



Improving Oral Health Through Measurement

DENTAL QUALITY ALLIANCE: Practice- and Clinician-Level Quality Measure Development Reports

Report 2: Subsequent/Advanced Procedure Following Initial Procedure

MARCH 2024

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Background

The Dental Quality Alliance (DQA) approved a resolution that a workgroup be formed to explore the development of practice- and clinician-level dental quality measures. This workgroup reports to the DQA's Measure Development and Maintenance Committee (MDMC). This report is the second in a series of reports providing updates on measure development activities and findings. All workgroup data, findings, and conclusions were reviewed by the MDMC. The final report reflects MDMC agreement with the findings and conclusions.

Workgroup Charge

- **Resolved**, that a Workgroup reporting to MDMC be convened by the DQA Chair to explore the development of validated practice- and clinician-level quality measures using both clinical and patient-reported data; and be it further,
- **Resolved**, that the Workgroup include partners with access to data that could be used to validate any potential measures developed by the Workgroup.

Report Purpose

The purpose of this report is to **present the results of evaluating various measures under the broad concept of Subsequent, more Advanced Procedures following an initial procedure**. Examples include crowns, partial dentures, endodontic treatment, or extractions following restoration placement.

Identification of Advanced Procedures Concepts

Following an environmental scan conducted by DQA staff that identified 530 unduplicated metrics, the Workgroup determined that it would first identify a starter set of measures calculated using claims data, because they have the highest feasibility for near-term implementation. Of the 530 metrics, 124 were identified as potentially implementable with claims data.

The Workgroup used a Delphi consensus process, using both a questionnaire with quantitative analyses of the responses and a series of workgroup meetings, to evaluate each of the 124 measures. Measures were classified into one of four categories:

- 1) **Excluded** concepts – no further consideration for practice/clinician based measurement;
- 2) **Roadmap** concepts – important but feasibility challenges;
- 3) **Provisional** concepts – undergoing further evaluation to better understand the evidence base and extent of performance gaps; and
- 4) **Included** concepts – will be specified and tested for a Starter Set of claims-based measures.

The first report in this series, [Report 1: Project Introduction, Delphi & Excluded Measure Concepts](#) provides more detail regarding the environmental scan, consensus process, and concept classification.

Provisional Concepts and Conceptual Considerations

Provisional concepts reflected areas where the workgroup determined it needed more information to reach consensus. Within this category were several measures reflecting the concept of **Advanced Procedure Following Initial Procedure**, such as a crown being placed on a tooth that was previously restored, endodontic treatment on a tooth that had a crown, and extraction of a tooth after endodontic treatment.

The workgroup identified the following considerations in its evaluation:

- **Evidence.** Is there sufficient evidence to enable identification of what expected survival rates should be to inform expectations around performance related to quality of care?
- **Performance gap.** To what extent does the measure identify an overall performance gap versus outliers in performance?
- **Provider control.** To what extent can providers influence the outcome/measure score? To what extent are there other factors outside of the provider's control that could influence measure scores?
- **Interpretability.** Can the measure score alone (i.e., without further investigation) be used to signify better or worse quality of care with respect to a specific aspect of care?
- **Risk of adverse consequences.** Are there potential unintended adverse consequences that could result from implementing the measure?

To explore these considerations, the workgroup began by selecting specific subsequent/advanced procedures after initial procedure concepts to evaluate:

- Percentage of active patients who received crowns/ partials/ endodontic treatment/ extraction procedures following a restoration placement
- Percentage of active patients who received endodontic treatment following crowns;
- Percentage of active patients who received extractions following crowns;
- Percentage of active patients who received implants requiring subsequent removal; and
- Percentage of active patient who received restorations following sealant placement.

Detailed specifications were developed for the first concept, and two data partners with large databases of practice- and clinician-level dental claims data provided data to inform the workgroup's evaluation. The remaining four concepts were subsequently evaluated using data from existing reports.

Advanced Procedure (crowns, partials, endodontic treatment, or extractions) after Restoration Placement

In addition to the collective expert opinion and quality measurement experience of the Workgroup members, two additional sources of information were sought by the workgroup to inform its deliberations of this concept: (1) data that would illustrate example measure scores and lend insight into the frequency with which advanced procedures occur and (2) evidence regarding restoration survival rates and factors contributing to the need for subsequent treatment.

Data Analysis

Methods

Population. Adults aged 19 years and older were included with stratifications by age categories (19-30; 31-50; 51-64; ≥ 65).

Data Sources. Two data partners with large databases of practice- and clinician-level dental claims data ran sample measure scores using detailed specifications described below.

Time Frame. The data runs used data from 2016 through 2019. Four years of data were used to allow follow-up time frames as long as 36 months. To avoid confounding by reduced service use in 2020 due to COVID-19, 2019 was selected as the most recent year to include in the analyses.

Level of Analysis. Separate analyses were conducted at the **practice** level and at the **clinician** level.

Specifications. Detailed specifications were developed to ensure that the data needed for the workgroup's evaluation would be captured and to promote consistency in data runs across the data partners running the analyses.

Four different rates were calculated to assess different follow-up time frames after the initial restoration placement:

Rate 1: 6-month follow-up period

Denominator 1: Restoration in 2016

Numerator 1: Crown/Endo/Partial/Extraction within 6 months of restoration

Rate 2: 12-month follow-up period

Denominator 2: Restoration in 2016 AND any dental service in 2017

Numerator 2: Crown/Endo/Partial/Extraction within 12 months of restoration

Rate 3: 24-month follow-up period

Denominator 3: Restoration in 2016 AND any dental service in 2018

Numerator 3: Crown/Endo/Partial/Extraction within 24 months of restoration

Rate 4: 36-month follow-up period

Denominator 4: Restoration in 2016 AND any dental service in 2019

Numerator 4: Crown/Endo/Partial/Extraction within 36 months of restoration

Sample Size. Data partners were requested to provide data for **practices and clinicians that had at least 100 patients in the denominator for Rate 4** (36-month follow-up). The same sample was used to calculate all four rates. Data partners also were asked to provide data for at least 100 practices and 100 clinicians.

