

Kidney Transplant Management Measure

Cost Measure Methodology

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1.0 Introduction

This document details the methodology for the Kidney Transplant Management measure and should be reviewed along with the Kidney Transplant Management Measure Codes List file, which contains the medical codes used in constructing the measure.

1.1 Measure Name

Kidney Transplant Management episode-based cost measure

1.2 Measure Description

Episode-based cost measures represent the cost to Medicare for the items and services provided to a patient during an episode of care (“episode”). In all supplemental documentation, the term “cost” generally means the standardized¹ Medicare allowed amount,² and claims data from Medicare Parts A, B, and D³ are used to construct this episode-based cost measure.

The Kidney Transplant Management episode-based cost measure evaluates a clinician’s or clinician group’s risk-adjusted and specialty-adjusted cost to Medicare for patients who receive medical care related to kidney transplant, beginning 90 days post-transplant. This chronic condition measure includes the costs of services that are clinically related to the attributed clinician’s role in managing care during a Kidney Transplant Management episode.

¹ Claim payments are standardized to account for differences in Medicare payments for the same service(s) across Medicare providers. Payment standardized costs remove the effect of differences in Medicare payment among health care providers that are the result of differences in regional health care provider expenses measured by hospital wage indexes and geographic price cost indexes or other payment adjustments such as those for teaching hospitals. For more information, please refer to the “CMS Part A and Part B Price (Payment) Standardization - Basics” and “CMS Part A and Part B Price (Payment) Standardization - Detailed Methods” documents posted on the [CMS Price \(Payment\) Standardization Overview](https://www.resdac.org/articles/cms-price-payment-standardization-overview) page (<https://www.resdac.org/articles/cms-price-payment-standardization-overview>).

Claim payments from Part D are payment standardized to allow resource use comparisons for providers who prescribe the same drug, even if the drug products are covered under varying Part D plans, produced by different manufacturers, or dispensed by separate pharmacies. For more information, please refer to the “CMS Part D Price (Payment) Standardization” document posted on the [CMS Price \(Payment\) Standardization Overview](https://www.resdac.org/articles/cms-price-payment-standardization-overview) page. (<https://www.resdac.org/articles/cms-price-payment-standardization-overview>).

² Cost is defined by allowed amounts on Medicare claims data, which include both Medicare trust fund payments and any applicable beneficiary deductible and coinsurance amounts.

³ Part D branded drug costs are also adjusted to account for post-point of sale drug rebates; more information can be found in the [Methodology for Rebates in Part D Standardized Amounts](https://www.cms.gov/medicare/quality-payment-program/cost-measures/about) on the CMS.gov QPP Cost Measures Information Page’s [About Cost Measures page](https://www.cms.gov/medicare/quality-payment-program/cost-measures/about) (<https://www.cms.gov/medicare/quality-payment-program/cost-measures/about>).

1.3 Measure Rationale

There are several opportunities for improvement and high-value care for kidney transplant patients. An analysis using the US Renal Data System of over 40,000 transplant recipients from 2005-2014 found that post-transplant readmissions make up 20% of all Medicare payments for transplantation, but up to half of these readmissions can be preventable.⁴ Readmissions within 30 days that have the highest costs are those associated with surgical complications, transplant rejection, and infection.⁵

Following clinical guidelines to test, screen, and monitor patients according to their level of risk, and following medication best practices, can also impact cost and quality of care. There is demonstrated variation in frequency of patient visits to transplant centers, by transplant center and region,⁶ suggesting opportunities for improvement in graft monitoring and reducing complications. Appropriate routine graft monitoring is important as it may ensure early detection of pathologies and reduce risk of graft failure. Research supports screening regularly for diabetes, hypertension, dyslipidemias, tobacco use, and obesity, to initiate early management of these conditions' interactions with kidney transplants.⁷

Clinicians can help lower drug costs as well as improve quality of management by following evidence-based guidelines. For instance, clinicians can optimize the dosage of long-term maintenance immunosuppressive medications by ensuring patients are on the lowest planned doses of maintenance medications by 2-4 months, absent transplant rejection.⁸ Clinicians can also follow additional published strategies to reduce drug costs, such as limiting the use of biologic agents for induction to patients at high risk of acute rejection and using lower-cost biosimilars when available. Care coordination can also ensure that responsible clinicians are aware of prescription changes and that patients are monitored following changes in medication regime.

Patient education may play a role in hospital readmissions and overall quality of care.⁹ Patient education regarding medication adherence, anticipated side effects and expected symptoms, diet, healthy lifestyle, as well as tobacco and proteinuria screening at office visits can also impact outcomes,¹⁰ as non-adherence has been shown to be associated with a high risk of acute rejection and allograft loss. Kidney transplant management care teams should have a system in place to address patient non-adherence, such as leveraging social workers, financial counselors, pharmacists, and others to engage with the patient and their family and monitor medication or other treatment adherence.

⁴ Hogan J et al. Assessing predictors of early and late hospital readmission after kidney transplantation. *Transplantation direct*. 2019 Aug;5(8).

⁵ Famure O, Kim ED, Au M, Zyla RE, Huang JW, Chen PX, Li Y, Kim SJ. What Are the Burden, Causes, and Costs of Early Hospital Readmissions After Kidney Transplantation? *Prog Transplant*. 2021 Jun;31(2):160-167. doi: 10.1177/15269248211003563. Epub 2021 Mar 24. PMID: 33759628; PMCID: PMC8182333.

⁶ Israni AK, Snyder JJ, Skeans MA, Tuomari AV, Maclean JR, Kasiske BL. Who is caring for kidney transplant patients? Variation by region, transplant center, and patient characteristics. *Am J Nephrol*. 2009;30(5):430-439.

⁷ Bia M, Adey DB, Bloom RD, Chan L, Kulkarni S, Tomlanovich S. KDOQI US commentary on the 2009 KDIGO clinical practice guideline for the care of kidney transplant recipients. *Am J Kidney Dis*. 2010 Aug;56(2):189-218. doi: 10.1053/j.ajkd.2010.04.010.

⁸ Ibid.

⁹ Harhay, M et al. Early rehospitalization after kidney transplantation: assessing preventability and prognosis. *American Journal of Transplantation*. 2013 Dec;13(12):3164-72.

¹⁰ Ibid.

The Kidney Transplant Management episode-based cost measure was selected for development based on input from the Chronic Kidney Disease (CKD) and End-Stage Renal Disease (ESRD) Clinician Expert Workgroup as well as the Wave 5 Public Comment Period, where experts and other interested members of the public recommended a parallel cost measure evaluating kidney transplant alongside the development of cost measures for stage 4 and 5 CKD and for ESRD. Clinical experts and other commenters noted that including the kidney transplant recipient population in cost measurement would align with the kidney care community's emphasis on post-transplant care and would help create beneficial incentives for providers.

1.4 Measure Numerator

The measure numerator is the weighted average ratio of the winsorized¹¹ scaled standardized observed cost to the scaled expected¹² cost for all Kidney Transplant Management episodes attributed to a clinician, where each ratio is weighted by each episode's number of days assigned to a clinician. This sum is then multiplied by the national average winsorized scaled observed episode cost to generate a dollar figure.

1.5 Measure Denominator

The measure denominator is the total number of days from Kidney Transplant Management episodes assigned to the clinician across all patients.

