/31/2009 REVISED: 08/02/2009 - PROGRAM LSMI169
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

N=492.

[30] See **Appendix 0** for table showing surgical rehospitalizations occurring greater than 30 days after index acute discharge for distributions by MS-DRG.

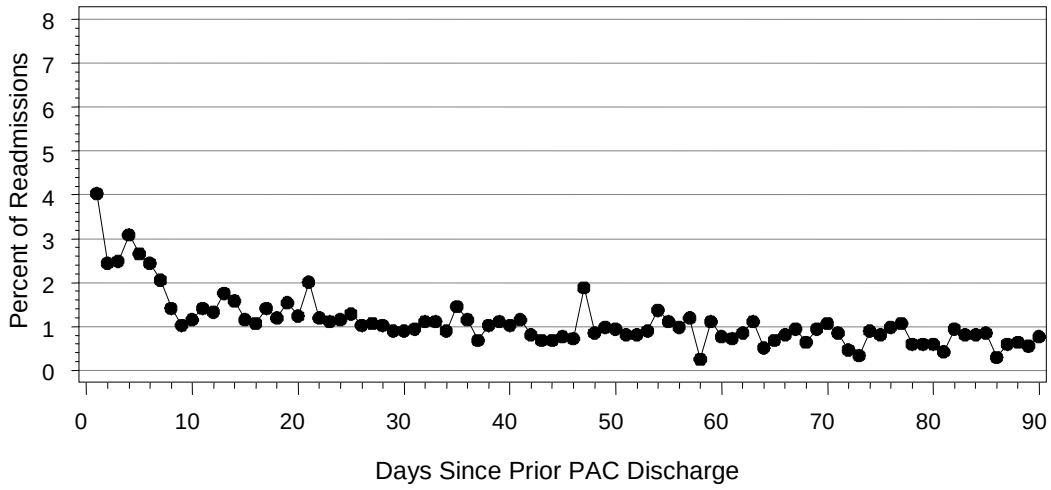
Figure 10. PAC Users, Percent of Readmissions Occurring Each Day, "Indeterminate" Surgical Readmissions Occurring More than 30 Days After Index Acute Discharge



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS74 DATED: 07/31/09 REVISED: 08/02/09 – PROGRAM LSMI169
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

N=656.

Figure 11. PAC Users, Percent of Readmissions Occurring Each Day, "Unrelated" Surgical Readmissions Occurring More than 30 Days After Index Acute Discharge



0208824.002 ASPE-PAC2 - REQUEST MOD2_LMS74 DATED: 07/31/2009 REVISED: 08/02/2009 - PROGRAM LSMI169
File= IN1.M2PERSON - 2006+2007 5 pct 2006 ACUTE Benes Person - See PSPA085

N=2327.

5. RTI V.2 Episode Descriptives

Based on the analyses of both time-based and diagnosis-based criteria presented in **Section 3** and **Section 4** and feedback from the technical expert panels, the RTI V.2 logic is summarized in **Table 20**.

Table 20. Summary of RTI V.2 Logic for Assigning PAC Claims and Rehospitalizations to Index Hospitalizations

RTI V.2 Logic

- All post-acute care claims initiating within:
  - 20 days of discharge from an acute hospital
  - 20 days of discharge from prior PAC
- Rehospitalizations
  - Medical within:
    - 30 days of discharge from acute
    - 20 days of discharge from PAC
  - Surgical within:
    - 30 days of discharge from acute, if related
    - 7 days of discharge from acute, if relatedness is indeterminate
  - All Direct transfers from PAC

Additional analyses were performed on the final RTI V.2 logic to provide an understanding of how the final logic works compared to the strictly time-based definitions of grouping PAC claims to index acute hospitalizations presented in **Section 3**. The final RTI V.2 logic incorporates the additional diagnosis based logic rules for medical and surgical rehospitalizations developed as a result of the rehospitalization specific analyses presented in **Section 4** in addition to the 20-day gap time-based logic for grouping PAC.

Tables 21a and **21b** show the number of days between settings and episode length by episode pattern under the RTI V.2 episode logic. As expected, the results are very similar to those shown in Table 6 and Table 7 using the 20-day gap episode logic. One key result to note is the shift in the number of beneficiaries with the episode patterns acute hospital to home health (AH) versus acute hospital to home health to acute hospital readmission (AHA) compared to the results of the 20-day gap logic. Under the 20-day gap episode definition, 19,232 beneficiaries had the episode pattern AH and 3,729 had the episode definition AHA. In comparison, after the implementation of the diagnosis-based rehospitalization criteria in RTI V.2, the number of beneficiaries with the episode pattern AH increased to 19,530 and the number of beneficiaries with the episode pattern AHA decreased to 3,468. The decrease in the AHA episodes under the RTI V.2 logic reflects the implementation of the rehospitalization criteria; episodes that were AHA under the time-based criteria only became episodes with the pattern AH after excluding rehospitalization that did not meet the criteria

in **Table 20**. **Tables 22a** and **22b** show similar analyses conducted at the MS-DRG level for the top 10 MS-DRGs discharged to PAC, rather than by episode pattern. The results show that the mean episode length varies considerably by MS-DRG. Beneficiaries in MS-DRG 470: Major joint replacement or reattachment of lower extremity without major complication or comorbidity (MCC) had an average episode length of 63.6 days, whereas beneficiaries in MS-DRG 065: Intracranial hemorrhage or cerebral infarction with complication or comorbidity (CC) had an average episode length of 89.1 days. Among the 10 MS-DRGs presented here, at the 95th percentile, episodes were shorter than 200 days in all cases except for MS-DRG 065, where length of stay was 248 days.

Tables 21a, 21b, 22a, and 22b provide summary statistics across all MS-DRGs and by MS-DRG (for the top 10 most frequent study MS-DRGs by volume) after the implementation of the RTI V.2 logic. **Table 23** shows the results for beneficiaries using PAC services and **Table 24** shows the results for the combined beneficiary sample of beneficiaries using PAC services and beneficiaries with an acute hospital readmission not using PAC. These tables provide the mean episode length, mean index acute hospital payment, mean episode payment (including index acute hospital payment, PAC payments, and rehospitalization payments), percent of beneficiaries with a rehospitalization, and the mean rehospitalization payment. For the combined sample, the table also shows the percent of beneficiaries using PAC. More than 97 percent of beneficiaries in MS-DRG 470: Major joint replacement or reattachment of lower extremity without MCC used PAC services and the average episode length for PAC users was 63.6 days and the percent of beneficiaries with a rehospitalization in their episode was 9.3 percent. In contrast, only 59.3 percent of beneficiaries in MS-DRG 194 Simple pneumonia & pleurisy with CC used PAC services and the average episode length for PAC users was 58.5 days, and 25.3 of beneficiaries using PAC had a rehospitalization. When looking at both PAC users and beneficiaries with a rehospitalization, the mean episode length increases to 59.3 and the percent of beneficiaries with a readmission increases to 29.1. In general, mean payments for index acute hospital admissions and episode payments are higher for PAC users than for the combined sample of PAC users and beneficiaries with readmissions.

Table 25 compares the episode length and payments for beneficiaries using PAC services in each of the study MS-DRGs under each of the episode definitions examined in this report; the 60-day gap episode definition, the 30-day gap episode definition, the 20-day gap episode definition, the 30-day window episode definition (including all claims initiating with the 30-day period), and, finally, the RTI V.2 logic. The results presented here highlight the similarities between the 30-day gap, the 20-day gap, and the RTI V.2 episode definitions with regard to episode length and payment. In contrast, the 60-day gap episodes have longer episode lengths of stay and higher payments, and the more restrictive 30-day window episode definition has shorter episode length and lower payments. Episode lengths of stay and payments vary widely across MS-DRGs.

Table 21a. Analysis of RTI V.2 Episode Definition Gaps Between Services, By Episode Pattern, All Study MS-DRGs, PAC Users

Pattern [a, b]	N	Percent	Cumulative Percent	Mean Gap First Pair	Mean Gap Last Pair	Gap First Pair 50th Percentile	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 50th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
AH	19,530	22.9	22.9	2.1	2.1	1	2	4	7	1	2	4	7
AS	13,152	15.5	38.4	0.0	0.0	0	0	0	0	0	0	0	0
ASH	7,096	8.3	46.7	0.0	2.0	0	0	0	0	1	2	4	6
AO	5,235	6.2	52.9	4.0	4.0	3	6	11	13	3	6	11	13
AHA	3,468	4.1	57.0	2.1	1.4	1	2	5	8	0	1	5	11
AIH	2,540	3.0	59.9	0.0	1.8	0	0	0	0	1	2	3	5
ASO	2,372	2.8	62.7	0.0	4.2	0	0	0	0	2	6	13	17
AHO	2,150	2.5	65.3	1.9	4.7	1	2	3	6	3	6	12	15
AHT	2,054	2.4	67.7	1.9	4.5	1	2	3	6	3	6	12	14
ASAS	1,903	2.2	69.9	0.0	0.3	0	0	0	0	0	0	0	0
ASA	1,575	1.9	71.8	0.0	2.0	0	0	0	0	0	1	9	14
AIO	1,280	1.5	73.3	0.0	4.6	0	0	0	0	4	6	10	12.5
AI	1,036	1.2	74.5	0.0	0.0	0	0	0	0	0	0	0	0
ASHO	909	1.1	75.6	0.0	5.2	0	0	0	0	4	7	13	15

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

[b] In separate analysis, RTI determined that only 0.8% of PAC episodes have any gaps greater than 20 days as a result of the rule that includes selected rehospitalizaitons that occur within 30 days of index acute discharge or an included rehospitalization. Mean length of stay for these episodes is 138 days.

Source: RTI analysis of Medicare claims 5% sample (LSMI185).

Table 21b. Analysis of RTI V.2 Episode Definition Length, By Episode Pattern, All Study-MS-DRGs, PAC Users

Pattern [a]	N	Percent	Cumulative Percent	Mean Episode Length	Episode Length 50th Percentile	Episode Length 75th Percentile	Episode Length 90th Percentile	Episode Length 95th Percentile
AH	19,530	22.9	22.9	47.6	37	57	70	114
AS	13,152	15.5	38.4	42.1	32	57	93	106
ASH	7,096	8.3	46.7	74.6	65	88	123	150
AO	5,235	6.2	52.9	34.6	29	48	74	96
AHA	3,468	4.1	57.0	47.1	34.5	52	83	113
AIH	2,540	3.0	59.9	67.8	55	75	100	141
ASO	2,372	2.8	62.7	81.4	69	114	149	174
AHO	2,150	2.5	65.3	73.9	67	89	115	141
AHT	2,054	2.4	67.7	71.7	65	91	120	141
ASAS	1,903	2.2	69.9	75.1	68	104	117	127
ASA	1,575	1.9	71.8	42.0	34	51	80	107
AIO	1,280	1.5	73.3	70.0	60	83	117.5	144.5
AI	1,036	1.2	74.5	18.4	17	22	28	33
ASHO	909	1.1	75.6	102.1	93	124	159	191

[a] Episode patterns are represented by letters: A=acute hospital; H=home health; S=skilled nursing facility; I=inpatient rehabilitation facility; L=long-term care acute hospital; O=hospital outpatient therapy; and T=independent therapist.

Source: RTI analysis of Medicare claims 5% sample (LSMI185).

Table 22a. Analysis of RTI V.2 Episode Definition Gaps Between Services, By MS-DRG, PAC Users

MS-DRG	N	Mean Gap First Pair of Services in Episode	Mean Gap Last Pair of Services in Episode	Gap First Pair 75th Percentile	Gap First Pair 90th Percentile	Gap First Pair 95th Percentile	Gap Last Pair 75th Percentile	Gap Last Pair 90th Percentile	Gap Last Pair 95th Percentile
470: Major joint replacement or reattachment of lower extremity without MCC	14,401	1.0	3.1	1	3	4	4	8	12
194: Simple pneumonia & pleurisy with CC	2,674	1.2	1.9	1	3	6	2	6	11
065: Intracranial hemorrhage or cerebral infarction with CC	2,370	0.7	2.4	0	2	4	3	7	12
481: Hip & femur procedures except major joint with CC	2,154	0.3	2.1	0	0	1	2	6	12
690: Kidney & urinary tract infections without MCC	2,120	1.1	1.9	1	4	7	2	6	11
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	1,672	1.2	2.6	1	4	7	3	8	12
292: Heart failure & shock with CC	1,637	1.3	2.1	1	3	6	2	6	11
641: Nutritional & miscellaneous metabolic disorders without MCC	1,620	1.2	1.9	1	4	6	2	6	10
299: Peripheral vascular disorders with MCC	1,537	0.9	1.6	1	3	5	1	5	10
482: Hip & femur procedures except major joint without CC/MCC	1,452	0.4	2.3	0	1	2	2	7	12

MCC=major complication or comorbidity; CC=complication or comobidity.

Source: RTI analysis of 2006 Medicare claims 5% sample (LSMI185).

Table 22b. Analysis of RTI V.2 Episode Definition Length, By MS-DRG, PAC Users

MS-DRG	N	Percent of All PAC Users	Cumulative Percent	Mean Episode Length (Days)	Episode Length 50th Percentile	Episode Length 75th Percentile	Episode Length 90th Percentile	Episode Length 95th Percentile
470: Major joint replacement or reattachment of lower extremity without MCC	14,401	13.4	13.4	63.6	54.0	79.0	111.0	137.0
194: Simple pneumonia & pleurisy with CC	2,674	2.5	15.8	58.5	42.0	69.0	114.0	159.0
065: Intracranial hemorrhage or cerebral infarction with CC	2,370	2.2	18.0	89.1	65.0	117.0	191.0	248.0
481: Hip & femur procedures except major joint with CC	2,154	2.0	20.0	87.9	73.5	111.0	157.0	198.0
690: Kidney & urinary tract infections without MCC	2,120	2.0	22.0	64.8	46.0	80.0	128.0	169.5
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	1,672	1.6	23.6	73.1	52.0	92.0	146.0	196.0
292: Heart failure & shock with CC	1,637	1.5	25.1	69.6	49.0	83.0	136.0	190.0
641: Nutritional & miscellaneous metabolic disorders without MCC	1,620	1.5	26.6	65.2	45.0	79.0	127.0	178.5
299: Peripheral vascular disorders with MCC	1,537	1.4	28.0	64.2	45.0	82.0	129.0	158.0
482: Hip & femur procedures except major joint without CC/MCC	1,452	1.3	29.4	78.7	67.0	102.0	142.0	179.0

MCC=major complication or comorbidity; CC=complication or comobidity.

Source: RTI analysis of 2006 Medicare claims 5% sample (LSMI185).

Table 23. RTI V.2 Summary Tables for PAC Users: Episode Length, Episode Payments, and Percent of Beneficiaries with Rehospitalizations

MS_FinalDRG	N	Mean Episode Length (Days)	Mean Index Admission Payment	Mean Episode Payment (Index Admission Payment + PAC Payment + Rehospitalizations)	Percent of Beneficiaries with a Readmission	Mean Rehospitalization Payment [a]
470: Major joint replacement or reattachment of lower extremity without MCC	14,401	63.6	$10,460	$19,734	9.3	$10,515
194: Simple pneumonia & pleurisy with CC	2,674	58.5	$5,102	$15,604	25.3	$11,167
065: Intracranial hemorrhage or cerebral infarction with CC	2,370	89.1	$6,291	$29,298	26.8	$11,646
481: Hip & femur procedures except major joint with CC	2,154	87.9	$9,681	$30,437	24.5	$11,055
690: Kidney & urinary tract infections without MCC	2,120	64.8	$4,025	$16,719	26.4	$11,427
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	1,672	73.1	$5,975	$22,381	21.2	$10,384
292: Heart failure & shock with CC	1,637	69.6	$5,289	$18,046	34.8	$13,295
641: Nutritional & miscellaneous metabolic disorders without MCC	1,620	65.2	$3,698	$16,573	24.6	$13,050
299: Peripheral vascular disorders with MCC	1,537	64.2	$9,200	$23,327	26.7	$14,179
482: Hip & femur procedures except major joint without CC/MCC	1,452	78.7	$8,247	$26,656	18.9	$10,772

MCC=major complication or comorbidity; CC=complication or comobidity.

[a] Mean rehospitalization payments are calculated for those beneficiaries with a rehospitalization during the episode.

Source: RTI analysis of Medicare claims 5% sample (MM2Y293).