Denominator considerations

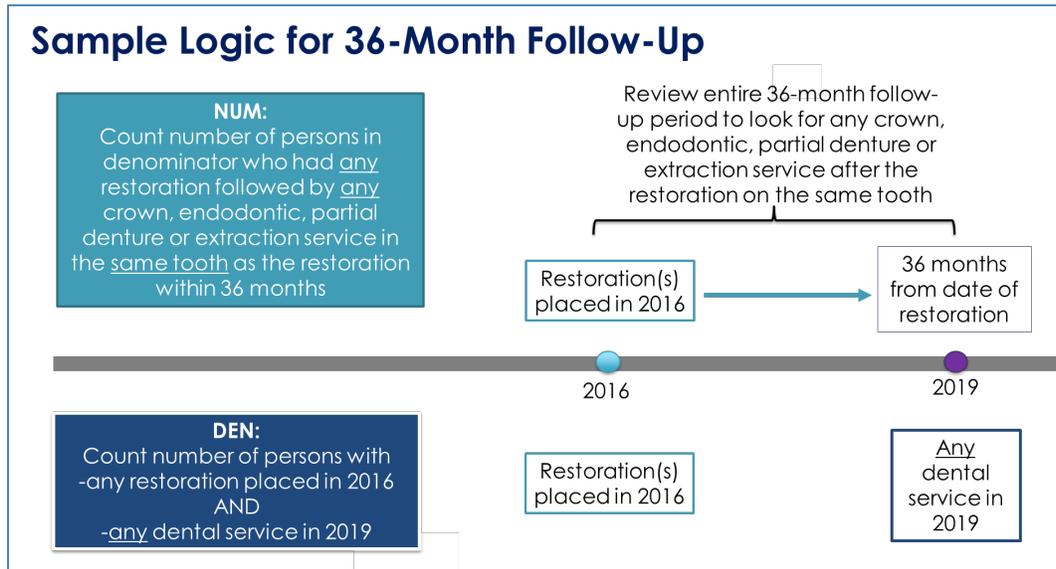
- The requirement for a dental service in Rates 2, 3, and 4 is to ensure that the patient is still present in the database at the time of follow-up measurement. For example, a patient who had a restoration in 2016 and then switched care to a practice or provider not contained within the database in 2017 should not be included in the measurements of Rates 2, 3, or 4 because it is not possible to assess whether any subsequent procedure was performed.
- A given patient was included in the denominator of each practice and of each clinician who placed a restoration in 2016. The measure score was at the patient level (and not the tooth level), but the same patient could be counted in the denominator of more than one practice or more than one clinician when the patient had an index restoration with more than one practice or more than one clinician, respectively, in 2016.

Numerator considerations

- An advanced follow-up procedure on the same tooth as the earlier restoration was counted if it occurred at any time during the follow-up time frame. For example, for Rate 4, any crown/endodontic/partial denture/extraction service that occurred at any time during the 36 months following the restoration placement would be counted in the numerator.
- The follow-up procedure for inclusion in the numerator could be performed by any practice or provider. It did not need to be with the same practice/clinician that placed the restoration in 2016.

Figure 1 illustrates the calculation logic for Rate 4, which has a 36-month follow-up period. The detailed specifications are contained in Appendix 1.

Figure 1. Sample Calculation Logic for Advanced Procedure Following Restoration Placement within 36 Months



Results

Table 1 provides summary statistics for each of the rates corresponding to the follow-up timeframes of 6, 12, 24, and 36 months. For example, for the 6-month follow-up time period for data partner 1, the average rate was 1.95% and the median rate was 1.52%. The median rate indicates that the percentage of patients who had a restoration in 2016 and also had an advanced procedure on the same tooth within 6 months was 1.52% or less for each 50% of the sample of practices and 50% of the sample of clinicians. When the follow-up timeframe was extended, the percentage of patients who had a restoration followed by more advanced treatment on the same tooth increased. For the 36-month follow-up period, the median rate increased to 10.91% for data partner 1. The rates for the two data partners were similar. The rates between practices and clinicians also were similar. Additional detailed results are contained in Appendix 2.

Table 1. Percentage of Patients Aged 19 Years or Older with an Advanced Procedure (crown, partial denture, endodontic service, extraction) Following Restoration Placement by Follow-Up Period

		6 months	12 months	24 months	36 months
PRACTICE					
Data Partner 1 (n=2,069)	Min	0.00%	0.00%	0.00%	0.00%
	Max	17.39%	27.19%	35.19%	46.15%
	Ave	1.95%	4.14%	8.09%	12.14%
	Median	1.52%	3.35%	7.19%	10.91%

PRACTICE- AND CLINICIAN-LEVEL DENTAL QUALITY MEASURE DEVELOPMENT REPORTS

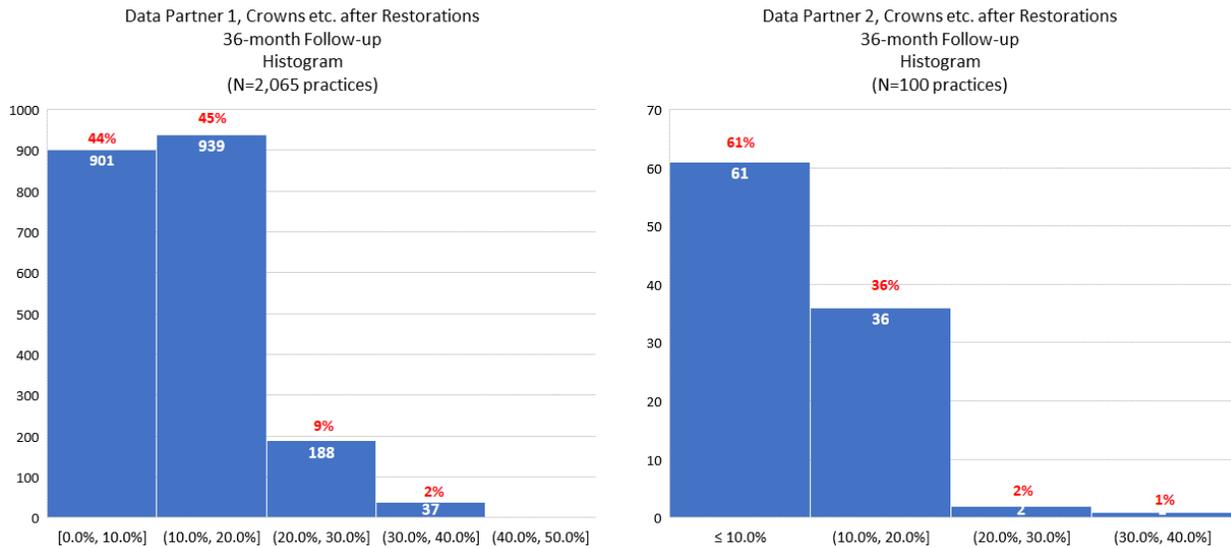
Data Partner 2 (n=100)	Min	0.00%	0.00%	0.71%	0.83%
	Max	10.00%	18.75%	34.48%	36.94%
	Ave	1.97%	3.87%	7.09%	9.70%
	Median	1.52%	3.33%	6.44%	8.80%
CLINICIAN					
Data Partner 1 (n=1744)	Min	0.00%	0.00%	0.00%	0.00%
	Max	16.58%	24.88%	39.67%	46.15%
	Ave	1.82%	3.86%	7.65%	11.51%
	Median	1.40%	3.15%	6.67%	10.26%
Data Partner 2 (n=100)	Min	0.00%	0.00%	0.79%	1.60%
	Max	10.00%	18.75%	34.48%	36.94%
	Ave	2.09%	3.93%	6.83%	9.85%
	Median	1.76%	3.29%	5.84%	8.21%

Table 2 summarizes the practice-level data for the 36-month follow-up period by selected percentiles. Figure 2 displays the practice level data for the 36-month follow-up period using histograms. The horizontal axis is the same in both figures and represents the rate ranges in 10% increments. The first column in each chart shows the number and percent of practices with rates of 10% or less: 44% of data partner 1 practices and 61% of data partner 2 practices had rates of 10% or less when looking for an advanced procedure following a restoration within 36 months.