1.6 Data Sources

The Kidney Transplant Management measure uses the following data sources:

- Medicare Part A, B, and D claims data from the Common Working File (CWF)
- Enrollment Database (EDB)
- Long Term Care Minimum Data Set (LTC MDS)¹³
- Organ Procurement and Transplantation Network (OPTN)

1.7 Care Settings

The Kidney Transplant Management measure focuses on the care provided by clinicians practicing in non-inpatient hospital settings for patients with care related to kidney transplant. The most frequent settings in which a Kidney Transplant Management episode is triggered include: office and outpatient hospital.

1.8 Cohort

The cohort for this cost measure consists of patients who are Medicare beneficiaries enrolled in Medicare fee-for-service who receive medical care related to kidney transplant, beginning 90 days post-transplant.

The cohort for this cost measure is also further refined by the definition of the episode group and measure-specific exclusions (refer to Section 4).

¹¹ For information on how costs are winsorized, please refer to Section 4.7.

¹² Expected costs refer to costs predicted by the risk adjustment model. For more information on expected costs and risk adjustment, please refer to Section 4.7.

¹³ For information on how LTC MDS data are used in risk adjustment, please refer to Section 4.7.

2.0 Methodology Steps

There are 2 overarching processes in calculating chronic condition episode-based cost measure scores: episode construction (Steps 1-5) and measure calculation (Steps 6-8). This section provides a brief summary of these processes for the Kidney Transplant Management measure. Section 4 describes the processes in detail and further defines the related concepts.

1. **Identify patients receiving care:** A trigger event identifies the start or continuation of a clinician group's management of a patient's chronic condition. A trigger event is identified by the occurrence of 2 Part B Physician/Supplier (Carrier) claims billed by the same clinician group practice within 180 days of one another. The pair of services must include a trigger claim and a confirming claim. The trigger claim is any code from a set of CPT/HCPCS codes for clinically relevant outpatient services when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. The confirming claim can be either another trigger code, or a confirming code from an additional set of CPT/HCPCS codes when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. Once a trigger event is identified, this opens a one-year attribution window from the point of the trigger claim, in which the patient's chronic condition care will be monitored by a clinician group.
2. **Identify the total length of care between a patient and a clinician group:** Once an attribution window is opened, it continues for 1 year unless there is a service that demonstrates a continuing care relationship, also known as a reaffirming claim. This service is billed during an open attribution window (from Step 1) by the same clinician group that billed the trigger event, and reaffirms and extends a clinician group's responsibility for managing a patient's chronic condition. A reaffirming claim is another instance of any confirming code.¹⁴ After a reaffirming claim is identified, the attribution window is extended by 1 year from the point of each reaffirming claim billed during an open attribution window. The total attribution window begins with the trigger claim and concludes 1 year after the final reaffirming claim. Therefore, the total attribution window can span multiple years and vary in length for different patients. This requires that the total attribution window is measured incrementally and periodically across multiple measurement periods.
3. **Define an episode:** Episodes are segments of the total attribution window that are counted in a particular measurement period, allowing clinicians to have their costs for Kidney Transplant Management episodes assessed for that year. Episodes are assigned to a clinician group (identified by Tax Identification Number [TIN]) or individual clinicians (identified by combination of TIN and National Provider Identifier [TIN-NPI]), and can vary in length. Episodes are assessed in the measurement period in which they conclude and only attribute days not previously measured in preceding measurement periods, so there is no double counting of episode costs.
4. **Attribute the episode to the clinician group and clinician(s):** The episode is attributed to the clinician group that bills the trigger and confirming claims for the total attribution window. To attribute the episode to an individual clinician, any clinician within the attributed clinician group who plays a substantial role in the care for the patient (i.e., billing at least 30% of trigger or confirming codes on Part B Physician/Supplier claim lines during the episode) is

¹⁴ While a trigger event requires two claims, a single reaffirming claim is needed to extend a clinician group's responsibility for managing a patient's chronic condition. This is because workgroups who have developed chronic condition measures to-date have favored a less strict reaffirming algorithm, indicating that once a clinician-patient relationship was established, a single reaffirming claim would be sufficient to extend the attribution window.

attributed the episode. There are also additional checks to ensure that clinicians are not attributed to an episode before they have their first encounter with the patient and that we capture appropriate specialties through prescription billing patterns.

5. **Assign costs to the episode and calculate the episode scaled observed cost:** Services that are clinically related to the care and management of a patient's chronic condition that occur during the episode are included in the measure. The standardized cost of the assigned services is summed and averaged across the number of days in an episode. This average daily cost is then multiplied by 365 to determine each episode's scaled (i.e., annualized) standardized observed cost.
6. **Exclude episodes:** Exclusions remove unique groups of patients or episodes from cost measure calculation in cases where it may be impractical or unfair to compare the costs of caring for these patients to the costs of caring for the cohort at large.
7. **Calculate the scaled expected cost for risk adjustment:** Risk adjustment predicts the expected costs by adjusting for factors outside of the clinician's or clinician group's reasonable influence (e.g., patient age, comorbidities, dual Medicare and Medicaid eligibility status, clinician specialty, and other factors). The episode group's scaled standardized observed costs are winsorized at the 98th percentile for each model to handle extreme observations. A regression is then run using the risk adjustment variables as covariates to estimate the expected cost of each episode. Further statistical techniques are applied to reduce the effects of extreme outliers on measure scores.
8. **Calculate the measure score:** For each episode, the ratio of winsorized scaled standardized observed cost to scaled expected cost (both of which are from Step 7) is calculated. The measure is calculated as a weighted average of these ratios across all of a clinician's or clinician group's attributed episodes, where the weighting is each episode's number of assigned days. The weighted average episode cost ratio is then multiplied by the national average winsorized scaled observed episode cost to generate a dollar figure for the cost measure score.

3.0 Measure Specifications Quick Reference

This page provides a quick, at-a-glance reference for the Kidney Transplant Management measure specifications. More details on each component can be found in Section 4, and the full list of codes and logic used to define each component can be found within the Kidney Transplant Management Measure Codes List file.

Episode Window: During what time period are costs measured?

An episode is a segment of time during which clinicians or clinician groups are assessed for the care that they provide to a patient with care related to kidney transplant.

- Kidney Transplant Management episodes can only be triggered beginning 90 days after transplant surgery.
- The episode window length for the Kidney Transplant Management measure is between 1 year (365 days) and 2 years minus 1 day (729 days), and can vary in length across patients.

Triggers: How does the measure identify the patient cohort and start of care?

- Patients receiving medical care for treatment of their care related to kidney transplant beginning at least 90 days post-transplant are included in the measure.
- The start or continuation of a clinician group's management of a patient's care related to kidney transplant is identified by the appearance of a pair of services within 180 days of one another: a **trigger code** followed by a **confirming code**. For the Kidney Transplant Management measure:
 - A **trigger code** is any code from a set of CPT/HCPCS codes for clinically relevant outpatient services (outpatient E&Ms or kidney education) when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant.
 - A **confirming code** is either any code from the same trigger set of CPT/HCPCS codes for clinically relevant outpatient services when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant, or a code from an additional set of CPT/HCPCS codes (for laboratory tests, transplant medication, or antibody treatment) when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant.

Service Assignment: Which clinically related costs are included in the measure?

Assigned services generally fall within the following clinical themes:

- Physician Services - Renal, Infection, Other
- Lab; Imaging; Medications; Part D Medication
- Emergency Room Use; Hospitalizations - Renal Related, Dialysis Access, Infections, Hematologic Complications, Cardiovascular and Pulmonary, Diabetic Complications, Other
- Other Surgical Services; Other Surgical Services - Hematologic Complications; Other Surgical Services - Infections; Post-Acute Care; DME Including Enteral/Parenteral Nutrition

Risk Adjustors: Which risk factors are accounted for in the risk adjustment model?