Table 24. RTI V.2 Summary Tables All Beneficiaries: Episode Length, Episode Payments, Percent Beneficiaries Using PAC, and Percent of Beneficiaries with Rehospitalizations

MS_FinalDRG	N	Percent of Beneficiaries Using PAC	Mean Episode Length (Days)	Mean Index Admission Payment	Mean Episode Payment (Index Admission Payment + PAC Payment + Rehospitalizations)	Percent of Beneficiaries with a Readmission	Mean Rehospitalization Payment [a]
470: Major joint replacement or reattachment of lower extremity without MCC	14,783	97.4	62.6	$10,459	$19,627	9.9	$10,335
194: Simple pneumonia & pleurisy with CC	4,510	59.3	43.1	$5,100	$13,341	29.1	$10,943
392: Esophagitis, gastroentestinal & miscellaneous digestive disorders without MCC	3,741	33.7	30.9	$3,684	$9,446	26.5	$10,452
690: Kidney & urinary tract infections without MCC	3,290	64.4	48.5	$3,987	$13,789	28.0	$11,056
247: Percutaneous cardiovascular procedures with drug-eluting stent without MCC	3,077	15.7	15.9	$14,870	$18,186	22.4	$10,445
292: Heart failure & shock with CC	3,067	53.4	47.4	$5,253	$14,691	34.2	$13,115
641: Nutritional & miscellaneous metabolic disorders without MCC	2,760	58.7	47.0	$3,630	$13,415	29.5	$11,469
192: Chronic obstructive pulmonary disease without CC/MCC	2,758	38.6	34.4	$4,195	$10,525	30.4	$10,932
065: Intracranial hemorrhage or cerebral infarction with CC	2,696	87.9	81.6	$6,339	$27,384	28.1	$11,371
293: Heart failure & shock without CC/MCC	2,640	44.2	39.3	$5,041	$12,099	30.2	$11,810
All MS-DRGs	176,157	61.2	48.6	$9,228	$19,307	26.9	$12,543

MCC=major complication or comorbidity; CC=complication or comobidity.

[a] Mean rehospitalization payments are calculated for those beneficiaries with a rehospitalization during the episode.

Table 25. Alternative Episode Definitions: Episode Length and Episode Payments for PAC Users

MS_FinalDRG	N	60-Day Gap Mean Episode Length	60-Day Gap Mean Episode Payment	30-Day Gap Mean Episode Length	30-Day Gap Mean Episode Payment	20-Day Gap Mean Episode Length	20-Day Gap Mean Episode Payment	30-Day Window Mean Episode Length	30-Day Window Mean Episode Payment	RTI V.2 Mean Episode Length	RTI V.2 Mean Episode Payment
470: Major joint replacement or reattachment of lower extremity without MCC	14,401	79.5	$21,333	69.5	$20,492	64.9	$20,157	41.3	$18,444	63.6	$19,734
194: Simple pneumonia & pleurisy with CC	2,674	81.7	$18,813	64.8	$16,614	58.4	$15,728	42.8	$12,895	58.5	$15,604
065: Intracranial hemorrhage or cerebral infarction with CC	2,370	119.3	$32,791	98.9	$31,037	90.4	$29,894	51.3	$23,834	89.1	$29,298
481: Hip & femur procedures except major joint with CC	2,154	113.5	$33,176	96.9	$31,724	89.3	$31,070	57.0	$26,178	87.9	$30,437
690: Kidney & urinary tract infections without MCC	2,120	90.4	$20,205	71.0	$17,866	65.0	$16,869	45.3	$13,117	64.8	$16,719
066: Intracranial hemorrhage or cerebral infarction without CC/MCC	1,672	98.8	$25,641	80.7	$23,737	74.4	$22,829	46.3	$19,032	73.1	$22,381
292: Heart failure & shock with CC	1,637	102.3	$23,493	77.1	$19,654	68.5	$17,952	45.9	$13,439	69.6	$18,046
641: Nutritional & miscellaneous metabolic disorders without MCC	1,620	89.5	$20,037	71.9	$18,141	65.9	$17,129	44.8	$12,711	65.2	$16,573
299: Peripheral vascular disorders with MCC	1,537	92.1	$27,603	70.9	$24,640	64.9	$23,605	46.7	$19,423	64.2	$23,327
482: Hip & femur procedures except major joint without CC/MCC	1,452	101.0	$28,477	84.8	$27,430	79.7	$26,997	53.5	$23,405	78.7	$26,656

MCC=major complication or comorbidity; CC=complication or comobidity.

Source: RTI analysis of Medicare claims 5% sample (MM2Y184).

6. Commercial Grouper Analyses

6.1 Background

Grouping of medical claims into "episodes of care" has become an increasingly popular method by which policy makers, researchers, health care providers, and health care insurers can compare relative resource use for various types of medical care. Grouping claims into episodes of care allows for the creation of resource utilization and financial measures for the treatment of different medical conditions across a range of health care providers. CMS and other government agencies are interested in evaluating the efficiencies and inefficiencies in physician practices and hospitals, with a possible long-term goal of developing value-based performance systems to reward health care providers for delivering efficient and cost-effective care.

Section 6 of this report presents results from an examination of two commercially available episode groupers applied to Medicare claims for hospitalization and post-acute care: the Thomson Medstat Medical Episode Grouper (MEG) and the Ingenix Symmetry Episode Treatment Groups (ETG). In general, episode groupers like MEG and ETG can:

- Process records that are either claim-level or individual line items
- Classify each beneficiary's care into episodes that may be concurrent or sequential
- Start episodes with a claim that represents a beneficiary's contact with a provider that is authoritative enough to start an episode
  - A hospitalization or physician visit or procedure is typical but grouper settings can expand this list
- Look "forward in time" in the data and, to some extent, "backward in time" as well for "related" claims to accrete to each episode to form the complete episode
  - Usually "related" by clusters of related ICD-9 diagnosis codes
- Allow other hospitalizations, other physician visits, therapies, or ancillary records (labs, x-rays) to accrete to form each complete episode
- Base episode severity levels on co-morbidities and/or markers for treatment
- Allow beneficiaries to have multiple episodes
- Force episodes to end after an episode-specific number of days with no claim related to that episode
  - Chronic conditions are usually limited by the data period
- Leave some claims or lines "ungrouped" if their diagnoses do not readily link to other claims, lines, or episodes.

Resource utilization groupers such as ETG or MEG are typically intended to track or compare the resources used to treat episodes of illness over time or to compare providers or provider groups to one another. However, for the purposes of this study, RTI used the commercial

grouper software products MEG and ETG to compare the grouping of PAC and readmission claims as defined by the RTI V.2 to the logic of the grouper packages. Unlike the two commercial products, RTI's claim assignment into episodes is based on time duration rather than the presence of a particular ICD-9 or procedure code. In contrast, the commercial groupers are under-inclusive as their grouping logics are tied to having the related diagnosis codes on subsequent claims. However, past research has shown that diagnosis codes on claims across the episode are frequently different (CMS, long-term care hospital [LTCH]/acute DRG comparisons; unpublished runs by RTI). These differences may be because the patient is admitted to the post-acute or subsequent provider for different reasons than the original admission (e.g., after surgery, the patient is admitted to a skilled nursing facility or rehabilitation hospital for follow-up care, not surgical services). It is likely that these differences will make reliance on using related diagnosis codes to link claims for post-acute care services and for rehospitalizations to hospitalizations within episodes less effective, especially in the Medicare population.

6.2 Research Aims

The specific aims of this study were to:

- Analyze how PAC and readmission claims that were defined based on RTI's revised V.2 logic were grouped when run through the commercial groupers;
- Examine the proportion of PAC and readmission claims that were grouped into episodes
    a. with the index admission with which RTI grouped them,
    b. with a different acute care inpatient admission other than RTI's acute index admission,
    c. without any acute inpatient hospitalization record, or
    d. remained ungrouped;
- Analyze whether the grouping results differed by site of PAC care (LTCH, skilled nursing facility [SNF], inpatient rehabilitation facility [IRF], home health agency [HHA], therapy);
- Examine whether results differed if the readmission record occurred within 30 days of the index acute admission versus more than 30 days after the index acute admission;
- Discuss the types of episodes (chronic and acute) that were created with the PAC and readmission claims when using the commercial groupers;
- Assess whether the pattern of episode types created varied by the grouping categories (with the index admission or not);
- Examine what proportion of PAC and readmission claims were considered "anchor" or starter records in their episodes, or claims "important" enough to begin an episode; and

- Discuss how all of the findings differed across certain high-frequency PAC DRGs (stroke, pneumonia, joint replacement, and heart failure).

Examining the different grouping patterns between RTI V.2 logic and both MEG and ETG logic will provide CMS with information regarding the different outcomes that are achieved when building post-acute care episodes using a time-based logic versus a diagnosis-based logic.

Figure 12 details the method by which we compared the RTI V.2 logic for grouping PAC and readmission claims with the logic by which the commercial groupers MEG and ETG grouped them.

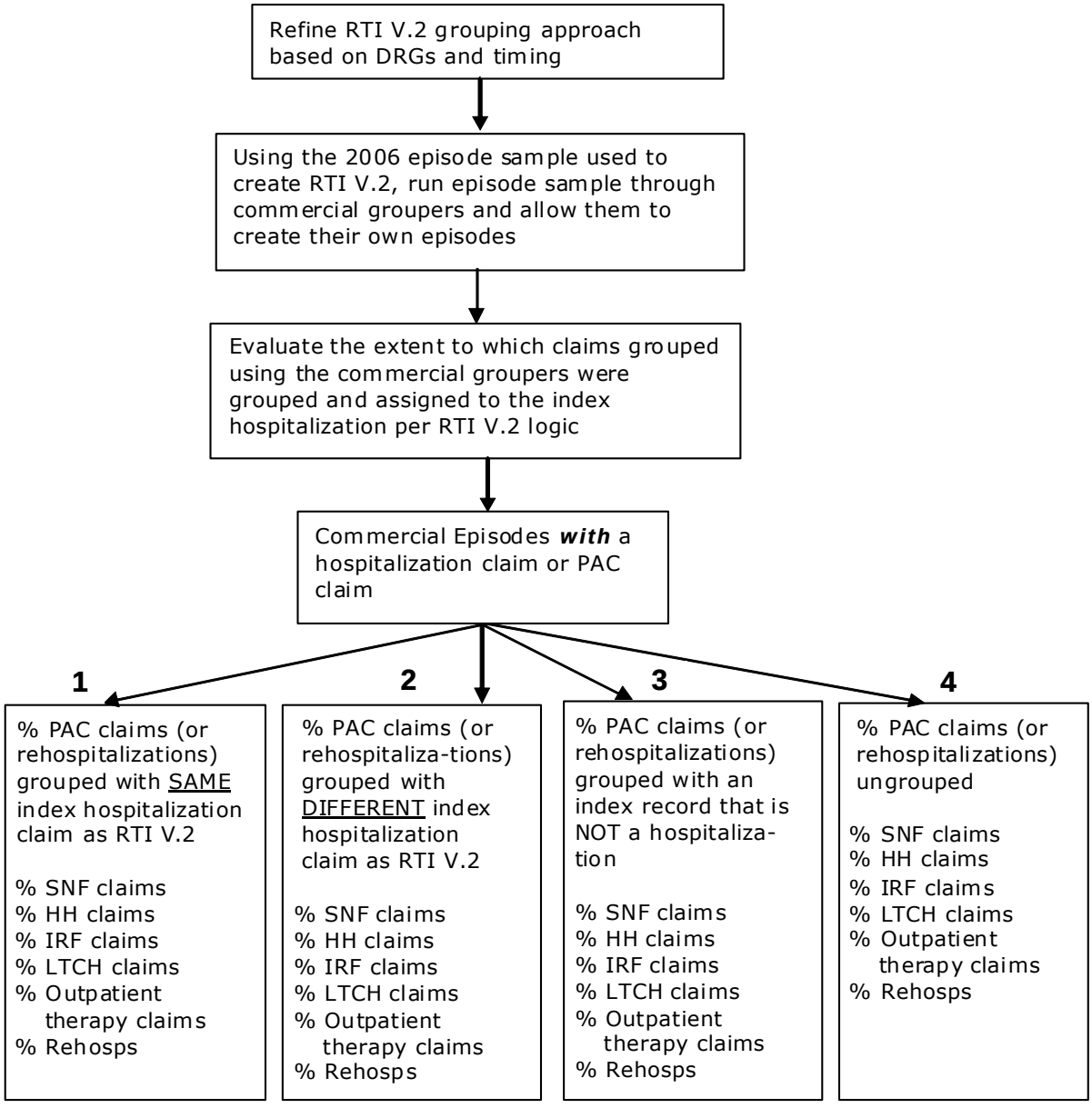
6.3 Process for Building Claims File for Grouper Analyses

For the grouper analyses, we used all of the 2006 and 2007 Medicare claims data files. Although the RTI V.2 logic begins with an index acute hospital stay during 2006, for the grouper analyses we used all of the 2006 and 2007 claims (and not just those that occurred after the 2006 acute inpatient hospitalization claim) to allow the groupers to build episodes using all of the claims for beneficiaries who met the RTI V.2 logic criteria, as discussed in the previous chapters.

We created a finder file of beneficiaries who had an index hospitalization in 2006 and had post-acute care after the index hospitalization. We then pulled all of the 2006 and 2007 Medicare claims for these beneficiaries for use in the groupers. In order to track where the RTI V.2 PAC claims and readmission claims were grouped in MEG and ETG, we created a unique claim_id variable on the Medicare source files. For purposes of easy debugging and tracking where particular claim types grouped in the commercial groupers went, we created a label for each claim type (Part B Clinician, Part B Therapy, SNF, etc.) and attached it to every record.

At this point, when the analytic claim file containing all the 2006 and 2007 Medicare claims for beneficiaries in our finder file was created and all of the claim type variables were created, we duplicated this new set of claims into two sets, one for MEG and one for ETG. This was done so that the various flags and variables that were specific to the individual groupers could be created (as discussed in detail in the MEG and ETG chapters within this section).

Figure 12. Flow Diagram Depicting Comparison of RTI V.2.0 with Commercial Groupers MEG and ETG



6.4 General Analyses Performed

The following two sections of this report present the analytic methodology and results for MEG and ETG separately. Note that because we did not aim to compare how MEG and ETG logic and grouping results differed from one another (rather, we aimed to compare RTI logic to MEG, and RTI logic to ETG), the results are shown separately for MEG and for ETG.

We present the results of three broad categories of analyses.

6.4.1 Overall Grouping Results

This section shows the overall grouping results in terms of the proportion of PAC and readmission records that grouped the following mutually exclusive categories:

a. *with RTI's index acute hospitalization record:* determined if RTI's inpatient acute admission was in the episode into which the PAC or readmission claim was grouped

b. *with another acute hospitalization record*: determined if the RTI's inpatient acute admission was NOT in the episode with the PAC or readmission claim, but another acute inpatient hospitalization claim was

c. *without any hospitalization record*: determined if the PAC or readmission claim was in an episode that did not have any other acute inpatient hospitalization record

d. *remained ungrouped*: determined if the episode created was given a number "0."

We show these grouping results for the First PAC record as defined by RTI's logic, for All PAC records as defined by RTI, and for the First Readmission record as defined by RTI. We also present these results overall, as well as stratified by the index acute admission DRG for DRG 014 (Stroke), DRG 089 (Pneumonia), DRG 544 (Joint replacement), and DRG 127 (Heart failure and shock).

For the First PAC and All PAC analyses, we present results overall, as well as stratified by PAC site (LTCH, IRF, SNF, HHA, and Therapy). For the Readmission analyses, we present results stratified by whether the readmission (as defined by RTI V.2 logic) happened within 30 days of the index acute hospital discharge or more than 30 days after the acute discharge.

6.4.2 "Starting Episode" Records

This section details the proportion of PAC and readmission claims that were the claims that started their episode, if they did not group into an episode with the index acute hospitalization record to which RTI had grouped it. A claim was defined as the starter record if it had the same start date as the start date of the episode into which it grouped.

6.4.3 Episode Type

This section details the types of episodes that were created using the groupers, including the proportion of acute episodes, the proportion of chronic episodes, and the specific types of chronic and acute episodes that were created.

Within each of these sections, we use tables and figures to detail the results. We highlight key findings within the body of this chapter, and then present more detailed tables (for example, DRG-specific tables, tables for Second PAC, Last PAC, etc.) in **Appendices Q–T**.

6.5 Thomson Medstat Medical Episode Grouper (MEG)

Thomson Medstat Medical Episode Grouper (MEG) version 7.26 was used in this project. MEG is predicated on the Disease Staging patient classification system and uses logic to create clinically relevant, severity-rated, and disease-specific groupings of claims. In addition to facility and professional claims, MEG also allows for pharmacy transactions to be included into the episode groupings, although we did not use Medicare Part D pharmacy claims in the current study.