Table 2. Rate 4 (36-month follow-up) Reported by Practice Percentiles

	Data Partner 1	Data Partner 2
10th percentile	5.03%	4.61%
25th percentile	7.55%	6.65%
50th percentile	10.91%	8.80%
75th percentile	15.25%	12.08%
90th percentile	20.67%	16.40%

Figure 2. Practice-Level Histograms for Rate 4 (36-month follow-up)



****NOTE: Data Partner 1 provided significant larger sample of data compared to Data Partner 2.****

Evidence

The workgroup also wanted to interpret the data in the context of what might be expected based on published, peer-reviewed research. Two questions were posed to staff at the ADA Science and Research Institute:

1. For posterior restorations in general, what are the expected survival rates for different follow-up time intervals?
2. What evidence exists regarding the effects of technical quality of the provider and patient factors with respect to survival?

The complete findings are provided in Appendix 3.

Regarding survival rates, the rates from the data partners were generally consistent with what has been observed in the literature. In general, survival rates tend to be quite high initially (i.e., during initial follow-up time frames) and decrease somewhat over time.

Regarding the contributions of patient versus provider factors in contributing to restoration survival, published research identifies a range of patient-level and provider-level factors that contribute to restoration survival. Contributing patient-related factors include caries risk, bruxism, periodontal status, oral hygiene, prior endodontic treatment, type of tooth restored and number of restored surfaces. Provider-related factors include experience level, skill level and treatment decisions.

Workgroup Determinations Regarding Advanced Procedure (crowns, endodontic treatment, partial dentures, or extractions) after Restoration Placement

The workgroup made the following determinations based on the group's collective expert opinion and experience, the data analyses, and related evidence from the literature.

Evidence and Interpretability. The research is not mature enough to draw conclusions about quality without further assessment of additional data and clinical information to understand why one practice or provider has higher/lower rates of subsequent treatment than others and the extent to which those rates are attributable to the performance of practices or clinicians.

Performance gap. At 36 months, median "survival" (no subsequent advanced procedure) is approximately 90%, raising questions about the extent to which there is a performance gap.

Provider control and measurement burden. Varying factors contribute to restoration survival rates. To have assessments that allow for use as a quality improvement measure in accountability applications (e.g., performance-based payment or public reporting), it would be important to take into account such factors such as age, number of surfaces, depth of restoration, previous treatment, patient risk factors, and so forth. Claims data limits the ability to assess and incorporate these factors when developing performance/quality of care measures.

Risk of adverse consequences. Concerns were raised that there could be unintended adverse consequences, particularly given the considerations listed above. For example, providers could improve performance by skipping conservative treatment approaches and going directly to more advanced treatment; the measure could unintentionally promote practice at the extremes of standards of care (i.e., overtreatment with crowns as the initial restorative choice) or reduce the engagement of patients in care decisions.

Benefit. Despite the above considerations, the workgroup concluded that a measure of advanced procedures following restorations **is beneficial for internal use to identify levels of practice or clinician performance that might be deemed to be statistical outliers, in order to spur further investigation** and inquiry to understand the reasons that a practice or clinician is a statistical outlier and determine whether practice or clinician modifications are warranted.

Related Concepts

The workgroup evaluated existing data for the following related "advanced procedure following initial procedure concepts":

- Endodontic treatment following crowns;
- Extractions following crowns/endo;
- Implants requiring removal; and

- Restorations following sealant placement.

One of the data partners provided data from existing reports related to the first three concepts, which were evaluated for a 36-month follow-up time frame. 90% of providers had rates of less than 5%. Thus, the frequency of occurrence of these related measure concepts (4 concepts in bullets noted above) was significantly lower than those observed for the measure related to crowns, endodontic treatment, partial dentures, or extractions after restoration. The data reviewed are contained in Appendix 4.

Data from the American Dental Association's Dental Experience and Research Exchange (DERE)TM registry were used to evaluate the concept of restorations following sealant placement.

Based on the similarity of the concepts conceptually and the lower frequency of occurrence with patterns similar to *the crowns, endodontic treatment, partial dentures, or extractions after restoration placement* measure, the workgroup determined that it was not necessary to develop detailed specifications and run additional data analyses to further evaluate the four concepts.

Additional evaluation of restorations following sealant placement. During its review of a draft report at its November 2023 meeting, the DQA suggested that the concept of restorations following sealant placement undergo additional data assessments specifically among children. Detailed specifications were developed to further evaluate this concept for children aged 6–18 years, examining follow-up timeframes of 6, 12, 24, and 36 months after sealant placement (Appendix 5). The two data partners ran sample practice-level and clinician-level measure scores, following the specifications.

For the 36-month follow-up time frame, the median rates for the two data partners at the practice level were 5.5% and 6.8%, and the median rates at the clinician level were 4.6% and 7.1%. The 90th percentiles were 12.7% and 14.7% at the practice level and 11.5% and 15.4% at the clinician level. These rates also were lower than those observed for the measure related to crowns, endodontic treatment, partial dentures, or extractions after restoration. The data reviewed are contained in Appendix 6. Consequently, the workgroup re-affirmed its initial determination that this measure should remain in this category of measures that may be useful for internal use to identify levels of practice or clinician performance that might be deemed to be statistical outliers.

Additional considerations for measures of implant repair or removal. The workgroup noted additional considerations related to the concept of implants that require subsequent repair or removal. Based on their expert opinion, the Workgroup determined that given the overall expected survival rates of implants, the time frame of 36-months was too short to allow an accurate assessment of implant repair or removal. However, it was also recognized that using significantly longer follow-up time frames would be challenging from a measurement perspective due to patient mobility between plans, practices, and clinicians. It was also noted

that expansions in coverage over the last 5 years have increased the number of dentists placing implants. Thus, the workgroup suggested that this concept should continue to be monitored for future measure development.

Workgroup Conclusions

The Workgroup determined that these measure concepts of advanced procedures following initial procedure best fit in the category of measures that can be used in the identification of practices or providers with “statistical outlier” performance. Identification of statistical outliers, by itself, does not provide a clear indication of performance quality without further investigation; rather, statistical outlier status warrants additional study or analysis. Causation may be related to unique variation in practitioner performance, but it may also be related to unique variation in one or more input factors, resource factors, or external factors affecting clinical processes of care. The Workgroup also recognizes that subsequent, more complex treatment may hold varying degrees of importance to and influence the care experience of individual patients who may be affected by outlier performance.

Based on the considerations above, the workgroup determined that the various measure concepts under the category of advanced procedure should not advance to reliability testing, at this time. The DQA prioritizes development of standardized measures to enable comparison between entities and over time, for the greatest public health impact. The Workgroup believes that all of the measure concepts reviewed in this report will increase measurement burden without concomitant public health impact.

Because the workgroup recognized the value of these concepts for internal use by organizations in assuring quality, it also determined that further consideration of how measures related to statistical outlier identification could be considered within an overall quality framework.