- Risk adjustors for factors specific to the condition, including prior heart failure hospitalization, frailty, two or more prior kidney transplants, age of the transplant, prior transplant rejection treatment, an episode that ended in renal failure, prior glomerulonephritis, prior lupus nephritis, prior BK nephropathy, prior cytomegalovirus (CMV) viremia, prior other organ transplant, incompatible donor blood type, human leukocyte antigen (HLA) immune incompatibility, highly sensitized patients, and characteristics of the kidney donor (whether living vs. deceased, whether positive for hepatitis C for living donors, and the Kidney Donor Profile Index [KDPI] for deceased donors). For the full list of standard and measure-specific risk adjustment variables, please reference the "RA" and "RA_Details" tabs of the Measure Codes List file.
- Standard risk adjustors from the CMS Hierarchical Condition Category (HCC) ESRD (CMS-HCC ESRD) 2021 Risk Adjustment Model, count of HCCs, interaction variables accounting for a range of comorbidities, patient age category, patient disability status, patient dual eligibility, number and types of clinician specialties from which the patient has received care, and recent use of institutional long-term care.

- A separate log-linear regression is run for each Part D enrollment status to ensure fair comparison. The episode group's scaled (i.e., annualized) observed costs are winsorized at the 98th percentile prior to the regression for each model to handle extreme observations.

Exclusions: Which populations are excluded from the measure?

- Measure-specific exclusions including atypical hemolytic-uremic syndrome (HUS).
- Standard exclusions to ensure data completeness:
 - The patient has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the episode window.
 - The patient was not enrolled in Medicare Parts A and B for the entirety of the lookback period plus episode window, or was enrolled in Part C for any part of the lookback plus episode window.
 - The patient was not found in the Medicare Enrollment Database (EDB).
 - The patient's death date occurred before the episode end date.
 - The patient has an episode window shorter than one year.
 - The patient has extremely low treatment costs.
 - The patient resided outside the United States or its territories during the episode window.

4.0 Detailed Measure Methodology

This section contains the technical details for the 2 overarching processes in calculating the Kidney Transplant Management cost measure in more detail: Sections 4.1 through 4.5 describe episode construction, and Sections 4.6 through 4.8 describe measure calculation.

4.1 Identify Patients Receiving Care

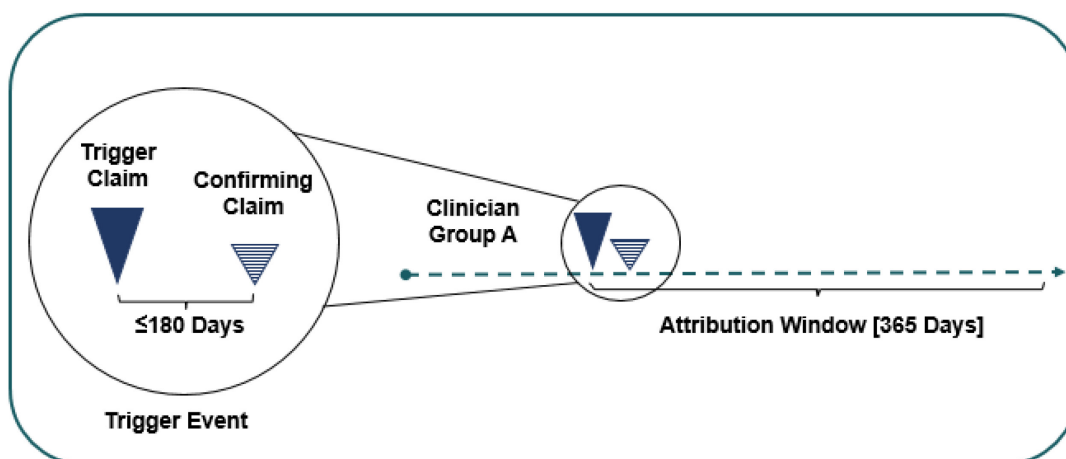
A **trigger event** is used to indicate the start of a clinician group's management of a patient's care related to kidney transplant and is identified by the occurrence of 2 Part B Physician/Supplier (Carrier) claims billed by the same clinician group practice. To identify a trigger event, the following 2 claims must be billed within the trigger window (within 180 days of one another): a **trigger claim**, followed by a **confirming claim**. Claims occurring less than 90 days after transplant surgery are not eligible for consideration as trigger, confirming, or reaffirming claims.

- A **trigger claim** is a Part B Physician/Supplier claim that contains a trigger code. For the Kidney Transplant Management measure, a trigger code is:
 - Any code from a set of CPT/HCPCS codes for clinically relevant outpatient services when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. These outpatient services can be summarized as:
 - Outpatient E&Ms
 - Kidney education
- A **confirming claim** is a second Part B Physician/Supplier claim billed by the same clinician group practice as the trigger claim, which contains a confirming code. For the Kidney Transplant Management measure, a confirming code is:
 - Any code from the same trigger set of CPT/HCPCS codes for clinically relevant outpatient services when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant, as listed above in trigger codes, or
 - Any code from an additional set of CPT/HCPCS codes, when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. These additional services can be summarized as:
 - Transplant medication
 - Laboratory tests
 - Antibody treatment

For the full list of trigger and confirming codes, as well as the requisite diagnosis codes, please refer to the "Trigger_Confirming" and "Trigger_DGN" tabs of the Kidney Transplant Management Measure Codes List file.

Once the trigger event is identified, the trigger event opens an **attribution window**, which is a year-long time period that begins on the date of the trigger claim. The attribution window defines a time period during which the patient's care related to kidney transplant care will be monitored by a clinician group.

Figure 1. Trigger Event and Attribution Window



The Kidney Transplant Management attribution window will be terminated at the time that a claim occurs that shows evidence of dialysis or evidence that the transplant has failed.

4.2 Identify the Total Length of Care Between a Patient and a Clinician Group

When the beginning of the clinician-patient relationship is identified, there might be evidence of a continuation of this relationship, as identified by reaffirming claims. A **reaffirming claim** is a service billed during an open attribution window by the same clinician group that billed the trigger event, and it reaffirms and extends a clinician group's responsibility for managing a patient's care related to kidney transplant. A reaffirming claim has the same definition as a confirming claim as defined in Section 4.1, meaning that a reaffirming claim is either:

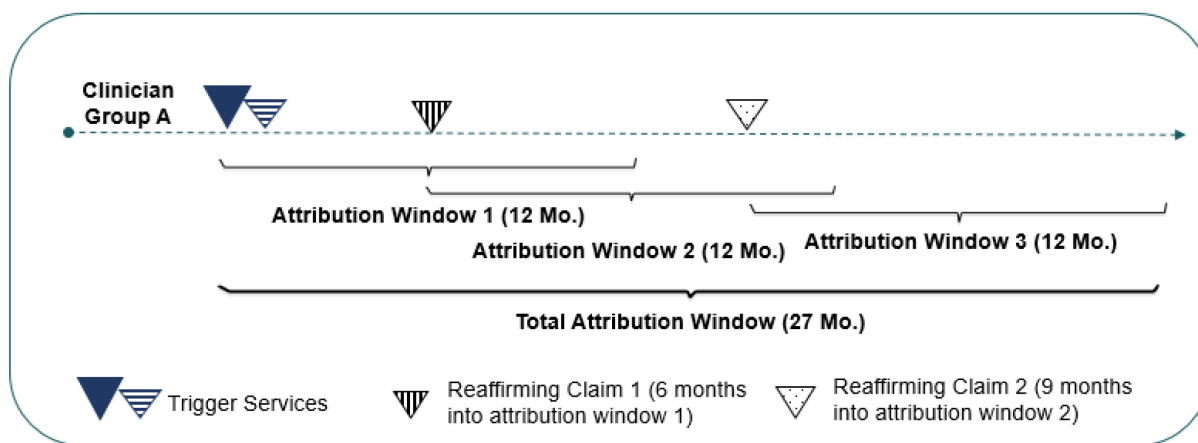
- Any code from the set of trigger CPT/HCPCS codes for clinically relevant outpatient services when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. These outpatient services can be summarized as:
 - Outpatient E&Ms
 - Kidney education
- Any code from the additional set of confirming CPT/HCPCS codes, when accompanied by an ICD-10 diagnosis code indicating care related to kidney transplant. These additional services include:
 - Transplant medication
 - Laboratory tests
 - Antibody treatment