MEG requires one input file: a combined inpatient and outpatient medical input file, with records sorted by patient and start date. An episode of care is initiated with a contact with the health care delivery system. The beginning of an episode is defined as the first claim received for an episode grouping. In this report, we refer to this claim as the "anchor record." MEG methodology allows physician office visits and hospitalizations to open or extend patient episodes. MEG allows for an "exclusion" flag to be created on any record type that should not be an "anchor" for an episode. Medstat's grouper assigns each episode to a MEG (disease classification) along with a main disease stage and detailed disease stages. In the MEG version that we used in this project, there were a total of 575 MEG classifications, and we did not examine the MEG classifications by disease stage. Therefore, throughout this report, the term MEG indicates the designation of an episode type to be a simple MEG without distinguishing disease stages.

In its grouping logic, MEG evaluates the pairing of diagnoses on claims to group the claims into diagnostically-related episodes of care. If a disease category is not assigned to a visit due to missing or invalid diagnosis codes on the input record, the visit is assigned to Episode Group 0. Episode Group 0 includes all visits that cannot be assigned to valid episode groups. Most records assigned to Episode Group 0 are lab and x-ray records. RTI used the episode definition provided with the MEG documentation to determine what types of episodes were created during the grouping process.

Below are some of the key features of MEG that were relevant to the current project and will be discussed in detail in the methodology section:

- MEG groups records (claims and/or line items) essentially using diagnosis codes
- Anchor records start episodes
  - Procedure codes are essentially ignored by MEG, but are used when the user creates the analytic file and sets "exclusion flags" for lab and x-rays (using procedure codes), so that they cannot be anchor records.
  - Also, per recommendation by Medstat, we excluded Durable Medical Equipment (DME) and Hospice from being anchor records
  - All other claim types can start episodes.
- Part B Physician/Supplier and Durable Medical Equipment records were split into line items (per telephone recommendation by Medstat)

- All other claim types were submitted to MEG as one record per claim
- User can choose to limit chronic episodes to 365 days or let the episodes run to the end of the data stream.
  - We did the latter, so chronic episodes start at the start of the first claim in the episode, and end at the end of the data stream (maximum 730 days)
- Users can stratify chronic episodes into acute flare ups
  - We *did not* stratify chronic episodes into acute flare ups

During this project, we ran MEG three times, changing the claims structure and parameter settings each time based on discussions with Medstat and with the CMS project officer. In the sections below, we describe how the three runs differed and what was changed for each subsequent run before deciding on our "final" claims structure and parameter settings (Run 3).

6.5.1 Diagnosis and Procedure Codes

Table 26 details the rules we used for structuring the input file for MEG. All diagnoses codes were used on all claim types, and the first 15 distinct (unduplicated) procedure codes were used.

Table 26. Diagnosis Codes and Procedure Codes Logic Rules Used in MEG

File	Diagnosis Codes	Procedure Codes
IP	All diagnosis codes	• We used the first 15 distinct procedure codes on claim (ICD-9 codes if available; otherwise HCPCS)
OP	All diagnosis codes	• We used the first 15 distinct procedure codes on claim (CPT codes if available; otherwise HCPCS)
SNF	All diagnosis codes	• No procedure codes used (procedure codes rarely available on any SNF claims)
HH	All diagnosis codes	• We used the first 15 distinct procedure codes on claim (ICD-9 codes if available; otherwise HCPCS)
HS	All diagnosis codes	• No procedure codes used (procedure codes rarely available on any Hospice claims)
Part B and DME	Line item diagnosis codes	• We used the first listed HCPCS/CPT code for each line item

MEG=Thomson Medstat Medical Episode Grouper; IP=Inpatient; HCPCS=Healthcare Common Procedure Coding System; OP=Outpatient; SNF=skilled nursing facility; DME= durable medical equipment; CPT=current procedural terminology.

6.5.2 Anchor Records

Many of the key decisions in creating the input file for MEG involved selecting the types of claims that could and could not start episodes. Anchor records are claims or lines that represent an interaction with a health care provider. Although MEG groups claims into episodes based essentially on diagnoses codes, one critical use of the procedure codes in

MEG involves setting an exclusion flag. This flag must be set by the user to 0 or 1 and, when set to "1" on a record, MEG will not allow that record to serve as an anchor and therefore will prevent the claim from starting an episode. In the MEG documentation, Medstat provides a recommended list of procedure codes for setting the exclusion flag. MEG calls this flag a "lab/x-ray flag" because their recommend list of procedure codes for exclusion is made up essentially of lab and x-ray procedure codes.

In Run 1, we created the lab/x-ray flag on all Medicare claims and set it to "1" only if every procedure on the claim (or on every line of the claim) was a lab or x-ray procedure. In other words, if there was a procedure code on the claim or any of the lines that represented a true procedure and not merely a diagnostic lab or x-ray, we left the claim unflagged. The only exception to this rule was all inpatient claims—we allowed all inpatient claims to start an episode regardless of the presence of lab or x-ray procedure codes. Also, for claims with missing procedure codes, there was no basis for flagging the claims as lab/x-ray, so these claims remained unflagged.

We used the current lab fee schedule as well as the Healthcare Common Procedure Coding System (HCPCS) codes 70010–76999, 78000–78999 (Diagnostic Radiology and Diagnostic Nuclear Medicine) to set the lab/x-ray exclusion flag.

After a telephone discussion with Medstat, we learned that this flag can be set to 1 on *any* kind of claim that the user wishes to exclude from starting episodes. We therefore ran MEG a second time, changing the structure of the claims slightly. In Run 2, in addition to the lab/x-ray exclusions that had been set in Run 1, we also excluded home health agencies (HHA), DME, and hospice claims from starting episodes. After discussions with the CMS project officer, we decided to unflag the HHA claims and allow them to anchor episodes (Run 3). All other exclusions remained.

6.5.3 Claims Versus Lines

In Run 1, we submitted all the Medicare claims through the MEG at the claim level, based on recommendations in the MEG documentation and user's guide. However, subsequent to the first run, we talked with Medstat and learned that the preferred method of structuring the Part B and DME claims for running the MEG was to run it with the lines rather than the claims. So for Run 2, we separated the Part B and DME claims into lines to run through the grouper. Lines were allowed to group into different episodes. All other claim types remained at the claim level.

6.5.4 Episode Limits

For this project, we used 2 full years of Medicare data (2006 and 2007) in the MEG. According to the MEG documentation, a user can choose to limit episodes to 365 days or let the episodes run to the end of the data stream. The MEG user's guide states that the recommended setting for chronic episodes is to limit them to 365 days. It is more common

for users to set an episode limit of 365 days for chronic episodes and have them build on an annual basis starting at the beginning of the calendar year. Using this setting, chronic episodes automatically had a start date of January 1, 2006, and an end date of December 31, 2006. Acute episodes were allowed to continue for the duration of the episode until a clean period (as determined by MEG) forced the episode to end.

However, after discussions with the CMS project officer, we decided to make the settings for the chronic and acute episodes more similar to one another. Therefore, in Run 2, we let the chronic episodes run as long as the data allowed (the "duration" setting), so episodes were allowed to start at the start of the first claim in the episode, and end at the end of the data stream (maximum 730 days). Because the goal of this project was to compare the logic of the commercial groupers to the RTI V.2 logic, and the RTI logic allows episodes to continue to build using 2007 claims, we decided not to limit the episode length and instead allowed the episodes to run the full data stream. This setting allowed us to make valid comparisons between RTI logic and the commercial grouper logic.

6.5.5 Admissions Build Option

The "admissions build" option tells the MEG software to group facility claims into inpatient stays or "admissions." This option essentially uses dates to determine if claims should be associated with an inpatient hospitalization. For example, if a physician bill date overlaps the dates that a beneficiary was hospitalized, this MEG option forces the physician claim to be associated with the hospitalization claim, regardless of the diagnosis codes. We did not use this option and instead let the claims group naturally.

6.5.6 Stratify Chronic Option

This MEG option allows the user to determine whether certain chronic MEGs are split into chronic episodes and acute flare ups of the chronic episode. For example, beneficiary has an episode for "diabetes," the episode could be split if the patient had an acute flare up of diabetes that required hospitalization. We did not use this option and therefore did not stratify the chronic episodes into acute flare ups. Therefore, in the results section, chronic episodes are discussed as a whole and not stratified by acute flare ups of chronic conditions.

6.5.7 Development of Final Claim Structure and Parameter Settings for Analyses

Below we provide a summary of the ways the three runs were varied in MEG and the final claims structure and MEG parameter settings that were used in the analysis (RUN 3):

RUN 1

- Started January 1, 2006, include all claims through December 31, 2007
- Number of days that limit an acute episode=730
- Chronic episodes allowed to build on a **yearly** basis (recommended parameter)

- Did not stratify chronic episodes into acute flare ups
- Set exclusion flags for labs and x-rays so that they cannot be anchors of episodes

RUN 2

Same as RUN 1 except:

- Excluding not just lab/x-ray, but some claims types from being anchors of episodes: HHA, DME, hospice
- Chronic episodes allowed to go the **duration** (rather than yearly)
- Part B and DME was split into lines, and lines allowed to associate with different episodes

RUN 3: Final MEG Settings Used in Analysis

Hybrid between RUN 1 and RUN 2:

- Started January 1, 2006, include all claims through December 31, 2007
- Number of days that limit an acute episode=730
- Chronic episodes allowed to go the **duration** (rather than yearly)
- Did not stratify chronic episodes into acute flare ups
- Labs and x-rays, as well as DME and hospice, could not be anchors of episodes (HHA records were again allowed to start episodes)
- Look-back period for nonstarting but related lab/x-rays=15 days (set by MEG)

6.6 MEG Results

This section discusses the results of the MEG analyses. We present the results of three broad categories of analyses: Overall grouping results, starting records analysis results, and types of acute and chronic episodes that were created by MEG.

6.6.1 MEG Grouping Results: With the Index Hospitalization, with Other Hospitalization, without Any Other Hospitalization

This section describes the MEG grouping results, for First PAC, All PAC, and First Readmissions. Similar tables are shown in **Appendix R** for Second PAC, Last PAC, and All PAC + Readmission claims.

First PAC

Tables 27a–27e presents the MEG grouping results for the First PAC claim in the episodes created by the RTI logic. Results are displayed graphically in **Figures R1–R12** in **Appendix R.**

First PAC: All DRGs

Table 27a shows the First PAC results across all of the index hospital DRGs. Overall, 43.8 percent of First PAC claims grouped into an MEG episode with the same index hospitalization with which RTI logic grouped the PAC claim. Approximately half of the PAC claims were grouped into an MEG episode that did not include any hospitalization. Approximately 5 percent of First PAC claims were grouped into an episode that included a hospitalization other than the index acute hospitalization. Essentially all First PAC claims were grouped by MEG, as fewer than 1 percent remained "ungrouped."

Grouping results also varied by First PAC service. **Table 27a** shows that, compared to the overall results, a smaller percentage of first LTCH and therapy records grouped with the index hospitalization (37.5 percent and 24 percent, respectively). Also, a much larger percentage of first Therapy records were grouped into episodes that had no hospitalization record (73 percent).

Table 27a. MEG Results: First PAC—PAC Users: All DRGs

First PAC	All First PAC N=108,316 (%)	First PAC LTCH N=2,122 (%)	First PAC IRF N=11,120 (%)	First PAC SNF N=44,195 (%)	First PAC HHA N=40,337 (%)	First PAC Therapy N=10,542 (%)
Ungrouped	0.04	0.0	0.0	0.07	0.0	0.13
With index hospitalization	43.8	37.5	46.2	44.4	47.9	24.0
With other hospitalization	5.1	8.2	5.6	5.3	5.2	2.9
Without any hospitalization	51.1	54.2	48.2	50.3	46.9	73.0

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Tables 27b-27e show the First PAC grouping results for specific high-frequency PAC DRGs.

First PAC: DRG 014: Stroke

Table 27b shows that approximately 62 percent of the First PAC claims for an index admission for DRG014: Stroke were grouped into an episode with that index hospitalization, and 34 percent grouped into a MEG episode without any hospitalization. Grouping results were highly varied across First PAC types. Larger percentages of LTCH and HHA First PAC claims after stroke admission were grouped into MEG episodes with the index stroke hospitalization (73 percent and 81 percent, respectively). Also, compared with all First PAC records for stroke, a larger percentage of IRF First PAC claims were grouped into episodes that did not have any acute hospitalization (47 percent), and a smaller percentage of First

PAC HHA records were grouped into episodes that did not have any acute hospitalization (17 percent).

Table 27b. MEG Results: First PAC—PAC Users: Index DRG 014: Stroke

First PAC	All First PAC N=4,875 (%)	First PAC LTCH N=89 (%)	First PAC IRF N=1,667 (%)	First PAC SNF N=1,730 (%)	First PAC HHA N=956 (%)	First PAC Therapy N=433 (%)
Ungrouped	0.02	0.0	0.0	0.06	0.0	0.0
With index hospitalization	62.1	73.0	47.3	65.5	81.5	60.5
With other hospitalization	3.7	3.4	5.8	3.7	1.8	0.69
Without any hospitalization	34.1	23.6	47.0	30.7	16.7	38.8

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

First PAC: DRG 089: Pneumonia

Table 27c shows the grouping results for First PAC records after an index admission for pneumonia. Approximately 45 percent of the First PAC claims for an index pneumonia were grouped into an episode with that index hospitalization, and 50 percent grouped into a MEG episode without any hospitalization. A much larger percentage of First PAC LTCH claims after acute admission for pneumonia grouped with the index hospitalization (70 percent), and a much smaller percentage of First PAC IRF and Therapy claims did so (19 percent and 4 percent, respectively). Although only 4.8 percent of all First PAC claims after pneumonia grouped into episodes that contain a hospitalization other than the index pneumonia admission, over 12 percent of First PAC IRF claims did so.

Table 27c. MEG Results: First PAC—PAC Users: Index DRG 089: Pneumonia

First PAC	All First PAC N=4,669 (%)	First PAC LTCH N=57 (%)	First PAC IRF N=83 (%)	First PAC SNF N=2,196 (%)	First PAC HHA N=1,747 (%)	First PAC Therapy N=586 (%)
Ungrouped	0.2	0.0	0.0	0.0	0.0	1.2
With index hospitalization	45.2	70.2	19.3	52.1	50.9	4.1
With other hospitalization	4.8	1.8	12.1	3.8	6.4	3.4
Without any hospitalization	49.8	28.1	68.7	44.1	42.8	91.3

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

First PAC: DRG544: Joint Replacement

Table 27d shows that approximately 72 percent of the First PAC claims for an index admission for DRG 544: Joint replacement were grouped into an episode with that index hospitalization, and just over 26 percent grouped into a MEG episode without any hospitalization. Results were similar for each of the First PAC sites with the exception of LTCH. Only 26.5 percent of First PAC claims that were LTCH grouped into an episode with the index hospitalization, and over 71 percent grouped into an episode without any hospitalization. Approximately 3 percent of First PAC claims that were IRF were grouped into episodes with another acute hospitalization, while only 0.5 percent of First PAC claims that were Therapy were grouped into episodes with another acute hospitalization.

Table 27d. MEG Results: First PAC—PAC Users: Index DRG 544: Joint Replacement of Lower Extremity

First PAC	All First PAC N=15,259 (%)	First PAC LTCH N=49 (%)	First PAC IRF N=2,954 (%)	First PAC SNF N=5,671 (%)	First PAC HHA N=5,429 (%)	First PAC Therapy N=1,156 (%)
Ungrouped	0.0	0.0	0.0	0.0	0.0	0.0
With index hospitalization	71.9	26.5	73.0	70.6	72.5	75.0
With other hospitalization	2.0	2.0	2.8	2.6	1.3	0.5
Without any hospitalization	26.1	71.4	24.2	26.8	26.1	24.5

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

First PAC: DRG 127: Heart Failure and Shock

Table 27e shows the grouping results for First PAC records after an index admission for DRG 127: Heart failure and shock. Approximately 20 percent of the First PAC claims for an index admission heart failure and shock were grouped into an episode with that index hospitalization, and just over 70 percent grouped into a MEG episode without any hospitalization. Results were similar across all First PAC sites except IRF (only 7.7 percent grouped with the index admission) and Therapy (only 6 percent grouped with the index admission). Over 90 percent of First PAC Therapy claims were grouped into episodes that had no acute hospital admission at all.

Table 27e. MEG Results: First PAC—PAC Users: Index DRG 127: Heart Failure and Shock

First PAC	All First PAC N=4,100 (%)	First PAC LTCH N=44 (%)	First PAC IRF N=78 (%)	First PAC SNF N=1,592 (%)	First PAC HHA N=2,016 (%)	First PAC Therapy N=327 (%)
Ungrouped	0.1	0.0	0.0	0.1	0.0	0.0
With index hospitalization	21.1	22.7	7.7	21.5	24.0	6.0
With other hospitalization	8.7	11.4	9.0	8.9	9.4	3.8
Without any hospitalization	70.2	65.9	83.3	69.5	66.6	90.3

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Compared to all of the DRGs examined, a relatively large percentage of First PAC claims for DRG 127: Heart failure and shock were grouped to episodes that contained an acute admission other than the index admission for heart failure (8.7 percent). Over 11 percent of First PAC LTCH claims grouped into episodes with another acute hospital admission, while only 3.8 percent of First PAC Therapy claims did.