Measures for Multiple Quality Implementation Purposes

Assuring and improving quality of care encompasses a broad range of activities. Different measures can support different quality-focused activities. The workgroup distinguished measurement for quality assurance from measurement for quality improvement, recognizing that quality assurance activities are a precursor to and support quality improvement efforts. It further distinguished between internal quality improvement efforts and external/accountability quality improvement efforts.¹⁻⁴

Figures 3 and 4 summarize the conceptual differences between these different and complementary quality activities, and their supporting measurement systems, all of which feed into an overall quality assurance and performance improvement program.

Quality assurance activities tend to be retrospective in nature and focus on compliance with policies, procedures and minimum care expectations/requirements. Quality assurance focuses

on provider competencies and measures that can identify outliers with respect to identified norms. The measure flags a provider or area that merits further investigation to determine if self-improvement or corrective actions are needed.

Quality improvement activities are more forward-looking and reflect an overall organizational approach to improving quality of care with the goal of not simply ensuring minimum performance criteria are met, but to raise overall organizational or system level performance. Quality improvement activities can be categorized as internal quality improvement or external quality improvement. **Internal** quality improvement activities focus on learning within the organization. Measurement is used to support internal quality improvement activities (e.g., as part of PDSA cycles), including internal comparative performance and monitoring progress over time. Performance results are used internally and, often, confidentially. **External** quality improvement involves external motivation for performance improvement and typically has “higher-stakes” applications, such as being reported publicly or being used in performance-based payment programs. External quality improvement is more likely to involve comparisons between entities.

Measures for both internal and external quality improvement should be grounded in the best available evidence (e.g., clinical guidelines) that improvement on the measure is associated with improvement in outcomes. The measures should also have clear interpretation related to care quality (e.g., a higher score signifies better quality) to guide improvement efforts. Although all quality measures should have demonstrated reliability (consistency and comparability of measurement) and validity (accurate representation of the quality concept), measures used in external quality improvement applications are held to the highest standards of quality measurement criteria because of the need to reliably compare entities and the more significant consequences of measurement. As a result, measures used in accountability applications, such as public reporting, payment-based programs, and accreditation, undergo evaluation and testing that demonstrates the measure is supported by evidence, has a demonstrated performance gap, meets scientific acceptability criteria for reliability and validity, and has low risk of adverse or unintended consequences.^{1,5,6}

Figure 4 illustrates how measures used for different purposes work together as part of an overall quality assurance and performance improvement program. The workgroup emphasized the value of all three activities (quality assurance, internal quality improvement, and external quality improvement) and the supporting measures.

The workgroup is prioritizing measures used for external quality improvement for the Starter Set of measures because they support standardized measures, enabling comparisons between entities or clinicians and over time for the greatest public health impact.

The Workgroup encourages practices to monitor measures based on concepts such as those below to identify causes of variation, statistical outliers, and provide targeted support for improvement on an ongoing basis.

- Percentage of active patients who received crowns/ partials/ endodontic treatment/ extraction procedures following a restoration placement
- Percentage of active patients who received endodontic treatment following crowns;
- Percentage of active patients who received extractions following crowns;
- Percentage of active patients who received implants requiring subsequent removal; and
- Percentage of active patients who received restorations following sealant placement.

Public Comment

A draft report was posted on the DQA website for a three-month public comment period (November 29, 2023 through February 29, 2024), with additional dissemination through email mailing lists and periodic reminders of the opportunity to comment. The DQA would like to thank all interested parties who submitted comments. Two comments were received (Appendix 7). Both agreed with the conclusions of the report. One commenter emphasized the importance of developing and implementing measures that are clearly tied to evidence and evidence-based guidelines, noted the limitations of measures that are based on claims data and limited to CDT procedure codes, and supported improved capture of diagnosis codes to advance quality measurement and improvement in dentistry. The DQA's practice- and clinician-based measurement activities are currently focused on measures that can be calculated using claims data due to their greater near-term feasibility of implementation. The next phase of work will focus on measures calculated using digital/electronic patient record data.