Claims occurring less than 90 days after transplant surgery are not eligible for consideration as a reaffirming claim. Each time a reaffirming claim is identified during an open attribution window, the attribution window will be extended by 1 year from the point of the reaffirming claim. The resulting overall time period of responsibility is defined as the **total attribution window**, which begins with the trigger claim and concludes 1 year after the final reaffirming claim. Therefore, the total attribution window can span multiple years and vary in length for different patients. Appendix A contains an illustration of the relationship between a trigger event, reaffirming claims, and a total attribution window.

Figure 2 below contains an example illustration of the relationship between a trigger event, reaffirming claims, and a total attribution window. In this hypothetical example, reaffirming claim

1 occurs 6 months into attribution window 1 and extends that attribution window by 1 year (until the end of attribution window 2), and then reaffirming claim 2 occurs 9 months into attribution window 2, extending that attribution window by another year (until the end of attribution window 3). Once all reaffirming claims are identified, the total period of time of the clinician-patient relationship is defined as the period covered by all attribution windows, beginning with the trigger claim and concluding 1 year after the final reaffirming claim. For this example, the total attribution window is 27 months long.

Figure 2. Example of Reaffirming Claims and Total Attribution Window



4.3 Define an Episode

Once the total attribution window has been constructed, it is divided into segments of time, also known as episodes. Episodes allow the measure to be calculated for a given measurement period, which is a static year-long period (i.e., calendar year) in which a clinician or clinician group will be measured.

An **episode** is defined, at a minimum, as a one-year segment of the total attribution window. Episodes are assessed in the measurement period in which they end and only include days not previously measured in preceding measurement periods. Clinicians or clinician groups are measured on a patient at the end of the calendar year if there are at least 365 days' worth of claims data that has not previously been assessed or when the total attribution window ends, ensuring that costs are only assessed once. The episode window lengths may vary depending on the length of the total attribution window and the number of days that have not been assessed in preceding measurement periods.

After the episode windows are constructed, the number of assigned days for each episode is determined and used as a weighting factor in the measure score calculation step. This weighting is done to ensure fair comparison across episodes, where cost is effectively scaled respective to the episode length to allow like comparisons between episodes of similar length. Appendix A contains a simplified example of episode construction, as well as a more detailed illustration of episode construction and assignment of days.

1. 365-day episode window, where there are no reaffirming claims during the year-long total attribution window
 - The episode **start date** is set as the start date of the total attribution window.
 - The episode **end date** is set as 365 days after the episode start date.
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.

2. 366- to 729-day episode window, where reaffirming claims extend the total attribution window to greater than one year
 - The episode **start date** is set as the start date of the total attribution window.
 - The episode **end date** is set as either:
 - The end of the total attribution window (which is 366 to 729 days after the episode start date), if the total attribution window ends by December 31 of the next calendar year (i.e., the measurement year);
 - December 31 of the next full calendar year (which is 366 to 729 days after the episode start date), if the total attribution window extends beyond December 31 of the next calendar year (i.e., the measurement year).
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.
3. 365-day episode window, where reaffirming events have resulted in a total attribution window that is at least two years in length that can be split into 365-day segments across multiple measurement periods
 - The episode **start date** is set as the beginning of a new calendar year (January 1) if it is a subsequent episode with at least 365 days' worth of claims data not captured in a preceding measurement period.
 - The episode **end date** is set as 365 days after the episode start date, at the end of that calendar year (December 31).
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days equals the number of days in the episode.
4. 365-day episode window, where the total attribution window concludes after a segment was measured in the previous measurement period
 - The episode **start date** is set as 365 days prior to the total attribution window end date if the remaining number of assigned days in the total attribution window is less than 365 days.
 - The episode **end date** is set as the end date of the total attribution window.
 - **Assign** the total number of days that have not been previously measured in the preceding episodes. In this case, the number of assigned days is smaller than the number of days in the episode, since the episode window would partially overlap with the preceding episode window. Only days not previously measured are assigned to the episode. This is done to ensure there is no double counting of episode costs.

4.4 Attribute the Episode to a Clinician Group or a Clinician

Once an episode has been defined, it is attributed to one or more clinicians of a specialty that is eligible for MIPS. The episodes are attributed to clinician groups, who are identified by their unique TIN, and individual clinicians, who are identified by their TIN and NPI pair (TIN-NPI). For codes relevant to this section, please see the "Attribution" tab of the Kidney Transplant Management Measure Codes List file.

TIN level attribution: An episode is attributed to the clinician group that billed the trigger event (trigger and confirming claims) for the total attribution window. Additionally, at least one clinician within the clinician group must have billed at least 2 condition-related prescriptions on different days to 2 different patients during the measurement period plus a one-year lookback period. The clinically related costs from the total number of assigned days are attributed to that clinician group.

TIN-NPI level attribution: An episode is attributed to any clinician within the attributed clinician group that billed at least 30% of the trigger or confirming codes on Part B Physician/Supplier claim lines during the episode.¹⁵ The measure's attribution methodology also imposes additional checks to ensure that TIN-NPIs are appropriately attributed. Specifically, TIN-NPIs that meet the 30% threshold must have:

- billed at least one trigger or confirming code within 1 year prior to or on the episode start date, and
- billed at least 2 condition-related prescriptions on different days to 2 different patients during the measurement period plus a one-year lookback period.

Future attribution rules may benefit from the implementation of patient relationship categories¹⁶ and codes.¹⁷ As required by section 101(f) of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA), the Centers for Medicare & Medicaid Services (CMS) will consider how to incorporate the patient relationship categories into episode-based cost measurement methodology as clinicians and billing experts gain experience with them.¹⁸

4.5 Assign Costs to an Episode and Calculate Episode Scaled Observed Costs

Medicare Parts A, B, and D services, and their costs, are assigned to an episode only when clinically related to the management and treatment of the patient's care related to kidney transplant during the episode. Assigned services may include treatment and diagnostic services, ancillary items, services directly related to treatment, and those furnished as a consequence of care (e.g., complications, readmissions, unplanned care, and emergency department visits). Unrelated services are not assigned to the episode. For example, the cost of care for a procedure that occurs during the episode that is not clinically related to the management and treatment of the patient's care related to kidney transplant (i.e., a knee arthroplasty) would not be assigned to the episode.

To ensure that only clinically related services are included, services during the episode window are assigned to the episode based on a series of service assignment rules, which are listed in the "Service_Assignment_AB" and "Service_Assignment_D" tabs of the Kidney Transplant Management Measure Codes List file.

For the Kidney Transplant Management episode group, services performed in the following service categories are considered for assignment to the episode:

- Outpatient (OP) Facility and Clinician Services
- Emergency Department (ED)

¹⁵ For a diagram illustrating an example of attribution to a TIN and TIN-NPI, please refer to Appendix B.