All PAC

Tables 28a–28e presents the MEG grouping results for all of the PAC claims in the episodes created by the RTI logic. Grouping patterns were generally the same as noted for the First PAC grouping results.

MEG: Percent Grouped with Index Hospitalization: All PAC

All PAC: All DRGs

Table 28a shows the grouping results for All PAC across all of the index hospital DRGs. Overall, 45.9 percent of All PAC claims grouped into an MEG episode with the same index hospitalization with which RTI logic grouped the PAC claim. Approximately 48 percent of the PAC claims were grouped into an MEG episode that did not include any hospitalization. Approximately 6 percent of the PAC claims were grouped into an episode that included a hospitalization other than the index acute hospitalization. Essentially all of the PAC claims were grouped by MEG (as almost none were "ungrouped").

Grouping results also varied by PAC service. **Table 28a** shows that the proportion that grouped into an episode without any acute hospitalization varied little by PAC type, but the proportion that grouped with another hospitalization did vary by PAC type. Overall, just under 6 percent of PAC records grouped into an episode with another acute admission. However 16.5 percent of LTCH records and 11.6 percent of SNF records grouped into an

episode with another acute admission, much higher than the overall rate. Also, the proportion that grouped with the index acute hospitalization was much smaller for LTCH claims (32.0 percent) than the overall rate (46.9 percent).

Table 28a. MEG Results: All PAC—PAC Users: All DRGs

All PAC	All PAC N=428,080 (%)	All LTCH N=3,052 (%)	All IRF N=12,972 (%)	All SNF N=66,275 (%)	All HHA N=82,489 (%)	All Therapy N=263,292 (%)
Ungrouped	0.1	0.0	0.0	0.1	0.0	0.1
With index hospitalization	45.9	32.0	42.7	37.4	37.9	50.8
With other hospitalization	5.6	16.5	8.0	11.6	7.5	3.3
Without any hospitalization	48.4	51.5	49.3	51.0	54.6	45.8

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Tables 28b–**28e** show the All PAC grouping results for specific high-frequency PAC DRGs.

All PAC: DRG 014: Stroke

Table 28b shows that approximately 66 percent of the PAC claims for an index admission for DRG 014 grouped into an episode with that index hospitalization for stroke, 30 percent grouped into a MEG episode without any hospitalization, and just over 4 percent grouped into an episode with a different acute hospitalization than the index stroke hospitalization.

Compared to All PAC sites, a much smaller percentage of IRF claims grouped with the index stroke hospitalization (45.9 percent). Also, compared to All PAC sites, a much larger percentage of LTCH claims grouped into episodes with a different hospitalization other than the index stroke admission (14.5 percent). The proportion that grouped into an episode with no acute admission also varied across PAC sites: a smaller percentage of LTCH claims (24.4 percent) and a larger percentage of IRF claims did (47.2 percent).

Table 28b. MEG Results: All PAC—PAC Users: Index DRG 014: Stroke

All PAC	All PAC N=19,481 (%)	All LTCH N=131 (%)	All IRF N=1,920 (%)	All SNF N=3,268 (%)	All HHA N=3,284 (%)	All Therapy N=10,878 (%)
Ungrouped	0.1	0.0	0.0	0.0	0.0	0.1
With index hospitalization	65.5	61.1	45.9	59.1	68.7	70.0
With other hospitalization	4.2	14.5	6.9	9.3	4.2	2.1
Without any hospitalization	30.2	24.4	47.2	31.6	27.0	27.8

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

All PAC: DRG 089: Pneumonia

Table 28c shows the grouping results for All PAC claims that followed an acute admission for pneumonia. Only 25.8 percent of the PAC claims after an index admission for pneumonia were grouped by MEG into an episode that also contained that same index admission. The majority of PAC claims went into an episode that had no acute hospitalization in the episode (66.4 percent). Just under 8 percent grouped into an episode with a hospitalization that was not the index pneumonia hospitalization.

Grouping results were highly varied across PAC sites for the PAC claims that followed a hospitalization for pneumonia. Although just over 25 percent overall grouped with the index pneumonia admission, almost 60 percent of LTCH claims and 44 percent of SNF claims grouped into an episode that also contained the index pneumonia claim. On the other hand, only 14 percent of IRF PAC claims and only 2 percent of Therapy PAC claims grouped with the index pneumonia admission. Similarly, compared to All PAC sites, a much smaller percentage of LTCH claims (31.7 percent) and a much larger percentage of Therapy claims (92.7 percent) grouped into episodes that did not contain any acute admission.

Table 28c. MEG Results: All PAC—PAC Users: Index DRG 089: Pneumonia

All PAC	All PAC N=10,158 (%)	All LTCH N=82 (%)	All IRF N=127 (%)	All SNF N=3,141 (%)	All HHA N=3,126 (%)	All Therapy N=3,682 (%)
Ungrouped	0.1	0.0	0.0	0.0	0.0	0.2
With index hospitalization	25.8	59.8	14.2	44.4	34.6	2.0
With other hospitalization	7.7	8.5	19.7	9.1	8.9	5.1
Without any hospitalization	66.4	31.7	66.1	46.5	56.4	92.7

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

All PAC: DRG544: Joint Replacement

Table 28d shows the grouping results for All PAC claims that followed an acute admission for joint replacement. Admissions for joint replacement represent the largest percentage of all admissions among PAC users. Of all the DRGs examined, this DRG had the largest proportion of PAC claims to group into MEG episodes with the index admission (73.7 percent). Also, 24.8 percent grouped into episodes with no acute hospitalization, and only 1.4 percent grouped into an episode that had an acute admission other than the one for joint replacement.

Table 28d. MEG Results: All PAC—PAC Users: Index DRG 544: Joint Replacement of Lower Extremity

All PAC	All PAC N=138,736 (%)	All LTCH N=88 (%)	All IRF N=3,114 (%)	All SNF N=6,951 (%)	All HHA N=11,557 (%)	All Therapy N=117,029 (%)
Ungrouped	0.1	0.0	0.0	0.0	0.0	0.1
With index hospitalization	73.7	21.2	71.6	64.3	62.5	75.4
With other hospitalization	1.4	21.2	3.5	6.0	3.2	0.9
Without any hospitalization	24.8	57.7	25.0	29.7	34.3	23.6

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

All PAC: DRG 127: Heart Failure and Shock

Table 28e shows the grouping results for All PAC claims that followed an acute admission for heart failure and shock. Of all DRGs examined, heart failure and shock had the smallest proportion of PAC claims grouped by MEG into episodes with the index heart failure hospitalization, only 13.5 percent. Furthermore, compared to other DRGs examined, PAC claims for heart failure and shock were the most likely to group into episodes with another hospitalization other than the heart failure hospitalization (12.6 percent). Almost three-quarters of PAC claims after an index admission for heart failure grouped by MEG into episodes without any hospitalization at all (73.8 percent). IRF claims were the least likely to group with the index hospitalization for heart failure (7.3 percent), and HHA claims were the most likely (19.0 percent).

Table 28e. MEG Results: All PAC—PAC Users: Index DRG 127: Heart Failure and Shock

All PAC	All PAC N=9,123 (%)	All LTCH N=83 (%)	All IRF N=123 (%)	All SNF N=2,633 (%)	All HHA N=3,707 (%)	All Therapy N=2,577 (%)
Ungrouped	0.1	0.0	0.0	0.2	0.0	0.1
With index hospitalization	13.5	14.5	7.3	17.0	19.0	2.2
With other hospitalization	12.6	22.9	15.5	16.3	11.9	9.4
Without any hospitalization	73.8	62.7	77.2	66.6	69.1	88.3

MEG=Thomson Medstat Medical Episode Grouper; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Grouping results were consistent across PAC sites with the exception of LTCH claims. A much smaller proportion of LTCH claims—only 21.2 percent—grouped with the index joint replacement admission, compared to the other PAC types. Furthermore, a much larger proportion of LTCH claims—21.2 percent—grouped into an episode with a different acute admission other than the joint replacement index admission. Similarly, while only 25 percent of PAC claims grouped into an episode that had no acute hospitalization, almost 60 percent of LTCH claims did so.

First Readmission

In addition to the First PAC and All PAC analyses, we examined how the MEG grouped hospitalization records that the RTI logic had grouped with the index admission (and thus considered "rehospitalizations").

Readmission analysis results are shown in **Tables 29a**–**29e** and in **Figure 13**. Overall, there were 26,034 First Readmission claims. We stratified the readmissions by those that happened within 30 days of an index acute discharge (n=16,027, 61.6 percent of First Readmissions), and those that happened more than 30 days after the index acute discharge (n=10,007, 38.4 percent of First Readmissions). Overall, 20 percent of First Readmissions that happened within 30 days of an acute index admission were grouped by MEG into episodes with that index acute admission. Not surprisingly, a slightly smaller percentage (15.9 percent) of readmissions that were more than 30 days after the acute index admission grouped into a MEG episode with that index acute admission. The majority of readmission records were grouped into episodes that had no other acute hospitalization in the episode (75.9 percent of those within 30 days of the index acute admission, and 78.8 percent of those more than 30 days after the index acute admission).

Grouping results for First Readmission claims varied greatly by the DRG of the index hospitalization (see **Tables 29b–29e** and **Figure 13**). Compared to all DRGs, a larger proportion of First Readmissions within 30 days of an index admission for Pneumonia (DRG 089) grouped into MEG episodes with that index pneumonia admission (32.0 percent). A much smaller proportion of readmissions that happened more than 30 days after an acute pneumonia hospitalization grouped with that index admission (21.8 percent). On the other hand, only 5 percent of First Readmissions within 30 days of an index admission for Joint replacement (DRG544) grouped into MEG episodes with that index joint replacement admission. A slightly larger percentage (7.8 percent) of rehospitalizations more than 30 days after an acute joint replacement hospitalization grouped with that index admission (the increase likely due to planned joint replacement readmissions).

Table 29a. MEG Results: First Readmission—All Index DRGs (N=26,034)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=16,027)	31+ days (n=10,007)
Percentage grouped with index hospital	20.1	15.9
Percentage grouped with another hospital	4.0	5.3
Percentage grouped without any other hospital	75.9	78.8

MEG=Thomson Medstat Medical Episode Grouper.

Table 29b. MEG Results: First Readmission—Index DRG 014: Stroke (N=1,305)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=703)	31+ days (n=602)
Percentage grouped with index hospital	27.9	24.3
Percentage grouped with another hospital	2.1	2.5
Percentage grouped without any other hospital	70.0	73.3

MEG=Thomson Medstat Medical Episode Grouper.

Table 29c. MEG Results: First Readmission—Index DRG 089: Pneumonia (N=1,195)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=759)	31+ days (n=436)
Percentage grouped with index hospital	32.0	21.8
Percentage grouped with another hospital	4.5	5.5
Percentage grouped without any other hospital	63.5	72.7

MEG=Thomson Medstat Medical Episode Grouper.

Table 29d. MEG Results: First Readmission—Index DRG 544: Joint Replacement Lower Extremity (N=1,541)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=965)	31+ days (n=576)
Percentage grouped with index hospital	5.2	7.1
Percentage grouped with another hospital	3.0	4.0
Percentage grouped without any other hospital	91.8	88.9

MEG=Thomson Medstat Medical Episode Grouper.

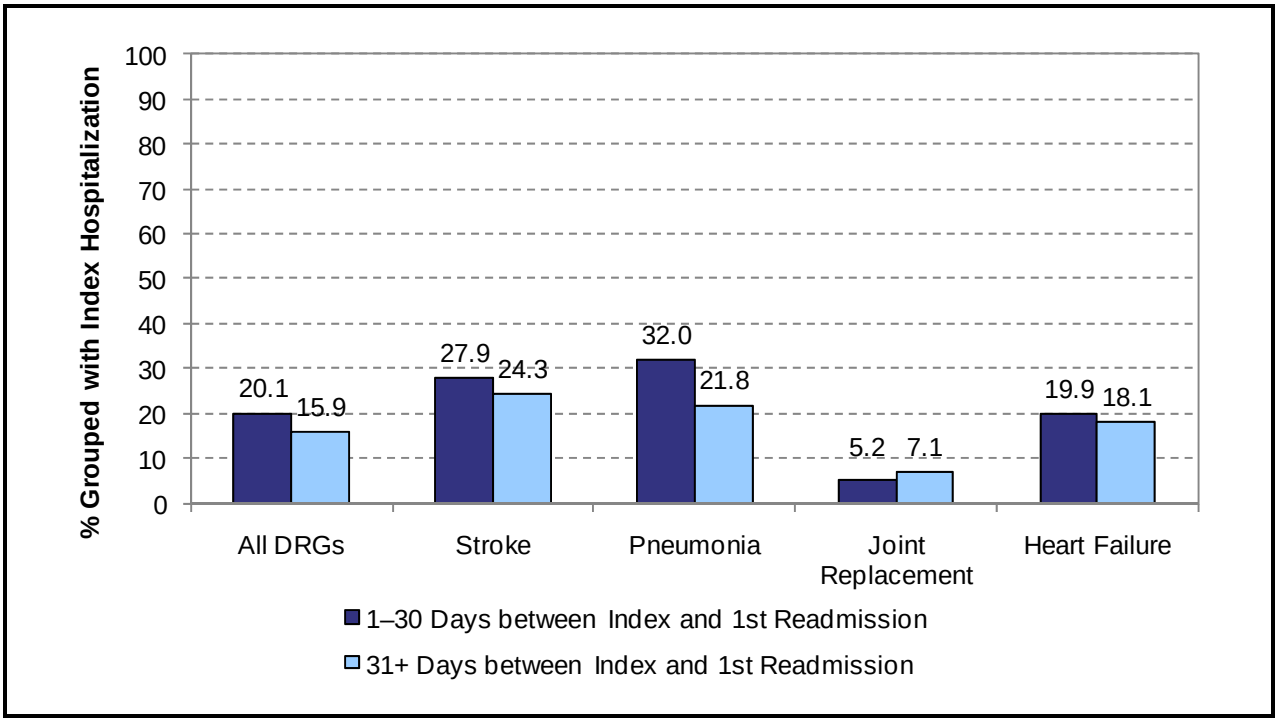
Table 29e. MEG Results: First Readmission—Index DRG 127: Heart Failure and Shock (N=1,465)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=868)	31+ days (n=597)
Percentage grouped with index hospital	19.9	18.1
Percentage grouped with another hospital	5.2	7.4
Percentage grouped without any other hospital	74.9	74.5

MEG=Thomson Medstat Medical Episode Grouper;

MEG: Percent Grouped with Index Hospitalization: First Readmission

Figure 13. First Readmission: MEG



6.6.2 MEG Grouping Results: "Starter Record" Analysis

We performed an analysis to examine the proportion of First PAC and First Readmission claims that were "starting anchor records" of the episodes into which they grouped. We defined the First PAC or First Readmission record as the starting anchor record if it had the same "From date" as the start date of the first non-excluded claim or line in the MEG episode, based on the MEG output. Note that the term "anchor" record is a term specific to the ETG, yet we use it for both MEG and ETG for the purpose of consistency. For this analysis, we are describing records that start the episodes.

Starting Records: First PAC

Tables 30a–30f show the results for the first starter record analysis of the First PAC record. Of the 47,401 total First PAC claims that grouped into MEG episodes with the index admission, only 1 was considered the starting anchor of the episode (it was a Therapy record). Of the 5,511 total First PAC claims that grouped into an episode with another acute hospitalization, 1,967 (or 35.7 percent) were considered starting anchors of the episode. Of the 55,359 total First PAC claims that grouped into episodes without any acute hospitalization, 23,603 (or 42.6 percent) were considered starting anchors of the episode.

These results were highly varied among First PAC sites. More than half of the First PAC IRF claims that grouped with another acute admission were considered the starting anchor record for their episode (52.3 percent). On the contrary, only 25 percent of First PAC Therapy claims were considered starting anchors in the episodes in which they grouped with another acute admission. Among those that grouped into a MEG without any acute admission, Therapy claims were most likely to be the starting anchors for the episodes (59.4 percent), and HHA claims were the least likely to be starting anchors (31.3 percent).