Figure 3. Measurement for Quality Assurance and Quality Improvement

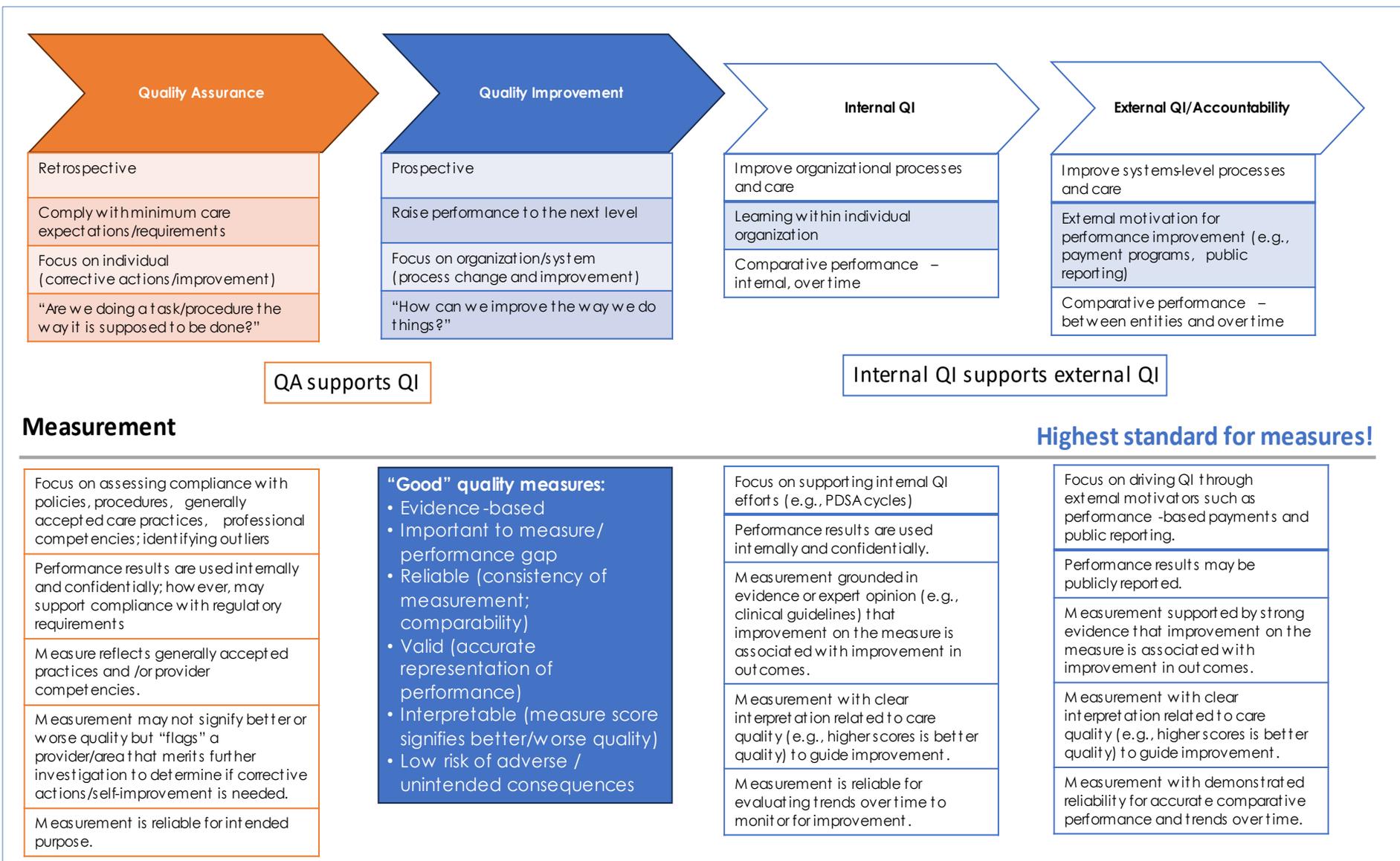
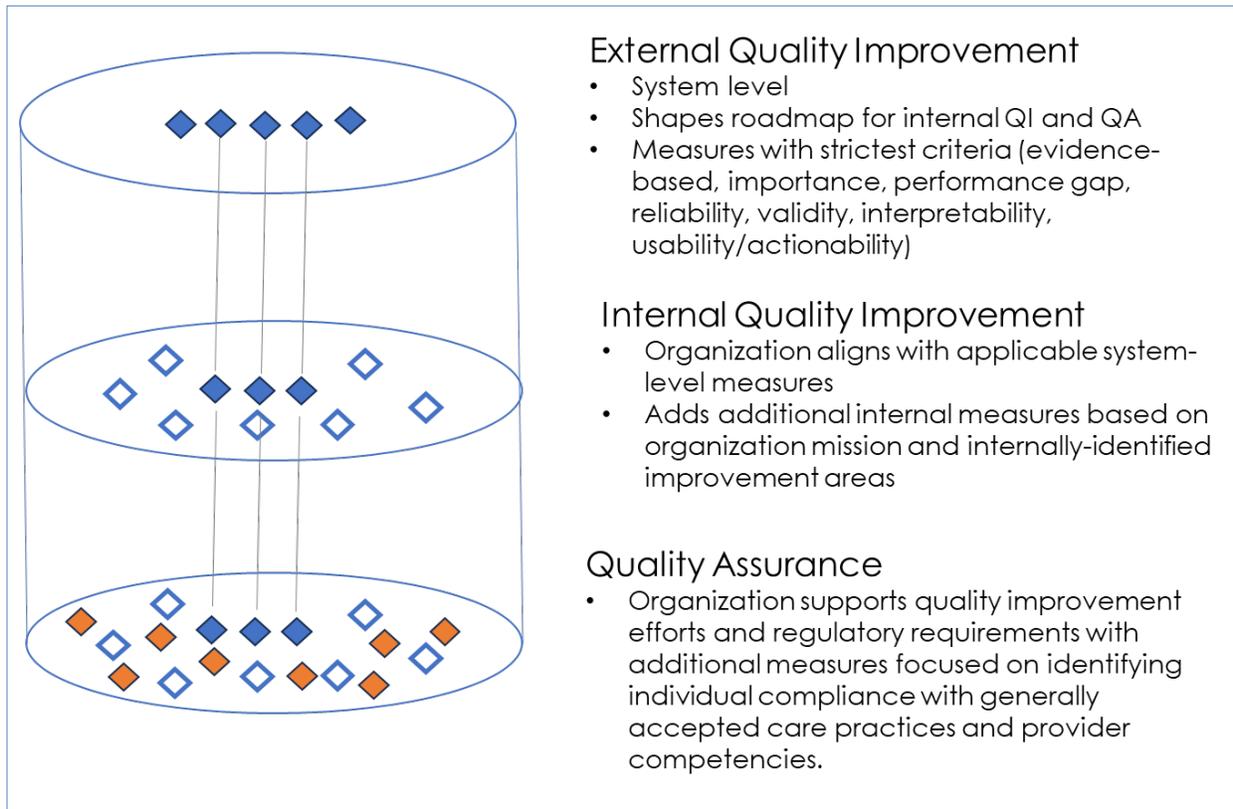


Figure 4. Measurement for Different and Complementary Purposes



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Appendix 1: Advanced Procedure (crowns, partials, endodontic treatment, or extractions) after Restoration Placement Measure Specifications

*****NOTE: THESE SPECIFICATIONS WERE DEVELOPED SOLELY TO INFORM EVALUATION OF THIS CONCEPT. THESE SPECIFICATIONS ARE NOT APPROVED SPECIFICATIONS TO BE USED IN QUALITY IMPROVEMENT PROGRAMS.*****

PRACTICE/CLINICIAN LEVEL MEASUREMENT: PROVISIONAL MEASURE CONCEPT SPECIFICATIONS FOR CONCEPT EVALUATION

CONCEPT: CROWNS/PARTIALS/ENDODONTIC/EXTRACTIONS FOLLOWING RESTORATION PLACEMENT

*****DATA TESTING PARTNERS: PLEASE DO NOT MAKE ANY ASSUMPTIONS. IF SOMETHING IS NOT CLEAR, THEN PLEASE CONTACT THE DQA AT DQA@ADA.ORG. ENSURING THE CLARITY AND UTILITY OF THE SPECIFICATIONS IS PART OF THIS PROCESS.*****

This report evaluates the percentage of active patients who received crowns/ partials/ endodontic/ extraction procedures following a restoration placement, using different follow-up time periods.

- **TESTING NOTES:**
 - We are testing four denominators and numerators that correspond to four different follow-up time frames: 6, 12, 24 and 36 months.
 - Please use CLAIMS data from 2016 through 2019.
- **Age**
 - Include adults >19 years. Measure scores will be stratified by the following age groups: 19-30; 31-50; 51-64; >=65.
- **Measuring Entity and Data Sources**
 - Third party [e.g., payer or business associate] using enrollment and claims data.
Claims data note: Include both paid and unpaid claims (including pending, suspended, and denied claims).

- Practice or provider or business associate with access to Practice Management System (PMS) and/or Electronic Dental Record (EDR) data
Billing/EDR data note: Include all posted procedures for completed treatment whether paid or unpaid. The code does NOT need to have been billed to an insurance company. Do not include procedures for which treatment was not completed (i.e., planned treatment).

- **Months to Days Conversion:** To accommodate months ranging from 28 to 31 days, the following standards apply:

Years	Months	Days
	1 month	30 days
	2 months	61 days
	3 months	91 days
	4 months	122 days
	5 months	152 days
	6 months	183 days
	7 months	213 days
	11 months	334 days
1 year	12 months	365 days
	13 months	395 days
2 years	24 months	730 days
3 years	36 months	1095 days
5 years	60 months	1826 days

- **Level of Reporting:**

- **Practice** (identified by TIN)

Note: When a single TIN is used across multiple locations within a group practice, the measure will result in an average score across locations. Conversely if one group practice uses individual TINs for each of its locations, then the measure will result in a score by location. Such contextual information will be useful in interpreting scores when used for comparisons.