¹⁶ The MACRA Patient Relationship Categories aim to distinguish the relationship and responsibility of a clinician with a patient at the time of furnishing an item or service, thereby facilitating the attribution of patients and episodes to one or more clinicians for purposes of measure score calculations. For more information on Patient Relationship Categories, please refer to the Patient Relationship Categories and codes operational list. (<https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/CMS-Patient-Relationship-Categories-and-Codes.pdf>)

¹⁷ The MACRA Patient Relationship Codes are HCPCS Level II modifier codes that clinicians report on claims to identify their patient relationship category. For the Patient Relationship Codes, please see Table 27 of the CY 2018 Physician Fee Schedule final rule. (<https://www.federalregister.gov/d/2017-23953/p-2203>)

¹⁸ For more information on the Patient Relationship Categories and Codes, please download the Patient Relationship Categories and Codes FAQ. (<https://gpp-cm-prod-content.s3.amazonaws.com/uploads/236/Patient-Relationship-Categories-and-Codes-webinar-FAQ.pdf>)

- Inpatient (IP) - Medical
- Inpatient Rehabilitation Facility (IRF), Long Term Care Hospital (LTCH), SNF¹⁹
- Part D drugs

In addition to service category, service assignment rules may be modified based on the service category in which the service is performed, as listed above. Service assignment rules can also be defined based on specific service information alone or service information combined with diagnosis information. Services may be assigned to the episode based on the following combinations:

- High level service code alone
- High level service code combined with first 3 digits of the ICD-10 diagnosis code
- High level service code combined with more specific service code
- High level service code combined with more specific service code and with 3-digit ICD-10 diagnosis code

The steps for assigning costs are as follows:

- **Identify** all services on claims with positive standardized payment that occur within the episode window.
- **Assign** identified services to the episode based on the types of service assignment rules described above.
- **Assign** all trigger and reaffirming Part B Physician/Supplier claims occurring during the episode window.
- **Assign** all SNF stays based on the following criteria:
 - Identify SNF stays where both (i) the SNF stay's qualifying IP stay is assigned to episode and (ii) the SNF stay occurs during the episode window.
 - For those identified SNF stays, determine the number of days that overlap with the episode window; if the overlap is greater than 30 days, cap claim amount assigned to the episode at 30 days.
- **Assign** all IRF and LTCH stays based on the following criteria:
 - Identify IRF and LTCH stays for which (i) there is a preceding IP stay discharged within 7 days prior to the stay's start date, (ii) the preceding IP stay is assigned to the episode, and (iii) the IRF and LTCH stays occur during the episode window.
 - For those identified IRF and LTCH stays, determine the distribution of grouped claim cost across episodes and cap claim amount assigned to the episode at the 90th percentile of each observed cost distribution.²⁰
- **Assign** all inpatient E&M claims during IP stays assigned to episode.
- **Sum** the standardized Medicare allowed amounts for all claims assigned to each episode to obtain the total standardized episode observed cost.
- **Average** the total standardized episode observed cost over the number of days in the episode to get the episode average daily standardized observed cost.
- **Multiply** the episode average daily standardized observed cost by 365 to get the episode scaled (annualized) standardized observed cost.

¹⁹ Services performed in the IRF, LTCH, and SNF settings are assigned to an episode based on their association with the grouped IP stay.

²⁰ Capping costs aims to limit the effects of extreme observed cost values on episode observed costs. Capping involves limiting the amount of claim costs that a provider can be assigned during an episode. For Kidney Transplant Management episodes with related LTCH and/or IRF costs, the value of the 90th percentile is assigned to all LTCH and IRF observed costs above the 90th percentile.

Service Assignment Example

- Clinician Group A has been providing continuous care management for Patient K's care related to kidney transplant, and is attributed an episode with Patient K during the measurement period.
- Clinician Group A administers prednisone to prevent transplant rejection for Patient K during the episode window. Because the prednisone for transplant rejection prevention is considered a clinically related service, its costs will be assigned to Clinician Group A's Kidney Transplant Management episode with Patient K.

4.6 Exclude Episodes

Before measure calculation, episode exclusions are applied to remove certain episodes from measure score calculation. Certain exclusions are applied across all chronic condition episode groups, and other exclusions are specific to this measure, based on consideration of the clinical characteristics of a homogenous patient cohort. All measure-specific exclusions are listed in the "Exclusions" and "Exclusions_Details" tabs in the Kidney Transplant Management Measure Codes List file.

Episodes are excluded from the Kidney Transplant Management measure if they meet any of the following cross-episode group conditions:

- The patient has a primary payer other than Medicare for any time overlapping the episode window or 120-day lookback period prior to the episode window.
- The patient was not enrolled in Medicare Parts A and B for the entirety of the 120-day lookback period plus episode window, or was enrolled in Part C for any part of the 120-day lookback period plus episode window.
- The patient is not found in the Medicare EDB.
- The patient has an episode window shorter than 1 year.
- The patient's death date occurred before the episode end date.
- The patient has extremely low treatment costs.
- The patient resided outside the United States or its territories during the episode window.

4.7 Estimate Scaled Expected Costs for Risk Adjustment

Risk adjustment is used to estimate episode expected costs in recognition of the different levels of care patients may require due to comorbidities, disability, age, specialty care, and other risk factors. The risk adjustment model includes variables from the CMS Hierarchical Condition Category End-Stage Renal Disease (CMS-HCC ESRD) 2021 Risk Adjustment Model,²¹ as well as other standard risk adjustors (e.g., patient age) and variables for clinical factors that may be outside the attributed clinician's reasonable influence. A full list of risk adjustment variables can be found in the "RA" and the "RA_Details" tabs of the Kidney Transplant Management Measure Codes List file.

²¹ CMS uses an HCC risk adjustment model to calculate risk scores. The HCC model ranks diagnoses into categories that represent conditions with similar cost patterns. Higher categories represent higher predicted healthcare costs, resulting in higher risk scores.

Steps for defining risk adjustment variables and estimating the risk adjustment model are as follows:

- **Define** HCC, number and types of clinician specialties from which the patient has received care,²² and episode group-specific risk adjustors using service and diagnosis information found on the patient's Medicare claims history in the 120-day default lookback period prior to the episode start date (or the timing specified in the "RA_Details" tab of the Measure Codes List file) for certain billing codes that indicate the presence of a procedure, condition, or characteristic. For clinician specialty information, include information obtained on the episode start date.
 - **Create** the following categories to identify HCC frequency as a marker of patient comorbidity: 0, 1, 2-3, 4-6, and 7+ HCCs.
- **Define** other risk adjustors that rely upon Medicare beneficiary enrollment and assessment data as follows:
 - Identify beneficiaries who are originally "Disabled without ESRD" or "Disabled with ESRD" using the original reason for joining Medicare field in the Medicare beneficiary EDB.
 - Identify beneficiaries who have spent at least 90 days in a long-term care institution (LTCI) without having been discharged to the community for 14 days, using LTC MDS assessment data. Then, identify the beneficiaries whose Kidney Transplant Management episode start date overlaps with their stay in an LTCI.
 - Identify beneficiaries who have partial or full dual Medicare and Medicaid eligibility status as of the episode start date; adjust for dual eligibility status when risk-adjusted costs are on average higher for dually enrolled beneficiaries (i.e., drop risk adjustor when coefficient is less than 0).
- **Define** other risk adjustors for factors related to the transplanted kidney using OPTN data.
- **Drop** risk adjustors that are defined for less than 15 episodes nationally for each Part D enrollment status to avoid using very small samples.
- **Categorize** beneficiaries into age ranges using their date of birth information in the Medicare beneficiary EDB. If an age range has a cell count less than 15, collapse this in the next adjacent age range category towards the reference category (65-69).