Table 30a. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—All First PAC

All First PAC	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	1 (0%)	47,401
Grouped with other hospitalization	1,967 (35.7%)	5,511
Grouped without any hospitalization	23,603 (42.6%)	55,359
Total	25,571 (23.6%)	108,316 [a]

[a] The total of 108,316 includes 45 records that were "ungrouped" and not shown in the table.

Table 30b. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC LTCH

First PAC LTCH	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	796
Grouped with other hospitalization	51 (29.1%)	174
Grouped without any hospitalization	472 (41.0%)	1,151
Total	523 (24.7%)	2,122

LTCH=long term care hospital.

Table 30c. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC IRF

First PAC IRF	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	5,135
Grouped with other hospitalization	327 (52.3%)	625
Grouped without any hospitalization	2,606 (48.6%)	5,360
Total	2,933 (26.4%)	11,120

IRF=inpatient rehabilitation facility.

Table 30d. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC SNF

First PAC SNF	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	19,609
Grouped with other hospitalization	974 (41.8%)	2,328
Grouped without any hospitalization	10,026 (45.1%)	22,227
Total	11,000 (24.9)	44,195 [a]

SNF=skilled nursing facility.

[a] The total of 44,195 includes 31 SNF records that were "ungrouped" and not shown in the table.

Table 30e. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC HHA

First PAC HHA	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	19,329
Grouped with other hospitalization	539 (25.9%)	2,082
Grouped without any hospitalization	5,926 (31.3%)	18,926
Total	6,465 (16.0%)	40,337

HHA=home health agency.

Table 30f. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC Therapy

First PAC Therapy	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	1 (0%)	2,532
Grouped with other hospitalization	76 (25.3%)	301
Grouped without any hospitalization	4,573 (59.4%)	7,695
Total	4,650 (44.1%)	10,542 [a]

[a] The total of 10,542 includes 14 Therapy records that were "ungrouped" and not shown in the table.

Anchor Records: First Readmission

Table 30g shows the results for the anchor record analysis of the First Readmission record. These results are shown stratified by those readmissions that occurred within 30 days of the acute index discharge and those that occurred more than 30 days after the index discharge. Among the readmission records that grouped into a MEG with the acute index hospitalization (n=3,220 for those within 30 days of the index admission, n=1,592 for those more than 30 days after the index admission), none were considered anchor records for their admission. It is highly likely that the index acute admission was the anchor in each of those episodes. Only about 3 percent of readmissions that occurred within 30 days of the index, and about 4 percent of those that occurred more than 30 days after the index, were considered anchors of episodes when grouped into a MEG with another hospitalization. On the other hand, the vast majority of the readmission records that grouped into a MEG in which they were the only acute index admission were considered anchor records of the episode (96.6 percent of those within 30 days of the index acute admission, and 95.9 percent of those more than 30 days after the index acute admission).

Table 30g. Percent of First Readmission Records that Were Starting Anchor Records in their Episode: All Index Admission DRGs

MEG Grouping Category	Within 30 Days of Index Admission: N (%) Starting Anchor Records	Within 30 Days of Index Admission: Total N	More than 30 Days of Index Admission: N (%) Starting Anchor Records	More than 30 Days of Index Admission: Total N
Grouped into a MEG with index hospitalization	0 (0%)	3,220	0 (0%)	1,592
Grouped into a MEG with another hospitalization	208 (3.4%)	645	176 (4.1%)	528
Grouped into a MEG without any other hospitalization	5,871 (96.6%)	12,162	4,097 (95.9%)	7,887
Total	6,079 (26.5)	16,027	4,273 (28.7%)	10,007

MEG=Thomson Medstat Medical Episode Grouper.

6.6.3 MEG Grouping Results: Acute and Chronic Episodes

The following results describe analyses that were performed to examine the types of MEGs into which PAC and readmission claims were grouped. In the report we show results for the grouping of the First PAC record, All PAC records, and All Readmission records, across all index admission DRGs. In **Appendix S,** we present more detailed tables by DRG for DRG 014 (Stroke), DRG 089 (Pneumonia), DRG 544 (Joint replacement), and DRG 127 (Heart failure/shock). Note that the numbers and percentages in these tables represent the number of claims and the percentage of claims (and not the number of episodes).

Acute and Chronic Episodes: First PAC

Table 31a shows the percentages of First PAC claims that were grouped into acute, chronic, and well-care episodes overall for First PAC, as well as by the three grouping categories (with index acute hospitalization, with another acute hospitalization, or without any hospitalization). For all First PAC claims, 45 percent grouped into an acute episode, 52.1 percent grouped into a chronic episode, and just under 3 percent grouped into an episode for well-care or preventive services. The patterns varied by grouping categories. Among the First PAC claims that grouped with RTI's index acute hospitalization, 43 percent went into acute episodes and 57 percent went into chronic episodes. A slightly larger percentage of the First PAC records that grouped into an episode with another acute hospitalization were grouped into chronic episodes (61 percent). Acute and chronic episodes were equally represented among First PAC claims that grouped into a MEG without any other acute hospitalization. However, all of the First PAC claims that were grouped into well-care episodes were in the grouping category "without any hospitalization."

Table 31b shows the rank order of the 10 most frequent types of *acute* episodes into which all First PAC claims were grouped. Overall, First PAC claims were most likely to group into an acute episode for bacterial pneumonia (11.5 percent of all First PAC claims grouped into this acute MEG). The second most frequent type of acute MEG into which First PAC claims grouped was fracture of the femur, head or neck (8 percent). The third most frequent type of acute MEG into which First PAC claims grouped was arrhythmias (5.8 percent). The remaining 7 most frequent acute MEGs into which First PAC claims grouped included: urinary tract infections; other arthropathies, bone and joint disorders; infections of the skin and subcutaneous tissue; complications of surgical and medical care; other neurological conditions; thrombophlebitis; and Injury to the spine and spinal cord (lower back). Overall, 50 percent of all First PAC claims were grouped into one of these 10 acute MEGs.

Table 31a. Types of MEG Episodes Created: First PAC

Type of MEG Episodes into Which First PAC Records Grouped	Overall First PAC (N)	Overall First PAC (%)	First PAC Grouped with Index Hospitalization (N)	First PAC Grouped with Index Hospitalization (%)	First PAC Grouped with Other Hospitalization (N)	First PAC Grouped with Other Hospitalization (%)	First PAC Grouped without Any Hospitalization (N)	First PAC Grouped without Any Hospitalization (%)
Acute	48,718	45.0	20,186	42.6	2,170	39.4	26,362	47.6
Chronic	56,462	52.1	27,215	57.4	3,341	60.6	25,906	46.8
Well-care/encounter for preventive health services	3,091	2.9	0	0.0	0	0.0	3,091	5.6
Total MEG episodes	108,316 [a]	100.0	47,401	100.0	5,511	100.0	55,359	100.0

MEG=Thomson Medstat Medical Episode Grouper.

[a] Includes 45 episodes that were "non-categorized" (contained ungrouped claims), not shown in table.

Table 31b. Top 10 Acute MEG Episodes Created: First PAC [a]

10 Most Common Acute MEG into Which First PAC Claims Grouped	N	%
Pneumonia: bacterial	5,603	11.5
Fracture: femur, head or neck	3,873	8.0
Arrhythmias	2,836	5.8
Urinary tract infections	2,668	5.5
Other arthropathies, bone and joint disorders	2,404	4.9
Infections of skin and subcutaneous tissue	2,004	4.1
Complications of surgical and medical care	1,945	4.0
Other neurological conditions	1,208	2.5
Thrombophlebitis	936	1.9
Injury: spine and spinal cord: low back	796	1.6

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all First PAC claims.

Table 31c shows the 10 most frequent *chronic* MEGs created for First PAC claims. Overall, osteoarthritis (except spine) was the most common chronic MEG into which First PAC claims were grouped (22.7 percent). Cerebrovascular disease was the second most frequent (11.8 percent), and coronary artery disease was third (9.2 percent). The remaining 7 most common chronic MEGs included: essential hypertension; chronic obstructive pulmonary disease; diabetes mellitus type 2 and hyperglycemic states; congestive heart failure; renal failure; dementia: primary degenerative (Alzheimer's or Picks Disease); and diabetes mellitus type 1. Overall, approximately 77 percent of all First PAC claims were grouped into one of these 10 chronic MEGs.

Table 31c. Top 10 Chronic MEG Episodes Created: First PAC [a]

10 Most Common Chronic MEG into Which First PAC Claims Grouped	N	%
Osteoarthritis, except spine	12,828	22.7
Cerebrovascular disease	6,678	11.8
Coronary artery disease	5,207	9.2
Essential hypertension	5,042	8.9
Chronic obstructive pulmonary disease	3,140	5.6
Diabetes mellitus type 2 and hyperglycemic states	2,987	5.3
Congestive heart failure	2,481	4.4
Renal failure	1,769	3.1
Dementia: primary degenerative (Alzheimer's or Picks Disease)	1,713	3.0
Diabetes mellitus type 1	1,484	2.6

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all First PAC claims.

Acute and Chronic Episodes: All PAC

Table 32a shows the percentages of All PAC claims that were grouped into acute, chronic, and well-care episodes overall for All PAC, as well as by the three grouping categories. Compared with the results for First PAC, a slightly smaller percentage of All PAC claims grouped into acute MEGs (45 percent), and a slightly larger percentage grouped into chronic MEGs (59 percent). Overall, less than 1 percent of All PAC claims were grouped into MEGs for well care. The most notable variation in this pattern was seen for the PAC records that grouped with the index acute hospitalization: only 24 percent grouped into acute MEGs and over three-quarters (77 percent) grouped into chronic MEGs. All of the PAC claims that were grouped into well-care MEGs were claims that grouped without any hospitalization record in the episode.

Table 32b shows the top 10 acute MEGs into which All PAC records were grouped. Fracture of the femur, head, or neck was the most common (7.7 percent), followed by bursitis (5.9 percent), infections of the skin and subcutaneous tissue (5.8 percent), and other arthopathies, bone and joint disorders (5.7 percent). Overall, approximately 50 percent of All PAC claims grouped into one of these 10 acute MEGs. **Table 32c** displays top 10 chronic MEGs into which All PAC records were grouped. Although the rank order is slightly different, the top 10 chronic MEGs into which All PAC records were grouped are the same top 10 chronic MEGs into which the First PAC records were grouped: osteoarthritis was most common (51.9 percent), followed by cerebrovascular disease (10.5 percent) and hypertension (4.3 percent). Overall, about 85 percent of All PAC claims grouped into one of these the top 10 chronic MEGs.

Table 32a. Types of MEG Episodes Created: All PAC

Type of MEG Episodes into Which All PAC Records Grouped	Overall All PAC (N)	Overall All PAC (%)	All PAC Grouped with Index Hospitalization (N)	All PAC Grouped with Index Hospitalization (%)	All PAC Grouped with Other Hospitalization (N)	All PAC Grouped with Other Hospitalization (%)	All PAC Grouped without Any Hospitalization (N)	All PAC Grouped without Any Hospitalization (%)
Acute	172,261	40.2	46,236	23.6	11,469	47.6	114,556	55.3
Chronic	251,665	58.8	150,108	76.5	12,646	52.4	88,911	42.9
Well care/encounter for preventive health services	3,874	0.9	0	0.0	0	0.0	3,874	1.9
Total MEG episodes	428,080 [a]	100.0	196,344	100.0	24,115	100.0	207,341	100.0

MEG=Thomson Medstat Medical Episode Grouper.

[a] Includes 280 episodes that were "non-categorized" (contained ungrouped claims), not shown in table.

Table 32b. Top 10 Acute MEG Episodes Created: All PAC [a]

10 Most Common Acute MEG into Which All PAC Claims Grouped	N	%
Fracture: femur, head or neck	13,324	7.7
Bursitis	10,077	5.9
Infections of skin and subcutaneous tissue	9,981	5.8
Other arthropathies, bone and joint disorders	9,853	5.7
Pneumonia: bacterial	8,690	5.0
Other neurological conditions	8,366	4.9
Other spinal and back disorders: low back	6,676	3.9
Decubitus ulcers	6,550	3.8
Complications of surgical and medical care	5,909	3.4
Fracture, dislocation, or sprain: humerus (head) or shoulder	5,366	3.1

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all PAC claims.

Table 32c. Top 10 Chronic MEG Episodes Created: All PAC [a]

10 Most Common Chronic MEG into Which All PAC Claims Grouped	N	%
Osteoarthritis, except spine	130,555	51.9
Cerebrovascular disease	26,528	10.5
Essential hypertension	10,839	4.3
Diabetes mellitus type 2 and hyperglycemic states	9,535	3.8
Coronary artery disease	8,820	3.5
Osteoarthritis, lumbar spine	7,415	3.0
Chronic obstructive pulmonary disease	6,221	2.5
Dementia: primary degenerative (Alzheimer's or Picks Disease)	5,065	2.0
Congestive heart failure	4,856	1.9
Diabetes mellitus type 1	4,565	1.8

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all PAC claims.

Acute and Chronic Episodes: All Readmissions

Table 33a shows the percentages of readmission claims that were grouped into acute and chronic episodes, overall for readmissions, as well as by the three grouping categories. Note that, unlike the PAC records, no readmission record was grouped into a MEG for well-care/preventive services. Overall, about 60 percent of readmission records grouped into acute MEGs, and about 40 percent into chronic MEGs. A slightly larger percentage of those readmissions that grouped into MEGs without any other acute hospitalization were in acute MEGs (64 percent), while a much larger percentage of readmissions that grouped with another acute hospitalization grouped into chronic MEGs (73 percent).

Table 33a. Types of MEG Episodes Created: All Readmissions [a]

Type of MEG Episodes into Which All Readmissions Records Grouped	Overall All Readmissions (N)	Overall All Readmissions (%)	All Readmissions Grouped with Index Hospitalization (N)	All Readmissions Grouped with Index Hospitalization (%)	All Readmissions Grouped with Other Hospitalization (N)	All Readmissions Grouped with Other Hospitalization (%)	All Readmissions Grouped without Any Hospitalization (N)	All Readmissions Grouped without Any Hospitalization (%)
Acute	22,953	59.0	2,900	44.2	508	26.6	19,545	64.2
Chronic	15,937	41.0	3,658	55.8	1,401	73.4	10,878	35.8
Total MEG episodes	38,890	100.0	6,558	100.0	1,909	100.0	30,423	100.0

MEG=Thomson Medstat Medical Episode Grouper.

[a] Includes 280 episodes that were "non-categorized" (contained ungrouped claims), not shown in table.

Table 33b shows the top 10 acute MEGs into which readmission claims were grouped. Regarding the acute MEGs, the most common was bacterial pneumonia (21 percent), followed by complications of surgical care (10.8 percent), urinary tract infections (8.9 percent), arrhythmias (5 percent), and thrombophlebitis (3.8 percent). The remaining top 10 acute MEGs included: clostridium difficile colitis; infections of skin and subcutaneous tissue; other gastrointestinal disorders; diverticular disease; and fracture: femur, head or neck. Overall these 10 acute MEGs represented 63 percent of all acute MEGs into which readmission claims were grouped. **Table 33c** shows the top 10 chronic MEGs into which readmission claims were grouped. The top three most frequent chronic MEGs were coronary artery disease, cerebrovascular disease, and hypertension.

Table 33b. Top 10 Acute MEG Episodes Created: All Readmissions [a]

10 Most Common Acute MEG into Which All Readmission Claims Grouped	N	%
Pneumonia: bacterial	4,812	21.0
Complications of surgical and medical care	2,489	10.8
Urinary tract infections	2,041	8.9
Arrhythmias	1,157	5.0
Thrombophlebitis	871	3.8
Clostridium difficile colitis	858	3.7
Infections of skin and subcutaneous tissue	641	2.8
Other gastrointestinal disorders	555	2.4
Diverticular disease	496	2.2
Fracture: femur, head or neck	424	1.9

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all Readmission claims.

6.7 Ingenix Symmetry Episode Treatment Groups (ETG)

The ETG software, version 7.0, was run on the same claims as the MEG software. This provided an opportunity to view of how a different algorithm for creating episodes of care would group the PAC claims. The ETG grouper builds episodes of services primarily linked by diagnoses. The records read by the program were customized to meet the needs of the ETG software and differ somewhat from the MEG input records.

6.7.1 Input Data

Input files had to be configured before running through the grouper software. An essential part of this configuration was breaking claims into line items allowing procedures on each line item to separately interact with the diagnosis or diagnoses in determining episode assignment.

Table 33c. Top 10 Chronic MEG Episodes Created: All Readmissions [a]

10 Most Common Chronic MEG into which All Readmission Claims Grouped	N	%
Coronary artery disease	2,338	14.7
Cerebrovascular disease	1,909	12.0
Essential hypertension	1,803	11.3
Renal failure	1,108	7.0
Chronic obstructive pulmonary disease	862	5.4
Congestive heart failure	703	4.4
Diabetes mellitus type 2 and hyperglycemic states	595	3.7
Diabetes mellitus type 1	455	2.9
Tibial, iliac, femoral, or popliteal artery disease	439	2.8
Cardiomyopathies	412	2.6

MEG=Thomson Medstat Medical Episode Grouper.