- **Clinician** (identified by Rendering Provider NPI)

Note: This measure specification should be used with an understanding of the context of the clinical workflow within the practice. For practices with a team-based approach to care (i.e., one dentist always performs the evaluation, and a second dentist or hygienist always performs the fluoride application), all patients will be attributed to the first dentist. The second dentist or hygienist cannot be “scored” based on these specifications even if they are responsible for applying the topical fluoride.

Sample Selection for Testing with Claims Data:

- **Practice:** Randomly select 100 practices among those that have at least 100 patients who qualify for DEN 4.
- **Clinician:** Randomly select 100 providers among those that have at least 100 patients who qualify for DEN 4.
- **Note:** These samples will be used to calculate all four denominators.

Specification

Four denominators and numerators that correspond to four different follow-up time frames (6, 12, 24, and 36 months) will be evaluated.

DENOMINATOR 1: RESTORATION IN 2016

Check if subject had a restoration placed in 2016.

1. Check if the subject meets age criterion:
 - a. If subject is ≥ 19 years as of December 31st, 2016, then proceed to next step.
 - b. If the age criterion is not met or there are missing or invalid field codes (e.g., date of birth), then STOP processing. This subject is not counted in the denominator.
2. Check if subject has **any restorations** placed in 2016:
 - a. If [SERVICE CODE] = any one or more code in range [D2140 through D2664] **AND**
 - b. If January 1, 2016 \leq [RESTORATION DATE OF SERVICE] \leq December 31, 2016, then proceed to next step.
 - c. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 1.
3. Attribute subject to **all practices** that placed **restorations in 2016**:
 - a. Assign subject to the *unique TIN* associated with each practice that placed at least one restoration in 2016.
 - b. Include in **Denominator 1 for the practice**.

Note: In this step, all **claims** with missing or invalid CDT CODE, missing or invalid billing provider TIN should not be included in the denominator.

4. Attribute subject to **all clinicians** that placed restorations in 2016:
 - a. Assign subject to the * unique RENDERING PROVIDER NPI* associated with each clinician that placed at least one restoration in 2016.
 - b. Include in **Denominator 1 for the clinician**.

Note: In this step, all **claims** with missing or invalid CDT CODE, missing or invalid billing provider TIN should not be included in the denominator.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 1 (DEN1)

NUMERATOR 1: CROWN/ENDO/PARTIAL/EXTRACTION WITHIN 6 MONTHS OF RESTORATION

For each practice and clinician: Among the subjects in Denominator 1, **for each restoration placed in 2016**, check if subject received any crown, endodontic, partial denture, or extraction service in the same tooth as the restoration within 6 months of the restoration placement with any practice/clinician:

5. Select subjects in the practice-specific or clinician-specific Denominator 1.
6. For **each restoration placed in 2016**, check if subject has any crown, endodontic, partial denture, or extraction service **in the same tooth within 6 months** (can be placed by any practice/clinician):
 - a. Crowns:
 - i. If any [CROWN CODE] = [D2710 through D2794]; AND
 - ii. [CROWN TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{CROWN DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 183$ days

OR

- b. Endodontic services:
 - i. If any [ENDODONTIC CODE] = [D3110 through D3999]; AND
 - ii. [ENDO TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $[\text{ENDO DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 183$ days

OR

- c. Partial denture services:
 - i. If any [PARTIAL DENTURE CODE] = [D5211 through D5286]; AND
 - ii. [PARTIAL TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{PARTIAL DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 183$ days

OR

- d. Extraction services:
 - i. If any [EXTRACTION CODE] = [D7111 through D7999]; AND
 - ii. [EXTRACTION TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{EXTRACTION DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 183$ days
- e. If subject had ANY follow-up procedure contained in (a) – (d) within 183 days, then **include in practice-specific or clinician-specific numerator 1**.

- f. If subject did not have any follow-up procedure contained in (a) – (d) within 183 days, then STOP processing; this subject is included in denominator 1, but will not be included in numerator 1.

NOTES:

- The crown/endo/partial/extraction procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the restoration in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 1, but is not included in numerator 1.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 1 (NUM 1)

- 7. Report (using reporting template):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 2: RESTORATION IN 2016 AND ANY DENTAL SERVICE IN 2017

Among those subjects in **Denominator 1**, select those who also have any dental service in 2017. The dental service in 2017 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

- 1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2017 (where the dental service in 2017 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND
 - c. If [DATE OF SERVICE] >= January 1, 2017 AND <= December 31, 2017, then include in **Denominator 2 for the practice**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 2.

NOTE: The dental service in 2017 can be with any practice. It does not need to be with the practice that provided the index restoration in 2016.

- 2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2017 (where the dental service in 2017 is not restricted to the same clinician):

- a. If subject is in Denominator 1 **AND**
- b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
- c. If [DATE OF SERVICE] >= January 1, 2017 AND <= December 31, 2017, then include in **Denominator 2 for the clinician**.
- d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 2.

NOTE: The dental service in 2017 can be with any clinician. It does not need to be with the clinician that provided the index restoration in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 2 (DEN2)

NUMERATOR 2: CROWN/ENDO/PARTIAL/EXTRACTION WITHIN 12 MONTHS OF RESTORATION

For each practice and clinician: Among the subjects in Denominator 2, **for each restoration placed in 2016**, check if subject received any crown, endodontic, partial denture, or extraction service in the same tooth as the restoration within 12 months of the restoration placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 2.
4. For **each restoration placed in 2016**, check If subject has any crown, endodontic, partial denture, or extraction service **in the same tooth within 12 months** (can be placed by any practice/clinician):
 - a. Crowns:
 - i. If any [CROWN CODE] = [D2710 through D2794]; AND
 - ii. [CROWN TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{CROWN DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 365$ days

OR

- b. Endodontic services:
 - i. If any [ENDODONTIC CODE] = [D3110 through D3999]; AND
 - ii. [ENDO TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $[\text{ENDO DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 365$ days

OR

- c. Partial denture services:
 - i. If any [PARTIAL DENTURE CODE] = [D5211 through D5286]; AND
 - ii. [PARTIAL TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND

- iii. $0 < [\text{PARTIAL DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 365 \text{ days}$

OR

- d. Extraction services:
 - i. If any [EXTRACTION CODE] = [D7111 through D7999]; AND
 - ii. [EXTRACTION TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{EXTRACTION DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 365 \text{ days}$
- e. If subject had ANY follow-up procedure contained in (a) – (d) within 365 days, then **include in practice-specific or clinician-specific numerator 2.**
- f. If subject did not have any follow-up procedure contained in (a) – (d) within 365 days, then STOP processing; this subject is included in denominator 2, but will not be included in numerator 2.

NOTES:

- The crown/endo/partial/extraction procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the restoration in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 2, but is not included in numerator 2.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 2 (NUM 2)

- 5. Report ([using reporting template](#)):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 3: RESTORATION IN 2016 AND ANY DENTAL SERVICE IN 2018

Among those subjects in **Denominator 1**, select those who also have any dental service in 2018. The dental service in 2018 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

- 1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2018 (where the dental service in 2018 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND

- c. If [DATE OF SERVICE] >= January 1, 2018 AND <= December 31, 2018, then include in **Denominator 3 for the practice**.
- d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 3.