The following steps are performed separately for each Part D enrollment status:

- **Winsorize**²³ the episode scaled observed cost as follows:
 - **Assign** the value of the 98th percentile to all episode scaled observed costs above the 98th percentile.
- **Run** a log-linear regression model to estimate the relationship between all the risk adjustment variables and the dependent variable, the episode winsorized scaled

²² Specialty groups include Allergy/Immunology, Anesthesiology, Behavioral Medicine, Cardiology, Chest Surgery, Chiropractor, Critical Care, Dentistry, Dermatology, Diagnostic Imaging, Emergency Medicine, Endocrinology, Facility, Gastroenterology, General Medicine/Family Practice, General Surgery and Surgical Oncology, Hospice and Palliative Care, Infectious Disease, Interventional Radiology, Nephrology, Neurology, Neurosurgery, NP/PA/Nurse Specialists.

²³ Winsorization aims to limit the effects of extreme values on expected costs. Winsorization is a statistical transformation that limits extreme values in data to reduce the effect of possible outliers. Winsorization of the lower end of the distribution (i.e., bottom coding) involves setting extremely low predicted values below a predetermined limit to be equal to that predetermined limit, and similarly for the higher end of the distribution involves setting extremely high predicted values above a predetermined limit to be equal to that predetermined limit.

observed cost calculated from the previous step, to obtain the episode scaled expected cost.

- **Re-transform** values from log scale to original (untransformed) cost scale to obtain the risk-adjusted episode cost.
- **Exclude** episodes with residual values less than the 1st percentile or higher than the 99th percentile to mitigate the impact that these episodes could have on the measure scores, and renormalize the expected cost after removal of outliers.

4.8 Calculate Measure Score

Measure scores are calculated for a clinician or clinician group practice as follows:

- **Calculate** the ratio of winsorized scaled standardized observed cost to scaled expected episode cost for each episode attributed to the clinician or clinician group.
- **Calculate** the measure as a weighted average of these ratios across all of a clinician's or a clinician group's attributed episodes, where the weighting is the number of assigned days for a clinician or a clinician group during the episode.
- **Multiply** the weighted average episode cost ratio by the national average winsorized scaled observed episode cost to generate a dollar figure for the cost measure score.

The clinician-level (or clinician group practice-level) risk-adjusted and specialty-adjusted cost for any attributed clinician (or clinician group practice) “j” can be represented mathematically as:

$$Measure\ Score_j = \left[\frac{1}{n_j} \sum_{i \in \{I_j\}} \left(\frac{Y_{ij}}{\hat{Y}_{ij}} \times n_{ij} \right) \right] * \left(\frac{1}{N} \sum_{i \in \{I\}} Y_i \right)$$

where:

Y_{ij}	is the winsorized scaled observed payment for episode i and attributed clinician (or clinician group practice) j
\hat{Y}_{ij}	is the scaled expected payment for episode i and attributed clinician (or clinician group practice) j
n_{ij}	is the number of assigned days for episode i and attributed clinician group practice j
n_j	is the total number of days assigned to attributed clinician (or clinician group practice) j across all episodes (summation of n_{ij})
N	is the total number of episodes attributed to clinicians (or clinician group practices) nationally
Y_i	is the winsorized scaled observed payment for episode i
$i \in \{I_j\}$	is all episodes attributed to clinician (or clinician group practice) j
$i \in \{I\}$	is all episodes attributed to clinicians (or clinician group practices) nationally

A diagram demonstrating a visual depiction of an example measure calculation can be found in Appendix C.

A lower measure score indicates that the observed episode costs are lower than or similar to expected costs for the care for the particular patients and episodes included in the calculation.

A higher measure score indicates that the observed episode costs are higher than expected for the care provided for the particular patients and episodes included in the calculation.

Appendix A. Example Illustrations of Scenarios for Episode Construction and Assignment of Days

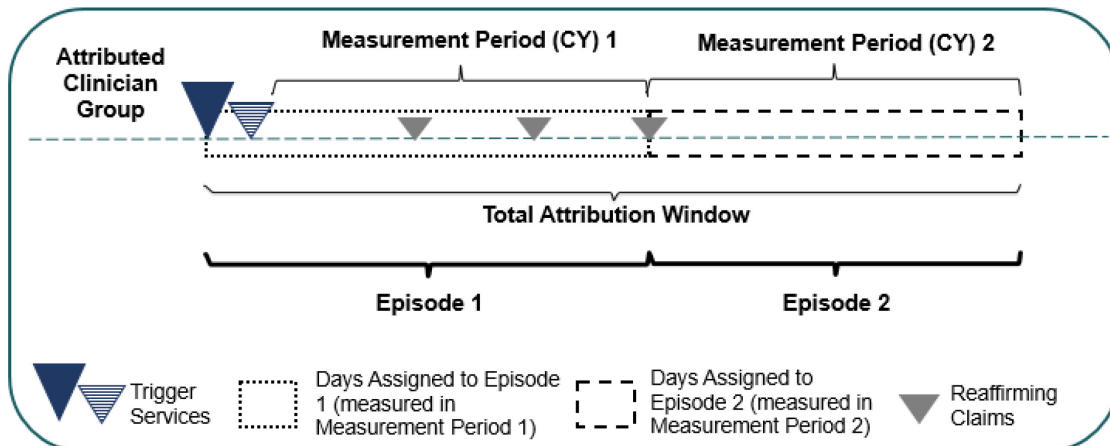
This appendix provides additional details on how an episode is constructed and attributed to a particular measurement period, and how days are assigned to an episode.

A.1. Simple Example of Defining an Episode

In Figure A-1 below:

- Episode 1 is a portion of the total attribution window that starts on the day of the trigger claim and concludes at the end of the subsequent measurement period (December 31). Since episode 1 ends in measurement period 1, the associated costs will be measured in measurement period 1.
- Episode 2 is a one-year long portion of the total attribution window that starts at the beginning of measurement period 2 (January 1) and ends at the end of the measurement period (December 31). Since episode 2 ends in measurement period 2, the associated costs will be measured in measurement period 2.

Figure A-1. Episode Windows



A.2. Episode Construction Examples

The figures below provide examples of how episodes are constructed and attributed to a particular measurement period. Overall, an episode's window is defined based on:

- whether the patient-clinician relationship during the measurement period was continuous, and
- the amount of claims data that has not been assessed in preceding measurement periods.

These examples also show how days are assigned to episodes. In each of these examples, we focus on episodes assessed in measurement period 2, which are used in Appendix C to demonstrate how the measure score is calculated in a given measurement period. Assigned days are used as a weighting factor at the measure score calculation step, where the observed to expected ratio of each episode is weighted by the number of assigned days to that episode and then averaged over all episodes attributed to the clinician or clinician group. Therefore, to

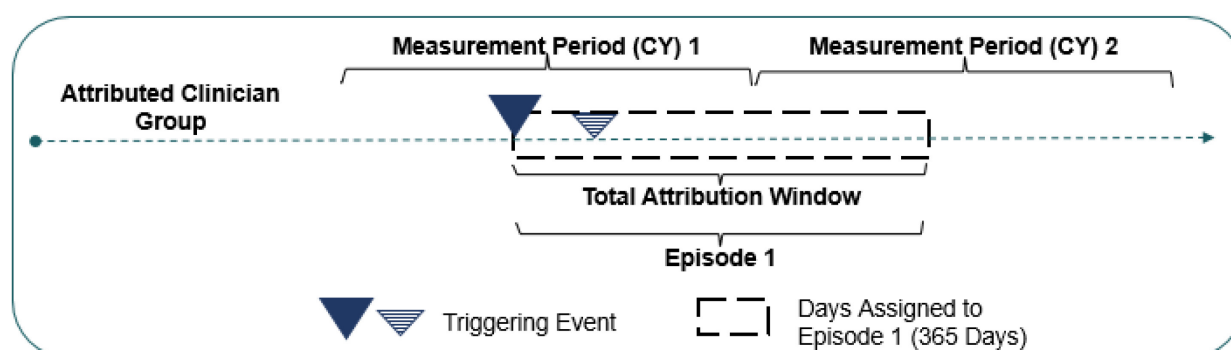
ensure fair comparison, longer episodes are given more weight during measure calculation than shorter episodes.