[a] N and % represent the N and percent of all Readmission claims.

ETG input files had a mixture of line-item-level records from the non-institutional claim sources, revenue center records (similar to line items) from most institutional claims and header-level records for inpatient stay MedPAR claims. The default setting for ETG was to break each claim into line items, but exceptions were made for inpatient and home health claims. All the inpatient institutional claims were input as one claim-level record to treat the stay as a unit rather than let it fragment. These claims were therefore entered at the header level. The revenue code 0101 (indicating room and board) was imputed in order to allow ETG to recognize these claims as inpatient facility-type claims.[31]

Non-institutional claims, from the physician/supplier file and durable medical equipment file were broken into line items. The institutional claims, those in the outpatient and hospice file, were also broken into revenue center-based line items. Home health claims were initially entered as separate line items until it was noted that ETG was systematically assigning HHA line-items to different episodes based on the discipline of the health care provider on each line item. It was concluded that this sorting could misrepresent the PAC services. Given that the revenue code 0023 indicates a home health claim, we opted to reduce the HHA claims to the line item containing the revenue code 0023. As discussed below, ETG accepts both procedure codes and revenue codes in determining a service type.

Each ETG input record can accommodate only one procedure, either CPT-4 or HCPCS, and only four diagnoses. It can also accommodate a revenue code if the user chooses to supply that. Inpatient records are recognized by the presence of a revenue code for room and

[31] MedPAR records do not have actual revenue codes on them, as multiple related revenue centers are aggregated into clusters.

board; the ICD-9 procedure codes in the record header are not accepted and CPT and HCPCS are infrequent except on SNF claims.

On non-institutional claims there is only one procedure and diagnosis each line item. On institutional claims the diagnoses are in the header of the claim, not in the revenue centers. The first four unduplicated header diagnoses were included on each institutional input record for ETG.

6.7.2 Internal Logic

General

ETG uses two types of information in determining whether a record is eligible to start an episode of care or just be considered part of an episode. These two features are Provider Type and Service Type. The user determines the Provider Type: Facility, Clinician, or Other. Only the first two may start an episode. The service type is related to the procedure on each record; it may be determined by the user or the ETG program itself from the procedure codes.

ETG groups records primarily using diagnosis. ETG examines each claim line in isolation, assigning a record type as management, surgery, inpatient facility, ancillary, or pharmacy. Record type is determined by the Provider Type and Service Type. Of these, management, surgery, and inpatient facility are considered anchors, which are allowed to begin episodes. Non-anchors include ancillary or pharmaceutical claims. As such, ETG allows Facility or Clinician records with CPT or HCPCS codes indicating management (E&M), surgery, or other treatments, and Facility records with a room and board revenue code to begin episodes. Once the anchor records are established the program attempts to link ancillary records to the anchors to form clusters and then assign the clusters to episodes.

Provider and Service Type

The user must assign each record to a provider type and this assignment is one of the determining factors in whether a record may start an episode. Among the institutional records we designated the inpatient and hospital outpatient records as Facility. The HHA, DME, and Hospice records were all classified as Other. Designation as provider type Other is sufficient to disallow the record from anchor status. There are many provider types in the institutional files, particularly in the outpatient file. We used the CMS certification number (formerly Medicare provider number), which is connected to a type of provider, to assign each claim to an ETG Provider Type. An example of an unusual assignment of a claim in the outpatient file is that for Federally Qualified Health Centers. These were assigned to Clinician as they are essentially clinic substitutes for physician offices. Each input record had a field for ETG Provider Type.

The non-institutional claims also had to be assigned a Provider Type. Claims in the physician/supplier file have claims from physicians, other clinicians, ambulances, labs, ambulatory surgical centers, etc. These were assigned based on the specialty code field on the line items. In this case, for example, labs were assigned to Other, ASCs to Facility, physicians and most other clinicians to Clinician. In all Provider Type assignments, judgment was a factor.

ETG uses the procedures, if present, to assign a type of service. Whereas we mapped the provider types ourselves, we allowed the program to determine the nature of the procedure code. The software can recognize the E&M and surgery codes and allows Facility and Clinician records with these to be anchor records. Records with lab, radiology, and other ancillary procedures would not be allowed to be anchor records, even if coded on Facility and Clinician claims. We did not attempt to change the default ETG settings on the mappings of services.

Settings

ETG was run on the population essentially with its default settings, with the exception of the defined length of chronic episodes, as well as selecting the first ICD-9 diagnosis code as the primary diagnosis. For the chronic episode setting, ETG gives a choice of limiting chronic episodes to 12 months or an indefinite period set by the user data stream. We defined our chronic episodes to unlimited length, allowing chronic episodes to run until reaching either the end of a clean period, or the end of the dataset. Unlimited episodes facilitated our ability to capture chronic episodes lasting less than 1 year in the 2006 calendar year, but extending into 2007. Additionally it allowed us to capture chronic episodes lasting longer than a 12-month period. For the ICD-9 diagnosis setting, selecting the option setting the first diagnosis as primary made almost no difference in record grouping. The non-institutional claims are constructed with only one diagnosis so the setting would not matter.

Pilot Runs

Once the records were properly configured for the ETG runs, we ran a test sample on records from two beneficiaries in order to examine and quality check the output. ETG output files were analyzed closely for potentially erroneous patterns indicating either mistaken configurations, or results idiosyncratic to the ETG software.

Although the results of some assignments were puzzling, our consultation with Ingenix regarding our results revealed no significant errors. For our own purposes, we did conduct some post-hoc sensitivity analyses to confirm that our chosen settings did not significantly change the results.

We experimented with the setting that declared the first diagnosis code to be primary, or made no distinction. There was little difference. We experimented with putting a procedure on the HHA record or omitting it. It made no difference. With HHA claims the more

important thing was keeping it as one record or letting line items split into different episodes by discipline, even when the diagnoses on the line items were the same. We opted for the former.

6.8 ETG Results

This section discusses the results of the ETG analyses. We present the results of three broad categories of analyses: Overall grouping results, Starting records analysis results, and types of acute and chronic episodes that were created by ETG.

6.8.1 ETG Grouping Results: With the Index Hospitalization, with Other Hospitalization, without Any Other Hospitalization

First PAC: all DRGs

Tables 34a–34e show the results from the analysis of grouping the First PAC claim from RTI's V.2 logic. These results are displayed graphically in **Appendix T, Figures T1–T12.** **Table 34a** shows the ETG grouping of First PAC stays across all of the index hospital DRGs. All but approximately 4 percent of First PAC records were grouped into at least one episode, with about 43 percent being grouped to the same index hospitalization with which the RTI V.2 logic grouped the First PAC claim. Approximately half of the First PAC records were grouped into an ETG episode that did not include any hospitalizations, while about 5 percent of First PAC records were grouped into an episode that included a hospitalization other than the index acute hospitalization.

These percentages grouping with the RTI V.2 admission differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (56 percent) of First PAC grouped in the same episode as the index hospitalization, while therapy records had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which almost 8 percent remained ungrouped.

Table 34a. ETG Results: First PAC—PAC Users: All DRGs

First PAC	All First PAC N=191,042 (%)	First PAC LTCH N=2,122 (%)	First PAC IRF N=11,120 (%)	First PAC SNF N=44,195 (%)	First PAC HHA N=40,337 (%)	First PAC Therapy N=93,268 (%)
Ungrouped	3.9	0.0	0.0	0.0	0.8	7.6
With index hospitalization	42.7	46.3	55.9	50.2	48.3	35.1
With other hospitalization	5.4	6.9	4.0	4.1	7.8	5.1
Without any hospitalization	48.0	46.8	40.1	45.7	43.1	52.1

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

These percentages grouping with the RTI V.2 admission differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (56 percent) of First PAC grouped in the same episode as the index hospitalization, while therapy records had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which almost 8 percent remained ungrouped.

Table 34b. ETG Results: First PAC—PAC Users: Index DRG 014: Stroke

First PAC	All First PAC N=7,923 (%)	First PAC LTCH N=89 (%)	First PAC IRF N=1,667 (%)	First PAC SNF N=1,730 (%)	First PAC HHA N=956 (%)	First PAC Therapy N=3,841 (%)
Ungrouped	2.3	0.0	0.0	0.0	0.3	5.2
With index hospitalization	74.1	66.3	73.6	72.4	84.0	72.6
With other hospitalization	1.9	5.6	2.7	2.8	2.2	0.9
Without any hospitalization	21.7	28.1	23.7	24.9	13.5	21.3

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

These percentages grouping with the RTI V.2 admission differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (56 percent) of First PAC grouped in the same episode as the index hospitalization, while therapy records had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which almost 8 percent remained ungrouped.

Table 34c. ETG Results: First PAC—PAC Users: Index DRG 089: Pneumonia

First PAC	All First PAC N=9,422 (%)	First PAC LTCH N=57 (%)	First PAC IRF N=83 (%)	First PAC SNF N=2,196 (%)	First PAC HHA N=1,747 (%)	First PAC Therapy N=5,339 (%)
Ungrouped	6.2	0.0	0.0	0.0	0.6	10.8
With index hospitalization	34.7	57.9	30.1	58.9	27.6	26.9
With other hospitalization	7.6	5.3	15.7	3.7	14.0	6.9
Without any hospitalization	51.5	36.8	54.2	37.4	57.8	55.4

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

These percentages grouping with the RTI V.2 admission differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (56 percent) of First PAC grouped in the same episode as the index hospitalization, while therapy records had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which almost 8 percent remained ungrouped.

Table 34d. ETG Results: First PAC—PAC Users: Index DRG 544: Joint Replacement of Lower Extremity

First PAC	All First PAC N=25,177 (%)	First PAC LTCH N=49 (%)49	First PAC IRF N=2,954 (%)	First PAC SNF N=5,671 (%)	First PAC HHA N=5,429 (%)	First PAC Therapy N=11,074 (%)
Ungrouped	0.9	0.0	0.0	0.0	0.2	2.0
With index hospitalization	68.9	36.7	55.8	62.4	50.0	85.1
With other hospitalization	1.4	0.0	2.6	1.2	2.6	0.7
Without any hospitalization	28.7	63.3	41.6	36.3	47.1	12.2

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

These percentages grouping with the RTI V.2 admission differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (56 percent) of First PAC grouped in the same episode as the index hospitalization, while therapy records had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which almost 8 percent remained ungrouped.

Table 34e. ETG Results: First PAC—PAC Users: Index DRG 127: Heart Failure and Shock

First PAC	All First PAC N=6,794 (%)	First PAC LTCH N=44 (%)	First PAC IRF N=78 (%)	First PAC SNF N=1,592 (%)	First PAC HHA N=2,016 (%)	First PAC Therapy N=3,064 (%)
Ungrouped	4.8	0.0	0.0	0.0	0.4	10.5
With index hospitalization	40.5	43.2	47.4	49.7	63.2	20.6
With other hospitalization	8.4	11.4	5.1	5.3	9.3	9.5
Without any hospitalization	46.3	45.5	47.4	45.0	27.1	59.4

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

First PAC: DRG 014: Stroke

Table 34b shows that ETG grouped approximately 74 percent of the stroke-specific First PAC records into an episode with the same index hospitalization as the RTI V.2 logic. These grouping percentages remained high across service types, the highest being 84 percent for the HHA records. Similar to the all-DRG analysis, the 2 percent average proportion of ungrouped DRG 014 records can mostly be attributed to the First PAC therapy records. Overall, DRG 014 specific records had a low grouping percentage to episodes with non-index hospitalizations.

First PAC: DRG 089: Pneumonia

Table 34c shows approximately 35 percent of the First PAC records for an index Pneumonia were grouped into an episode with that index hospitalization, and 50 percent grouped into an ETG episode without any hospitalization. Compared to the stroke DRG (2.3 percent), pneumonia-specific First PAC records had a higher proportion (6.2 percent) of ungrouped records, mostly attributed to the therapy records. Results varied across service type. A much larger percentage of First PAC LTCH records (58 percent) and SNF records (59 percent) were grouped with an episode with the index hospitalization compared to IRF, HHA, or therapy records.

First PAC: DRG 544: Joint Replacement

Table 34d shows that ETG grouped about 69 percent of DRG 544-specific First PAC records with an episode containing the same index hospitalization with which the RTI V.2 logic grouped the first DRG 544-specific PAC claim. This percentage differed across PAC service types, the highest for therapy records (85 percent) and SNF records (56 percent), the lowest for LTCH (37 percent). Ungrouped records and records grouping to episodes with hospitalizations other than the index hospitalization remained relatively low. In contrast, about 63 percent of First PAC LTCH records were grouped to episodes without any hospitalization, significantly higher than the overall average of 29 percent for all DRG 544 First PAC records.

First PAC: DRG 127: Heart Failure and Shock

Table 34e shows that ETG grouped about 40 percent of DRG 127-specific First PAC records with an episode containing the same index hospitalization with which the RTI V.2 logic grouped the first DRG 127-specific PAC claim and 46 percent to episodes without any hospitalization. Within the 40 percent that grouped to the index hospitalization, First PAC HHA had the highest proportion of records grouped (63 percent), while therapy had the least proportion (21 percent). Similar to the First PAC pneumonia therapy records, approximately 10 percent of First PAC heart failure therapy records remained ungrouped.

All PAC: All DRGs

Tables 35a–**35e** show the results from the grouping analysis of All PAC claims from RTI's V.2 logic. **Table 35a** shows the All PAC results across all of the index hospital DRGs. Results

were similar to the First PAC results. All but approximately 4 percent of All PAC records were grouped into at least one episode, with about 45 percent being grouped to the same index hospitalization with which the RTI V.2 logic grouped the First PAC claim. About 44 percent of the All PAC records were grouped into an ETG episode that did not include any hospitalizations, while about 7 percent of All PAC records were grouped into an episode that included a hospitalization other than the index acute hospitalization.

These results differed by the First PAC service type. Compared to the overall average, IRF records had the highest proportion (53 percent) of First PAC grouped in the same episode as the index hospitalization, while LTCH had the lowest (35 percent). The overall average 4 percent of ungrouped First PAC can mostly be attributed to therapy records, of which 5 percent remained ungrouped.

Table 35a. ETG Results: All PAC—PAC Users: All DRGs

All PAC	All PAC N=1,093,544 (%)	All LTCH N=3,052 (%)	All IRF N=12,972 (%)	All SNF N=66,275 (%)	All HHA N=82,489 (%)	All Therapy N=928,766 (%)
Ungrouped	4.3	0.0	0.0	0.1	0.9	5.0
With index hospitalization	44.8	39.8	52.7	43.5	41.4	45.1
With other hospitalization	6.8	14.7	6.9	11.2	10.0	6.2
Without any hospitalization	44.1	45.6	40.4	45.3	47.8	43.7

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Table 35b. ETG Results: All PAC—PAC Users: Index DRG 014: Stroke

All PAC	All PAC N=86,897 (%)	All LTCH N=131 (%)	All IRF N=1,920 (%)	All SNF N=3,268 (%)	All HHA N=3,284 (%)	All Therapy N=78,294 (%)
Ungrouped	2.7	0.0	0.0	0.0	0.4	3.0
With index hospitalization	70.7	54.2	72.7	65.4	73.8	70.7
With other hospitalization	3.1	13.0	3.8	9.2	5.6	2.7
Without any hospitalization	23.6	32.8	23.5	25.3	20.3	23.6

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Table 35c. ETG Results: All PAC—PAC Users: Index DRG 089: Pneumonia

All PAC	All PAC N=29,535 (%)	All LTCH N=82 (%)	All IRF N=127 (%)	All SNF N=3,141 (%)	All HHA N=3,126 (%)	All Therapy N=23,059 (%)
Ungrouped	4.2	0.0	0.0	0.0	0.9	5.3
With index hospitalization	19.9	50.0	26.0	50.7	20.3	15.5
With other hospitalization	12.0	12.2	26.0	10.6	16.8	11.4
Without any hospitalization	63.9	37.8	48.0	38.7	62.1	67.8

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Table 35d. ETG Results: All PAC—PAC Users: Index DRG 544: Joint Replacement of Lower Extremity

All PAC	All PAC N=268,694 (%)	All LTCH N=85 (%)	All IRF N=3,114 (%)	All SNF N=6,951 (%)	All HHA N=11,557 (%)	All Therapy N=246,987 (%)
Ungrouped	4.9	0.0	0.0	0.0	0.3	5.3
With index hospitalization	74.9	32.9	55.0	59.4	42.4	77.2
With other hospitalization	1.7	9.4	3.5	4.5	4.5	1.4
Without any hospitalization	18.6	57.7	41.5	36.1	52.9	16.2

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

Table 35e. ETG Results: All PAC—PAC Users: Index DRG 127: Heart Failure and Shock

All PAC	All PAC N=24,663 (%)	All LTCH N=83 (%)	All IRF N=123 (%)	All SNF N=2,633 (%)	All HHA N=3,707 (%)	All Therapy N=18,117 (%)
Ungrouped	4.0	0.0	0.0	0.0	0.7	5.3
With index hospitalization	28.0	31.3	32.5	42.7	56.1	20.1
With other hospitalization	11.1	20.5	19.5	12.7	12.5	10.5
Without any hospitalization	56.9	48.2	48.0	44.6	30.8	64.1

ETG=Ingenix Symmetry Episode Treatment Groups; LTCH=long-term care hospital; IRF=inpatient rehabilitation facility; SNF=skilled nursing facility; HHA=home health agency.