NOTE: The dental service in 2018 can be with any practice. It does not need to be with the practice that provided the index restoration in 2016.

2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2018 (where the dental service in 2018 is not restricted to the same clinician):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
 - c. If [DATE OF SERVICE] >= January 1, 2018 AND <= December 31, 2018, then include in **Denominator 3 for the clinician**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 3.

NOTE: The dental service in 2018 can be with any clinician. It does not need to be with the clinician that provided the index restoration in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 3 (DEN3)

NUMERATOR 3: CROWN/ENDO/PARTIAL/EXTRACTION WITHIN 24 MONTHS OF RESTORATION

For each practice and clinician: Among the subjects in Denominator 3, **for each restoration placed in 2016**, check if subject received any crown, endodontic, partial denture, or extraction service in the same tooth as the restoration within 24 months of the restoration placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 3.
4. For **each restoration placed in 2016**, check if subject has any crown, endodontic, partial denture, or extraction service **in the same tooth within 24 months** (can be placed by any practice/clinician):
 - a. Crowns:
 - i. If any [CROWN CODE] = [D2710 through D2794]; AND
 - ii. [CROWN TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [CROWN DATE OF SERVICE] - [RESTORATION DATE OF SERVICE] \leq 730$ days

OR

- b. Endodontic services:
- i. If any [ENDODONTIC CODE] = [D3110 through D3999]; AND
 - ii. [ENDO TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. [ENDO DATE OF SERVICE] – [RESTORATION DATE OF SERVICE] <= 730 days

OR

- c. Partial denture services:
- i. If any [PARTIAL DENTURE CODE] = [D5211 through D5286]; AND
 - ii. [PARTIAL TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. 0 < [PARTIAL DATE OF SERVICE] – [RESTORATION DATE OF SERVICE] <= 730 days

OR

- d. Extraction services:
- i. If any [EXTRACTION CODE] = [D7111 through D7999]; AND
 - ii. [EXTRACTION TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. 0 < [EXTRACTION DATE OF SERVICE] – [RESTORATION DATE OF SERVICE] <= 730 days
- e. If subject had ANY follow-up procedure contained in (a) – (d) within 730 days, then **include in practice-specific or clinician-specific numerator 3**.
- f. If subject did not have any follow-up procedure contained in (a) – (d) within 730 days, then STOP processing; this subject is included in denominator 3, but will not be included in numerator 3.

NOTES:

- The crown/endo/partial/extraction procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the restoration in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 3, but is not included in numerator 3.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 3 (NUM 3)

5. Report ([using reporting template](#)):
- a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 4: RESTORATION IN 2016 AND ANY DENTAL SERVICE IN 2019

Among those subjects in **Denominator 1**, select those who also have any dental service in 2019. The dental service in 2019 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2019 (where the dental service in 2019 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND
 - c. If [DATE OF SERVICE] >= January 1, 2019 AND <= December 31, 2019, then include in **Denominator 4 for the practice**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 4.

NOTE: The dental service in 2019 can be with any practice. It does not need to be with the practice that provided the index restoration in 2016.

2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2019 (where the dental service in 2019 is not restricted to the same clinician):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
 - c. If [DATE OF SERVICE] >= January 1, 2019 AND <= December 31, 2019, then include in **Denominator 4 for the clinician**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 4.

NOTE: The dental service in 2019 can be with any clinician. It does not need to be with the clinician that provided the index restoration in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 4 (DEN4)

NUMERATOR 4: CROWN/ENDO/PARTIAL/EXTRACTION WITHIN 36 MONTHS OF RESTORATION

For each practice and clinician: Among the subjects in Denominator 4, **for each restoration placed in 2016**, check if subject received any crown, endodontic, partial denture, or extraction service in the same tooth as the restoration within 36 months of the restoration placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 4.

4. For **each restoration placed in 2016**, check if subject has any crown, endodontic, partial denture, or extraction service **in the same tooth within 36 months** (can be placed by any practice/clinician):
- a. Crowns:
 - i. If any [CROWN CODE] = [D2710 through D2794]; AND
 - ii. [CROWN TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{CROWN DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 1,095$ days
- OR**
- b. Endodontic services:
 - i. If any [ENDODONTIC CODE] = [D3110 through D3999]; AND
 - ii. [ENDO TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $[\text{ENDO DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 1,095$ days
- OR**
- c. Partial denture services:
 - i. If any [PARTIAL DENTURE CODE] = [D5211 through D5286]; AND
 - ii. [PARTIAL TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{PARTIAL DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 1,095$ days
- OR**
- d. Extraction services:
 - i. If any [EXTRACTION CODE] = [D7111 through D7999]; AND
 - ii. [EXTRACTION TOOTH NUMBER] = [RESTORATION TOOTH NUMBER]; AND
 - iii. $0 < [\text{EXTRACTION DATE OF SERVICE}] - [\text{RESTORATION DATE OF SERVICE}] \leq 730$ days
 - e. If subject had ANY follow-up procedure contained in (a) – (d) within 1,095 days, then **include in practice-specific or clinician-specific numerator 4**.
 - f. If subject did not have any follow-up procedure contained in (a) – (d) within 1,095 days, then STOP processing; this subject is included in denominator 4, but will not be included in numerator 4.

NOTES:

- The crown/endo/partial/extraction procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the restoration in 2016.

- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 4, but is not included in numerator 4.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 4 (NUM 4)

5. Report ([using reporting template](#)):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

Appendix 2: Advanced Procedure (crowns, partials, endodontic treatment, or extractions) after Restoration Placement Practice and Clinician Rates, Stratified by Age

Crowns/partial/endodontic/extractions following restoration placement: >=19 YEARS													
Practice													
		DEN1	NUM1	RATE1	DEN2	NUM2	RATE2	DEN3	NUM3	RATE3	DEN4	NUM4	RATE4
		#ptnts w/ Eval/Rest in 2016	#ptnts w/ Crown/etc. within 6 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2017	#ptnts w/ Crown/etc. within 12 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2018	#ptnts w/ Crown/etc. within 24 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2019	#ptnts w/ Crown/etc. within 36 mos.	
>=19 Years (total, nonstratified)													
Data Partner 1 (n=2,069)	Median	195	3	1.52%	161	6	3.35%	145	11	7.19%	134	16	10.91%
Data Partner 2 (n=100)	Median	251	4	1.52%	184	7	3.33%	148	10	6.44%	128	12	8.80%
19-30 Years													
Data Partner 1	Median	37	0	0.00%	26	0	0.00%	21	1	3.85%	18	1	6.25%
Data Partner 2	Median	46	0	0.00%	29	0	0.00%	22	1	2.99%	17	1	2.77%
31-50 Years													
Data Partner 1	Median	77	1	1.39%	63	2	2.86%	58	4	5.71%	55	5	8.70%
Data Partner 2	Median	102	1	1.21%	1.21%	2	2.59%	64	3	4.84%	59	4	6.66%
51-64 Years													
Data Partner 1	Median	58	1	1.69%	51	2	3.77%	47	4	8.16%	44	6	12.73%
Data Partner 2	Median	64	1	1.85%	52	2	3.68%	46	3	7.23%	41	5	10.60%
>=65 Years													
Data Partner 1	Median	24	0	0.00%	21	1	4.00%	19	2	10.00%	17	3	15.63%
Data Partner 2	Median	27	0	0.00%	22	1	4.88%	20	2	9.88%	18	2	13.33%