Episode Window 1. 365 Days; No Reaffirming Claims During the Total Attribution Window

Figure A-2 illustrates a Kidney Transplant Management episode that is 365 days long. This episode begins during the first measurement period with a pair of triggering services that opens a one-year long attribution window that extends into the second measurement period. While a reaffirming service would have extended the relationship between the patient and the attributed clinician, the absence of a reaffirming claim ends this clinician-patient relationship after 365 days. Therefore, in this example, the length of the total attribution window and the episode are the same.

- **Measurement Period 1:** Costs will not be assessed during measurement period 1 because there was not a year's worth of claims data to assess during this measurement period.
- **Measurement Period 2:** Costs will be assessed during measurement period 2 because the episode ended in measurement period 2 and contained a year's worth of claims data that have not been previously assessed.
 - Since none of the days were previously assessed, all 365 days would be assigned to episode 1 and would be used as a weighting factor at the measure score calculation step.

Figure A-2. Episode Window (365 Days; No Reaffirming Claims)



Episode Window 2. 366 to 729 days; Reaffirming Claims During the Total Attribution Window

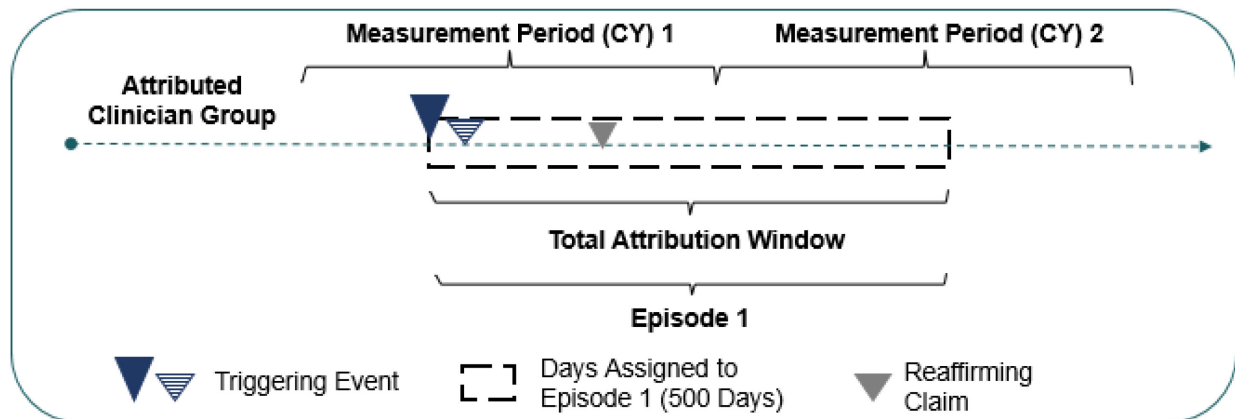
Figure A-3 illustrates a Kidney Transplant Management episode that is longer than 365 days.²⁴ This episode begins during measurement period 1, contains 1 reaffirming claim 135 days into the attribution window that extends the initial attribution window by another 365 days, and ends 500 days after the trigger claim during measurement period 2.

- **Measurement Period 1:** Costs will not be assessed during measurement period 1 because of the absence of a year's worth of claims data to assess during this measurement period.

²⁴ Episodes can be up to 729 days long. At 730 days, the patient's episode would be split into 2 distinct 365-day long episodes because there would be a year's worth of claims data available in each episode.

- **Measurement Period 2:** Costs will be assessed during measurement period 2 because the episode ended in measurement period 2 and contained a year's worth of claims data that have not been previously assessed.
 - Since none of the days were previously assessed, all 500 days would be assigned to episode 1 and would be used as a weighting factor at the measure score calculation step.

Figure A-3. Episode Window (366 to 729 Days; Reaffirming Claims)



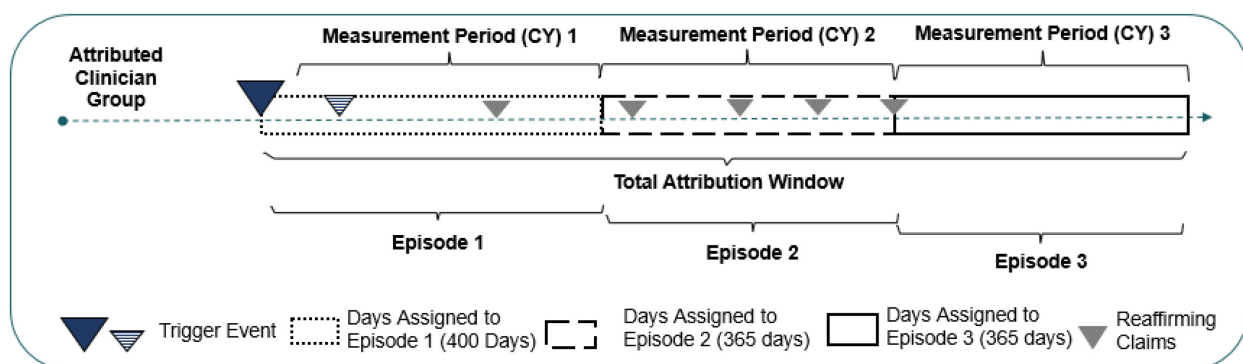
Episode Window 3. 365 days; Multi-Year Total Attribution Window

Figure A-4 illustrates a long total attribution window that is at least two years in length with a Kidney Transplant Management episode that is 365 days long, where sufficient claims data was assessed in the preceding measurement period.

The total attribution window begins with a pair of trigger services billed 35 days before measurement period 1, and ends approximately 38 months later, when the clinician-patient relationship ends during measurement period 3.

- **Measurement Period 1:** Episode 1 started on the day of the trigger claim and ended at the end of measurement period 1 (on December 31).
 - Costs will be assessed during measurement period 1 because episode 1 ended in measurement period 1 and contained at least a year's worth of claims data that have not been previously assessed. Since none of the days were previously assessed, all 400 days would be assigned to episode 1.
- **Measurement Period 2:** Episode 2 started on January 1 of measurement period 2 and ended on December 31 of measurement period 2.
 - Costs will be assessed during measurement period 2 because the episode ended in measurement period 2 and contained a year's worth of claims data that have not been previously assessed. Since none of the days were previously assessed, all 365 days would be assigned to episode 2.
- **Measurement Period 3:** Episode 3 started on January 1 of measurement period 3 and ended on December 31 of measurement period 3.
 - Costs will be assessed during measurement period 3 because the episode ended in measurement period 3 and contained a year's worth of claims data that have not been previously assessed. Since none of the days were previously assessed, all 365 days would be assigned to episode 3.