All PAC DRG 014: Stroke

Table 35b shows that ETG grouped approximately 71 percent of the stroke-specific PAC records into episodes with the same index hospitalizations as the RTI V.2 logic. These grouping percentages remained high across service types, the highest being 74 percent for the HHA records. Similar to the All PAC, all DRG analysis, the 3 percent average proportion of ungrouped DRG 014 records can mostly be attributed to the PAC therapy records. Overall, DRG 014 specific records had a low grouping percentage to episodes with non-index hospitalizations.

All PAC: DRG 089: Pneumonia

Table 35c shows that approximately 20 percent of the pneumonia-specific PAC records were grouped into an episode with the index hospitalization, in contrast to 64 percent that grouped into an ETG episode without any hospitalization. Results varied across service type. Compared to the overall average of 20 percent grouping to an episode with same index hospitalization, a much larger percentage of PAC LTCH records (50 percent) and PAC SNF records (50 percent) were grouped with an episode with the index hospitalization compared to IRF (26 percent), HHA (20 percent), or therapy records (15 percent).

All PAC DRG 544: Joint Replacement

Table 35d shows that ETG grouped about 75 percent of DRG 544-specific PAC records with an episode containing the same index hospitalization with which the RTI V.2 logic grouped the DRG 544-specific PAC records. This percentage differed across PAC service types, the highest for therapy records (77 percent), and SNF records (60 percent), the lowest for LTCH (33 percent). Ungrouped records and records grouping to episodes with hospitalizations other than the index hospitalization remained relatively low. In contrast, about 58 percent of DRG 544-specific PAC LTCH records were grouped to episodes without any hospitalization, significantly higher than the overall average of 19 percent for all DRG 544-specific PAC records.

All PAC: DRG 127: Heart Failure and Shock

Table 35e shows that ETG grouped about 28 percent of DRG 127-specific PAC records with an episode containing the same index hospitalization with which the RTI V.2 logic grouped the DRG 127-specific PAC records, and 57 percent to episodes without any hospitalization. The absolute difference between these percentages is greater in the All PAC analysis (29 percent), compared to the First PAC analysis (6 percent).

Within the 28 percent that grouped to the index hospitalization, the PAC HHA records had the highest proportion of records grouped (56 percent), while therapy had the least proportion (20 percent), results that are consistent with the First PAC heart failure results. Approximately 4 percent of all heart failure-specific PAC records remain ungrouped, attributed mostly to the PAC therapy records.

First Readmission Grouping Results

Tables 36a–36e and **Figure 14** summarize the proportion of First Readmissions are grouped to an episode with the index hospitalization, stratified into DRG-specific groups, and length of time in days between the index hospitalization discharge and the first hospital readmission.

Overall, 24 percent and 19 percent of 1–30 day and 31+ day readmissions, respectively, grouped to an episode with the same index hospitalization. These proportions of grouping First Readmissions to episodes containing the index hospitalizations remained similar across most DRGs, with exception of joint replacement which were consistently lower (16 percent, and 15 percent for 1–30 and 31+); and heart failure and shock, which were consistently higher (34 percent, and 32 percent for 1–30 and 31+).

Table 36a. ETG Results: First Readmission—All Index DRGs (N=26,034)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=16,027)	31+ days (n=10,007)
Percentage grouped with index hospital	23.8	18.7
Percentage grouped with another hospital	5.2	6.4
Percentage grouped without any other hospital	70.9	74.9

ETG=Ingenix Symmetry Episode Treatment Groups.

Table 36b. ETG Results: First Readmission—Index DRG 014: Stroke (N=1,305)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=703)	31+ days (n=602)
Percentage grouped with index hospital	28.0	25.3
Percentage grouped with another hospital	3.8	4.0
Percentage grouped without any other hospital	68.1	70.8

ETG=Ingenix Symmetry Episode Treatment Groups.

Table 36c. ETG Results: First Readmission—Index DRG 089: Pneumonia (N=1,195)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=759)	31+ days (n=436)
Percentage grouped with index hospital	25.4	17.4
Percentage grouped with another hospital	7.4	7.8
Percentage grouped without any other hospital	67.2	74.8

ETG=Ingenix Symmetry Episode Treatment Groups.

Table 36d. ETG Results: First Readmission—Index DRG 544: Joint Replacement Lower Extremity (N=1,541)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=965)	31+ days (n=576)
Percentage grouped with index hospital	16.2	15.5
Percentage grouped with another hospital	3.9	5.0
Percentage grouped without any other hospital	79.9	79.5

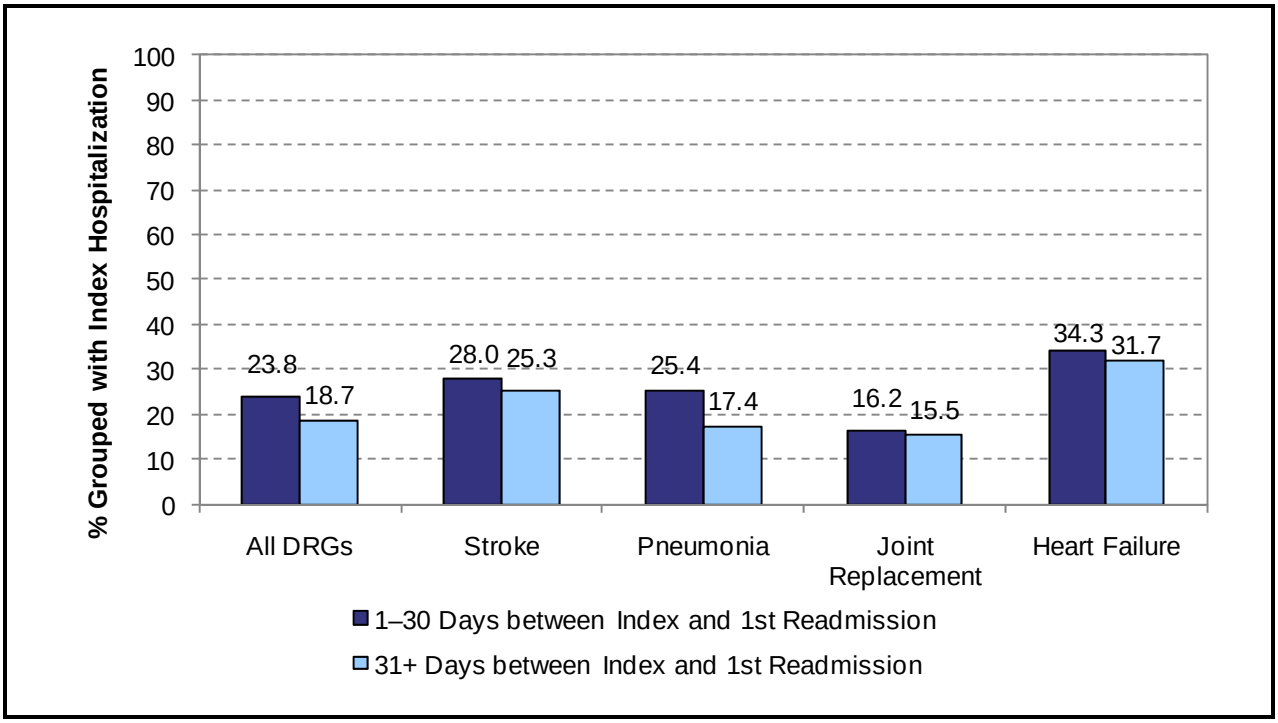
ETG=Ingenix Symmetry Episode Treatment Groups.

Table 36e. ETG Results: First Readmission—Index DRG 127: Heart Failure and Shock (N=1,465)

First Readmission: Days Between Index Discharge and First Readmission	1–30 days (n=868)	31+ days (n=597)
Percentage grouped with index hospital	34.3	31.7
Percentage grouped with another hospital	5.3	5.9
Percentage grouped without any other hospital	60.4	62.5

ETG=Ingenix Symmetry Episode Treatment Groups.

Figure 14. First Readmission: ETG



Differences between the 0–30 days and 31+ days were highest in the pneumonia readmissions (8 percentage points), and lowest in the joint replacement readmissions (1 percentage point), compared to the difference for all DRGs (5 percent). Overall, the ETG had a high proportion of First Readmissions being grouped to episodes without another hospitalization. While 71 percent and 75 percent of 0–30 and 31+ day readmissions, respectively, grouped to an episode without a hospitalization. These proportions were slightly lower within the heart-failure group (60 percent, and 63 percent for 1–30 and 31+, respectively), and slightly higher in the joint replacement group (80 percent and 80 percent, for 0–30 and 31+, respectively)

6.8.2 ETG Grouping Results: Starting Anchor Record Analysis

We performed an analysis to examine the proportion of First PAC and First Readmission records that were started the episodes into which they grouped. We defined the First PAC or First Readmission record as the starting anchor record if it had the same "From date" as the start date of the episode, based on the ETG output.

Starting Anchor Records: First PAC

Among those First PAC records that grouped into an episode with the index hospitalization, none were the first anchor record for that episode. This is consistent across all PAC types as shown in **Table 37a**. Among the First PAC records that grouped into an episode with an acute admission other than the index admission, approximately 12 percent were first anchor records for the episode. This varied by First PAC site (**Tables 37b** through **37f**): First PACs that were LTCH (19.7 percent), IRF (18.7 percent), and SNF (24 percent) were extremely more likely to be first anchor records in their episodes, whereas First PAC HHA records (0.9 percent) were extremely less likely to serve as first anchors of their episodes. Similar trends were noted for those First PAC records that grouped into an episode that had no other hospitalization: IRF (39.8 percent) and SNF (38.1 percent) were much more likely to serve as first anchor records for the episodes, whereas HHA records were much less likely to be first anchors (1.9 percent). Inpatient stays, including inpatient PAC stays in LTCH, IRF, and SNF, are always allowed to be anchor records and can start episodes.

Table 37a. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—All First PAC

All First PAC	N (%) Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	81,622
Grouped with other hospitalization	1,228 (11.8%)	10,331
Grouped without any hospitalization	25,015 (27.3%)	91,640
Total	26,243 (13.7%)	191,142

Table 37b. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC LTCH

First PAC LTCH	N (%)Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	983
Grouped with other hospitalization	29 (19.9%)	146
Grouped without any hospitalization	254 (25.6%)	993
Total	283 (13.3%)	2,122

LTCH=long-term care hospital.

Table 37c. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC IRF

First PAC IRF	N (%)Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	6,220
Grouped with other hospitalization	82 (18.7%)	439
Grouped without any hospitalization	1,776 (39.8%)	4,461
Total	1,858 (16.7%)	11,120

IRF=inpatient rehabilitation facility.

Table 37d. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC SNF

First PAC SNF	N (%)Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	22,182
Grouped with other hospitalization	432 (24.0%)	1,802
Grouped without any hospitalization	7,690 (38%)	20,206
Total	8,122 (18.4%)	44,195

SNF=skilled nursing facility.

Table 37e. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC HHA

First PAC HHA	N (%)Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	19,484
Grouped with other hospitalization	30 (1%)	3,164
Grouped without any hospitalization	333 (1.9%)	17,370
Total	363 (1%)	40,337

HHA-home health agency.

Table 37f. Percent of First PAC Records that Were Starting Anchor Records in Their Episode: All Index Admission DRGs—First PAC Therapy

First PAC Therapy	N (%)Starting Anchor Records	Total N
Grouped with index hospitalization	0 (0%)	32,753
Grouped with other hospitalization	655 (13.7%)	4,780
Grouped without any hospitalization	14,962 (30.8%)	48,610
Total	15,617 (16%)	93,268

Starting Anchor Records: First Readmission

Table 37g shows the results for the anchor record analysis of the First Readmission record. These results are shown stratified by those readmissions that occurred within 30 days of the acute index discharge and those that occurred more than 30 days after the index discharge. Among the readmission records that grouped into an ETG with the acute index hospitalization (n=3,821 for those within 30 days of the index admission, n=1,871 for those more than 30 days after the index admission), none were considered anchor records for their admission. It is highly likely that the index acute admission was the anchor in each of those episodes. Only about 4 percent of readmissions that occurred within 30 days of the index, and about 4 percent of those that occurred more than 30 days after the index, were considered anchors of episodes when grouped into an ETG with another hospitalization. On the other hand, the vast majority of the readmission records that grouped into an ETG in which they were the only acute admission were considered anchor records of the episode (96.2 percent of those within 30 days of the index acute admission, and 95.8 percent of those more than 30 days after the index acute admission).

6.8.3 ETG Grouping Results: Acute and Chronic Episodes

The following section describes analyses that were performed to examine the types of ETG into which PAC and readmission records were grouped. In the report we show results for the grouping of the First PAC record, All PAC records, and All Readmission records, across all index admission DRGs. In **Appendix U** we present more detailed tables by DRG for DRG 014 (Stroke), DRG 089 (Pneumonia), DRG 544 (Joint replacement), and DRG 127 (Heart failure/shock). Note that the numbers and percentages in these tables represent the number of records and the percentage of records (and not the number of episodes).

Table 37g. Percent of First Readmission Records that Were Starting Anchor Records in their Episode: All Index Admission DRGs

First Readmission	Within 30 Days of Index Admission: N (%) Starting Anchor Records	Within 30 Days of Index Admission: Total N	More than 30 Days of Index Admission: N (%) Starting Anchor Records	More than 30 Days of Index Admission: Total N
Grouped into an ETG with index hospitalization	0 (0%)	3,821	0 (0%)	1,871
Grouped into an ETG with another hospitalization	205 (3.8%)	838	160 (4.2%)	638
Grouped into an ETG without any other hospitalization	5,249 (96.2%)	11,368	3,618 (95.8%)	7,498
Total	5,454	16,027	3,778	10,007

ETG=Ingenix Symmetry Episode Treatment Groups.

Acute and Chronic Episodes: First PAC

Table 38a shows the percentages of First PAC records that were grouped into acute or chronic overall for First PAC, as well as by the three grouping categories (with index acute hospitalization, with another acute hospitalization, or without any hospitalization). For all First PAC records, 38 percent grouped into an acute episode and 62 percent grouped into a chronic episode. These patterns varied by grouping categories. Among the First PAC records that grouped with RTI's index acute hospitalization, 33 percent went into acute episodes and 67 percent went into chronic episodes. The percentages were higher among the First PAC records that grouped with another hospitalization: 15 percent went to acute episodes and 85 percent went to chronic episodes. Percentages were approximately similar to the RTI index hospitalization among the First PAC records that grouped without any hospitalization: 36 percent went to acute episodes and 64 percent went to chronic episodes.

Table 38a. Types of ETG Episodes Created: First PAC

Type of ETG Episodes into Which First PAC Records Grouped	Overall First PAC N	Overall First PAC %	First PAC Grouped with Index Hospitali-zation N	First PAC Grouped with Index Hospitali-zation %	First PAC Grouped with Other Hospitali-zation N	First PAC Grouped with Other Hospitali-zation %	First PAC Grouped without Any Hospitali-zation N	First PAC Grouped without Any Hospitali-zation %
N and % First PAC grouped into *acute*	72,026	37.7	27314	33.5	1,556	15.1	1121	35.7
N and % First PAC grouped into *chronic*	118,518	62.0	54301	66.5	8,775	84.9	2021	64.3
Total First PAC claims	191,042	100.0	81622	100.0	10,331	100.0	3142	100.0

ETG=Ingenix Symmetry Episode Treatment Groups.