Figure A-4. Episode Window (365 days; Multi-Year Total Attribution Window)



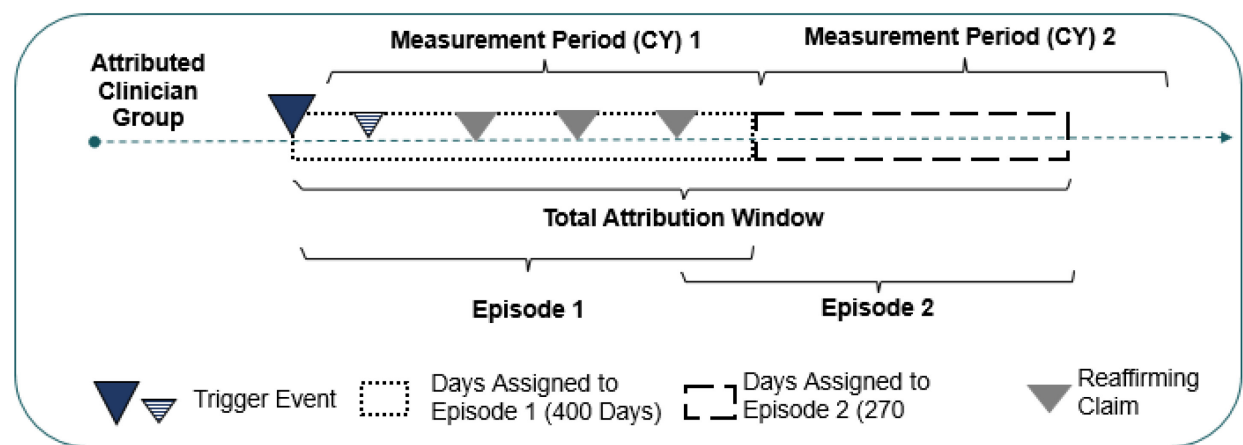
Episode Window 4. 365 Days; Overlapping Episodes

Figure A-5 depicts how the remaining days of long total attribution windows are assessed when there are less than 365 days of claims data that has not been previously assessed.

In this example, the total attribution window begins with a pair of trigger services billed approximately 35 days before measurement period 1 and ends 670 days (approximately 22 months) later, when the clinician-patient relationship ends during measurement period 2.

- **Measurement Period 1:** For episode 1, costs will be assessed during measurement period 1 because episode 1 ended in measurement period 1 and contained at least a year's worth of claims data that have not been previously assessed. Since none of the days were previously assessed, all 400 days would be assigned to episode 1.
- **Measurement Period 2:** For episode 2, there is not a year's worth of claims data between the end of episode 1 and the end of the total attribution window. Therefore, the start date of episode 2 is set as 365 days prior to the end of the total attribution window, and falls during episode 1.
 - Since the costs during the days where episodes 1 and 2 overlap have already been assessed during measurement period 1, only the days occurring **after** the episode 1 end date will be assigned to episode 2 (270 days). These 270 days will be used as a weighting factor at the measure score calculation step.

Figure A-5. Episode Window (365 Days; Overlapping Episodes)



Appendix B. Illustration of Attribution to Individual Clinicians (TIN-NPI)

This appendix provides a detailed illustration of the attribution methodology at the TIN and TIN-NPI levels. Once a Kidney Transplant Management episode has been defined, it is attributed to the:

- TIN that billed the trigger services (trigger claim and confirming claim) for the total attribution window, and to the
- TIN-NPI(s) within the attributed TIN that billed at least 30% of trigger or confirming codes on Part B Physician/Supplier claim lines during the episode.

The measure's attribution methodology also imposes additional checks to ensure that TINs and TIN-NPIs are appropriately attributed. Specifically:

- Both the TIN and TIN-NPI attribution methodologies require that at least one clinician within the TIN must have billed at least 2 condition-related prescriptions on different days to 2 different patients during the measurement period plus a one-year lookback period.
- TIN-NPIs that meet the 30% threshold must have billed at least one trigger or confirming code within 1 year prior to or on the episode start date.

Figure B-1. TIN-NPI Attribution

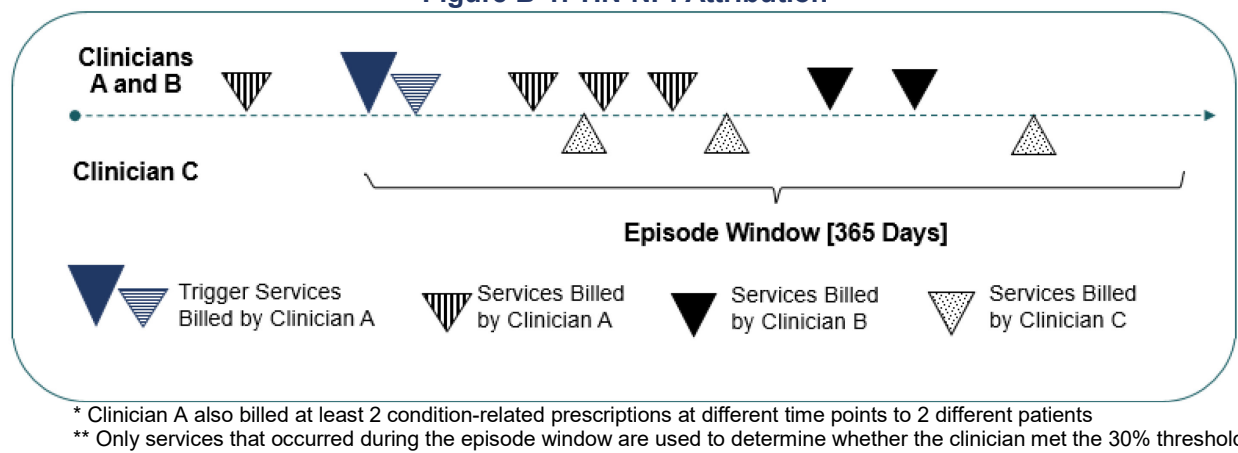


Figure B-1 illustrates a scenario in which 3 clinicians (A, B, and C) within an attributed clinician group (TIN 1) have billed services during a patient's episode window. Within the episode window, there are a total of 10 services billed across the 3 clinicians. Each of these services is uniquely marked depending on the clinician that billed the service.

For TIN level attribution, TIN 1 is attributed the episode because it billed the trigger services for the patient and has at least one clinician, Clinician A, that billed at least 2 condition-related prescriptions at different time points to 2 different patients. **For TIN-NPI level attribution,** Clinician A bills 5 qualifying services (5/10, 50%), Clinician B bills 2 services (2/10, 20%), and Clinician C bills 3 services (3/10, 30%) during the episode window. Clinicians A and C met the 30% threshold, so they are considered for attribution. Clinician B did not meet the 30% threshold, so it is not considered for attribution.

- Check 1: Clinician A billed at least one trigger or confirming code within 1 year prior to or on the episode start date, so it is considered for attribution. Clinician C did not bill any such services, so Clinician C is not considered for attribution.

- Check 2: Clinician A also billed at least 2 condition-related prescriptions at different time points to 2 different patients during the measurement period plus a one-year lookback period. Therefore, Clinician A is considered for attribution.

Since only Clinician A met the 30% threshold and the 2 additional checks, it is attributed this episode.

Appendix C. Measure Calculation Example

This sub-section shows how the measure score is calculated. Figure C-1 below provides an illustrated example of measure calculation, using an example measure where the clinician group has only 4 attributed episodes for demonstration purposes.

Figure C-1. Chronic Condition Episode-Based Cost Measure Calculation Steps