Table 38b shows the rank order of the 10 most frequent types of *acute* episodes into which all First PAC records were grouped. Overall, First PAC records were most likely to group into an acute episode for closed fracture or dislocation—thigh, hip & pelvis without complications, with comorbidities, with surgery (7.25 percent of all First PAC records grouped into this acute ETG). The second most frequent type of acute ETG into which First PAC records grouped was minor unspecified orthopedic disorder (6.9 percent). The third most frequent type of acute ETG into which First PAC records grouped was bacterial lung infection (5.8 percent). The remaining 7 most frequent acute ETGs into which First PAC records grouped included: (1) non-routine inoculation; (2) infected lower genitourinary system, (3) spinal trauma; (4) major specific procedures; (5) orthopedic signs and symptoms unspecified; (6) conditional exam; and (7) closed fracture/dislocation without complications, with comorbidities, without surgery. Overall, approximately 43 percent of all First PAC records were grouped into one of these 10 acute ETGs.

Table 38b. Rank Order: Top 10 Acute ETG Episodes Created: First PAC [a]

10 Most Common Acute ETG into Which First PAC Claims Grouped	N	%
Closed fraction/dislocation—pelvic girdle, without complications; with comorbidities, with surgery	5,224	7.3
Minor orthopedic disorder—unspecified	4,987	6.9
Bacterial lung infection without complication, with comorbidities	4,914	6.8
Non-routine inoculation	4,573	6.3
Infect lower genitourinary system not sexually transmitted disease, without complication with comorbidities	2,745	3.8
Spinal trauma, with complication, with comorbidity, without surgery	1,899	2.6
Major specific procedures not otherwise specified	1,875	2.6
Orthopedic signs and symptoms-unspecified	1,571	2.2
Conditional exam	1,564	2.2
Closed fraction/dislocation—pelvic girdle, without complications; with comorbidities, without surgery	1,392	1.9

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all First PAC claims.

Table 38c shows the 10 most frequent *chronic* ETG created for First PAC records. Overall, cerebral vascular accident (stroke) was the most common chronic ETG into which First PAC records were grouped (9.4 percent). This is classified as a chronic ETG. Joint degeneration was the second most frequent (8.7 percent), and congestive heart failure was third (6.2 percent). The remaining 7 most common chronic ETGs included: (1) ischemic heart disease; (2) chronic renal failure; (3) hypertension; (4) joint degeneration (without complications, without comorbidities, with surgery; (5) diabetes (without complications, with comorbidities,

without surgery); (6) COPD (without complications, with comorbidities, without surgery); and (7) dementia. Overall, 47 percent of First PAC records were grouped into these 10 chronic ETGs.

Table 38c. Rank Order: Top 10 Chronic ETG Episodes Created: First PAC [a]

10 Most Common Chronic ETG into Which First PAC Claims Grouped	N	%
Cerebrovascular accident, without complications, with comorbidities, without surgery	11,155	9.4
Joint degeneration—knee lower leg, without complications, with comorbidities with surgery	10,269	8.7
Chronic heart failure without complications, with comorbidities, without surgery	7,418	6.3
Ischemic heart disease without complications, with comorbidities, without surgery	5,962	5.0
Chronic renal failure, with complications, with comorbidities	5,210	4.4
Hypertension, without complications, with comorbidities	4,451	3.8
Joint degeneration—knee, lower leg, without complications, without comorbidities, with surgery	3,406	2.9
Diabetes without complications, with comorbidities, without surgery	3,109	2.6
COPD, without complications, with comorbidities, without surgery	2,560	2.2
Dementia	2,501	2.1

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all First PAC claims.

Acute and Chronic Episodes: All PAC

Table 39a shows the percentages of All PAC records that were grouped into acute and chronic ETG episodes overall for All PAC, as well as by the three grouping categories. Compared with the results for First PAC, a slightly smaller percentage of All PAC records grouped into acute ETGs (32 percent), and a slightly larger percentage grouped into chronic ETGs (67 percent). The most notable variation in this pattern was seen for the PAC records that grouped with the index acute hospitalization: only 20 percent grouped into acute ETGs and over 79 percent grouped into chronic ETGs.

Table 39b shows the top 10 *acute* ETGs into which All PAC records were grouped. Among acute ETGs, the most common was minor orthopedic unspecified disorder (9.8 percent), followed by closed fracture/dislocation (8.9 percent), bacterial lung infection (3.6 percent), orthopedic signs and symptoms (2.9 percent), spinal trauma (2.6 percent), conditional exam (2.3 percent), open fracture/dislocation of pelvis (2.2 percent); lower genitourinary infection (2.2 percent), and gasteroenterology disease, signs and symptoms (2 percent). Overall, about 38 percent of All PAC records grouped into these 10 acute ETGs.

Table 39a. Types of ETG Episodes Created: All PAC

Type of ETG Episodes into Which All PAC Records Grouped	Overall All PAC N	Overall All PAC %	All PAC Grouped with Index Hospitali-zation N	All PAC Grouped with Index Hospitali-zation %	All PAC Grouped with Other Hospitali-zation N	All PAC Grouped with Other Hospitali-zation %	All PAC Grouped without Any Hospitali-zation N	All PAC Grouped without Any Hospitali-zation %
N and % All PAC grouped into *acute*	350,661	32.1	100,332	20.5	21,280	28.5	4,866	34.7
N and % All PAC grouped into *chronic*	730,163	66.8	389,038	79.5	53,399	71.5	9,159	65.3
Total All PAC claims	1,093,554[a]	100.0	489,501	100.0	74,679	100.0	14,025	100.0

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] Includes PAC claims that were "non-categorized," not shown in table.

Table 39b. Top 10 Acute ETG Episodes Created: All PAC [a]

10 Most Common Acute ETG into Which All PAC Claims Grouped	N	%
Minor orthopedic disorder—unspecified	34,362	9.8
Closed fracture/dislocation—pelvic girdle, without comp, with comorbidity, with surgery	31,228	8.9
Bacterial lung infection, without complications with comorbidities	12,778	3.6
Orthopedic sign and symptoms—unspecified	10,076	2.9
Spinal trauma with complications with comorbidities without surgery	9,281	2.7
Conditional exam	8,032	2.3
Neurological disease sign and symptoms	7,887	2.3
Open fracture/dislocation—pelvic girdle	7,794	2.2
Infection lower genitourinary system not sexually transmitted disease, without complication, with comorbidities	7,682	2.2
Gastroenterology disease sign and symptoms	7,100	2.0

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all First PAC claims.

Table 39c shows the top 10 *chronic* ETGs into which All PAC records were grouped. For the overall All PAC records, joint degeneration (without complications, with comorbidities, with surgery) was most common (20.4 percent), followed by cerebral vascular accident (12.2 percent) and joint degeneration (without complications, without comorbidities, with surgery (4.9 percent). Overall, the top 10 chronic ETGs into which All PAC records grouped represented over 56 percent of All PAC records grouped into chronic episodes.

Table 39c. Top 10 Chronic ETG Episodes Created: All PAC [a]

10 Most Common Chronic ETG into Which All PAC Claims Grouped	N	%
Joint degeneration—knee lower/leg, without complications, with comorbidities, with surgery	148,971	20.4
Cerebrovascular accident, without complications, with comorbidities, without surgery	88,841	12.2
Joint degeneration—knee lower/leg, without complication, without comorbidities, with surgery	35,861	4.9
Chronic heart failure without complications, with comorbidities, without surgery	25,596	3.5
Joint degeneration—pelvic girdle, without complication, with comorbidities, with surgery	23,911	3.3
Ischemic heart disease, without complication, with comorbidities, without surgery	19,081	2.6
Joint degeneration—back, with complications, with comorbidities, with surgery	18,355	2.5
Chronic renal failure, with complications, with comorbidities	17,609	2.4
Diabetes, without complications, with comorbidities, without surgery	16,571	2.3
Hypertension, without complications, with comorbidities.	16,304	2.2

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all First PAC claims.

Acute and Chronic Episodes: All Readmissions

Table 40a shows the percentages of readmission records that were grouped into acute and chronic episodes, overall for readmissions, as well as by the three grouping categories. Overall, about 46 percent of readmission records grouped into acute ETGs, and about 54 percent into chronic ETGs. Approximately equal proportions of those readmissions that grouped into ETGs without any other acute hospitalization were in acute ETGs (49 percent), compared to chronic ETGs (51 percent). A much larger percentage of readmissions that grouped with another acute hospitalization grouped into chronic ETGs (82 percent) compared to acute ETGs (18 percent).

Table 40a. Types of ETG Episodes Created: All Readmissions

Type of ETG Episodes into Which All Readm Records Grouped	Overall All Readm N [a]	Overall All Readm %	All Readm Grouped with Index Hosp N	All Readm Grouped with Index Hosp %	All Readm Grouped with Other Hosp N	All Readm Grouped with Other Hosp %	All Readm Grouped without Any Hosp N	All Readm Grouped without Any Hosp %
N and % All Readm grouped into *acute*	17,903	46.0	2,275	28.9	440	17.8	687	49.3
N and % All Readm grouped into *chronic*	20,987	54.0	5,583	71.1	2,027	82.2	707	50.7
Total All Readm claims	38,890	100.0	7,858	100.0	2,467	100.0	1,394	100.0

ETG=Ingenix Symmetry Episode Treatment Groups; Readm=Readmissions; Hosp=Hospitalization.

[a] N and % represent the N and percent of all Readmission claims.

Table 40b shows the top 10 *acute* ETGs into which readmission records were grouped. The most common acute ETG was bacterial lung infection without complication, with comorbidities (10.85 percent); followed by septicemia (10.83 percent); lower genitourinary tract infection (7.1 percent); other infection diseases of intestine/abdominal region (4 percent); and bacterial lung infection with complications, with comorbidities (3.4 percent). The remaining 5 of the 10 acute ETGs included: (1) closed fracture, dislocation of pelvis (2.9 percent); (2) late effects and late complications of environmental trauma and poisonings (2.7 percent); (3) acute renal failure (2.5 percent); (4) septicemia with complications, without surgery (2.4 percent); and (5) bowel obstruction without complications, without surgery (2 percent). Overall, about 49 percent of All Readmission claims were grouped into these 10 acute ETGs.

Table 40b. Rank Order: Top 10 Acute Episodes Created: All Readmissions [a]

10 Most Common Acute ETG into Which All Readmission Claims Grouped	N	%
Bacterial lung infection, without complications, with comorbidities	1,943	10.9
Septicemia, without complications, without surgery	1,938	10.8
Infection of lower genitourinary system, not sexually transmitted disease, without complication, with comorbidity	1,269	7.1
Other infectious disease of intestine/abdomen, without surgery	790	4.4
Bacterial lung infection, with complications, with comorbidities	610	3.4
Closed fracture/dislocation—pelvic girdle, without complication, with comorbidity, with surgery	520	2.9
Late effects and late complications	478	2.7
Acute renal failure	455	2.5
Septicemia, with complication, without surgery	422	2.4
Bowel obstruction, without complications, without surgery	362	2.0

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all Readmission claims.

Table 40c shows the rank order of the top 10 *chronic* ETGs into which readmission records were grouped. The 5 most common were congestive heart failure without complications, with comorbidities, without surgery (13.5 percent); ischemic heart disease (6.04 percent); cerebrovascular disease (6.01 percent); COPD (4.9 percent); and occupational and environmental pulmonary disease (4.6 percent). The remaining most frequent chronic ETGs for readmission records included: (1) ischemic heart disease (4.6 percent); (2) other metabolic disorders (3.9 percent); (3) chronic renal failure (3.5 percent); (4) congestive heart failure with complication, with comorbidities, without surgery (3.5 percent); and (5) hypertension without complications, without comorbidities (2.8 percent). Overall, 53 percent of All Readmission claims grouped into these 10 chronic ETGs.

Table 40c. Rank Order: Top 10 Chronic Episodes Created: All Readmissions [a]

10 Most Common Chronic ETG into Which All Readmission Claims Grouped	N	%
Chronic heart failure without complications, with comorbidities, without surgery	2,835	13.5
Ischemic heart disease, without complications, with comorbidities, without surgery	1,268	6.0
Cerebrovascular accident without complications, with comorbidities, without surgery	1,262	6.0
COPD, without complications, with comorbidities, without surgery	1,021	4.9
Occupational & environmental pulmonary disease, with comorbidities; without surgery	969	4.6
Ischemic heart disease, with complications, with comorbidities, without surgery	961	4.6
Other met disorder, except cystic fibrosis, with comorbidities, without surgery	829	3.9
Chronic renal failure, without complications, with comorbidities	738	3.5
Chronic heart failure, with complications, with comorbidities, without surgery	732	3.5
Hypertension, without complications, with comorbidities	589	2.8

ETG=Ingenix Symmetry Episode Treatment Groups.

[a] N and % represent the N and percent of all Readmission claims.

6.9 Discussion

This chapter presents results from the grouping of Medicare claims using two commercially available episode groupers to examine how the commercial groupers grouped claims for post-acute care and for readmissions compared with how RTI grouped them. We used (1) Thomson Medstat Medical Episode Grouper (MEG) and (2) Ingenix Symmetry Episode Treatment Groups (ETG). RTI's claim assignment into episodes is based on time duration rather than the presence of a particular ICD-9 or procedure code. In contrast, the commercial groupers' logics are tied to having the related diagnosis codes on subsequent claims. Because past research has shown that diagnosis codes on claims across the episode are frequently different (particularly among post-acute care claims), this work explored our hypothesis that these differences will make reliance on using related diagnosis codes to link claims for post-acute care services and for rehospitalizations to hospitalizations within episodes less effective, especially in the Medicare population.

Overall, MEG grouped First PAC claims into episodes with the index admission to which RTI grouped it only about 44 percent of the time, and ETG did about 43 percent of the time. In MEG, First PAC claims that were Home Health were slightly more likely to group into MEG episodes with the index admission, yet only 48 percent of the time, and First PAC claims that were IRF were more likely to group into ETG episodes with the index admission, still only 56 percent of the time. This indicates that in general, Home Health and IRF diagnoses codes are more similar to the diagnosis codes on the index hospitalization claim than other PAC claim types (but not exact, as they group with the index admission only about half of

the time). Conversely, in both MEG and ETG, First PAC records that were Therapy were much less likely to group with the index admission record, indicating that the diagnoses codes on the Therapy claims are likely highly unrelated to the diagnosis code on the index admission.

First PAC claims after an acute index admission for joint replacement likely have very similar or related diagnosis codes as the index admission claim, as the claims grouped together in MEG episodes 72 percent of the time. A similar finding was noted in ETG for index admission for a stroke. Overall, the highest match rate noted in both MEG and ETG was in first home health claims after an index admission for stroke (82 percent and 84 percent, respectively). Home health claims likely have a high proportion of their diagnosis codes that match the diagnosis code on the acute hospitalization record, particularly after a hospitalization for stroke.

In addition to PAC claims, we also examined acute index admission claims that RTI had considered a "readmission" after an index hospitalization and assessed the proportion that grouped with those index admissions by the groupers. We stratified the rehospitalizations into those that occurred within 30 days of the index admission and those that occurred more than 30 days after the index admission, with the hypothesis that those that occurred within 30 days of the index admission were more likely "related" to that index admission and therefore would group into episodes with the index admission more frequently.

In MEG, only 20 percent of readmission claims that occurred within 30 days of an index acute admission, according to RTI logic, were grouped into MEG episodes with that index acute admission. Readmission claims after an index acute admission for pneumonia were slightly more likely to group with that index admission (32 percent), and readmission claims after an index acute admission for Joint Replacement were far less likely to group with that index admission (5 percent). It seems that acute hospitalizations within 30 days of a hospitalization for pneumonia likely have a diagnosis of pneumonia (or something closely related to pneumonia), whereas acute hospitalizations within 30 days of a hospitalization for joint replacement likely have a very different diagnosis. ETG results for readmissions were similar.

Overall, most of the readmission claims were grouped by the commercial groupers into episodes that had no other acute hospitalization claim, which indicates that the commercial groupers did not treat the claims that RTI considered "readmissions" as real "readmissions," but as index admissions that started a different episode. This was true most often for an index admission for joint replacement. What RTI considered a "rehospitalization" within 30 days of an admission for joint replacement, MEG considered the start of a new episode over 90 percent of the time, and ETG considered the start of a new episode about 80 percent of the time.

RTI presented the conceptual framework for the grouper analyses and their results to a Technical Expert Panel composed of clinicians from acute and PAC settings. The foundation of this discussion was to see if they agreed with our assessment that the commercial groupers that group claims into episodes based on related claim diagnosis codes were not the appropriate logic by which to group Medicare post-acute care claims into episodes of post-acute care. TEP participants reviewed the data described above. The TEP members were in agreement with our original hypothesis: the commercial episode groupers created post-acute care episodes using Medicare claims in a far different manner than RTI did. Relying on diagnosis codes to group claims into episodes of care resulted in relatively few PAC and readmission claims being associated with the index acute admission. Clearly this is because the diagnoses on PAC claims and claims that RTI considers "readmissions" were not always closely related to the diagnosis on the index hospitalization.