PRACTICE- AND CLINICIAN-LEVEL DENTAL QUALITY MEASURE DEVELOPMENT REPORTS

Crowns/partials/endodontic/extractions following restoration placement: >=19 YEARS													
Clinician													
		DEN1	NUM1	RATE1	DEN2	NUM2	RATE2	DEN3	NUM3	RATE3	DEN4	NUM4	RATE4
		#ptnts w/ Eval/Rest in 2016	#ptnts w/ Crown/etc. within 6 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2017	#ptnts w/ Crown/etc. within 12 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2018	#ptnts w/ Crown/etc. within 24 mos.		#ptnts w/ Eval/Rest in 2016 & Any Dental Service in 2019	#ptnts w/ Crown/etc. within 36 mos.	
>=19 Years (total, nonstratified)													
Data Partner 1 (n=1744)	Median	184	3	1.40%	153	5	3.15%	139	10	6.67%	129	14	10.26%
Data Partner 2 (n=100)	Median	255	5	1.76%	184	7	3.29%	152	10	5.84%	132	13	8.21%
19-30 Years													
Data Partner 1	Median	35	0	0.00%	25	0	0.00%	21	1	3.23%	18	1	5.88%
Data Partner 2	Median	50	0	0.00%	33	0	0.00%	24	1	1.50%	19	1	3.65%
31-50 Years													
Data Partner 1	Median	71	1	1.27%	60	2	2.66%	55	3	5.26%	52	4	8.30%
Data Partner 2	Median	97	2	1.63%	73	3	3.26%	63	4	5.22%	54	4	6.74%
51-64 Years													
Data Partner 1	Median	54	1	1.54%	48	2	3.45%	45	3	7.55%	42	5	11.76%
Data Partner 2	Median	68	2	1.88%	56	2	3.58%	47	3	7.23%	43	4	10.35%
>=65 Years													
Data Partner 1	Median	23	0	0.00%	20	1	3.45%	19	2	9.52%	17	2	15.00%
Data Partner 2	Median	28	0	0.00%	22	1	1.95%	18	1	7.69%	17	2	12.50%

Appendix 3: Evidence Review by ADA Science and Research Institute

1. For posterior restorations (regardless of material) in general, what is the expected survival rate at 12/24 and 36 months?

After examining seven meta-analyses spanning from 2012 to 2022, it has been found that the survival rate for posterior restorations in both primary and permanent teeth, regardless of the material used, ranges from 61.6% to 97% for at least 48 months. The survival rates are affected by the type of teeth being evaluated (permanent or primary), the material used, and the number of restored surfaces.

Type of posterior restoration	Type of dentition	Follow-up periods	Survival Rate	Reference
Resin composite materials (hybrid, micro-hybrid, nanohybrid or bulk fill composite) and Glass- ionomers	Permanent	At least 2 years	After 4 years: 95–97% with no significant differences between the resin composite materials. After 10 years: 85–90% with no significant difference between hybrid, micro-hybrid, and non-hybrid resin materials. For compomer and GIC (Glass Ionomer Cement) restorations, the mean overall survival rate was about 80% after 6 years.	(Heintze, Loguercio et al. 2022)
Atraumatic Restorative Treatment (ART)	Primary and permanent teeth	12 to 36 months	For primary teeth: 71% in 12 months to 65% in 36 months. For permanent teeth: 96% in 12 months to 61% in 36 months.	(Garbim, Laux et al. 2021)
Amalgam and composite resin restorations	Permanent	At least 3 years	Amalgam: 92.5% Direct resin composite: 85.8%	(Worthington, Khangura et al. 2021)
Bulk-fill resin composites and conventional resin composites	Permanent	12-72 months	Bulk-fill: 94.43% Conventional: 96.68%	(Velo, Lemos et al. 2019)

Ceramic, Hybrid and Composite Onlays	Permanent	12 months or more	The estimated restoration survival rate was 94.2%	(Bustamante-Hernández, Montiel-Company et al. 2020)
Atraumatic restorative treatment (ART) sealants and restorations	Primary and permanent teeth	At least 1 year	Survival rates of single-surface ART restorations over the first 2 years in primary teeth: 93% Survival rates of multiple-surface ART restorations in primary teeth over the first 2 years in primary teeth: 62%. Survival rates of single-surface ART restorations over the first 3 years: 85% Survival rates for single-surface ART restorations in permanent teeth over the first 3 years: 85% Survival rates for multiple-surface ART restorations in permanent teeth over 1 year: 86%. The mean annual dentine lesion incidence rate, in pits and fissures previously sealed using ART, over the first 3 years was 1%.	(de Amorim, Leal et al. 2012)
Resin composites, compomers, amalgams and glass-ionomer	Permanent (Class II restorations)	Average 4.6 years	61.6%	(Kopperud, Tveit et al. 2012)

2. Are patient factors more predominant or technical quality of the provider more predominant when it comes to survival?

Clinical retrospective and practice-based studies published that patient-related factors, such as caries risk and bruxism (Laske et al. 2019, Opdam et al. 2007; Opdam et al. 2010; van de Sande et al. 2013) as well as socioeconomic status (Correa et al. 2013; Collares et al. 2018), are **variables of main importance in restoration survival**. Systematic reviews including patient-related risk factors showed that their influence on restoration performance is significant and relevant (Opdam et al. 2014; van de Sande et al. 2016). Besides patient-related factors, dentist factors, such as personal skills and treatment decisions (Laegreid et al. 2014; Laske et al. 2016a; Collares et al. 2017) and health insurance policies (Khalaf et al. 2014), may play a significant role in the survival of restorations placed in general practice as well.

Studies identified several of these risk factors, such as socioeconomic status (Correa et al. 2013), general health, periodontal status (Adolphi et al. 2007), oral hygiene (Kopperud et al. 2012), high caries risk (Kopperud et al. 2012; van de Sande et al. 2013), and parafunctional habits (van de Sande et al. 2013; Pallesen and van Dijken 2015). Moreover, restoration size (Lucarotti et al. 2014; Laske et al. 2016b) and the presence of an endodontic treatment (Laske et al. 2016b) were found as risk factors for survival.

According to Laske et al. (2019), a wide range in operator AFR (Annual Failure Risk) was found, varying between 3.6% and 11.7%. This is remarkable in that all included dentists are motivated above average to provide high-quality care. As indicated in another study (Laske et al. 2016b), the observed differences may be related to operator skills, clinical experience, sex, and age, but it could also be related to practice organization, intervention choices by the dentists, and different patient needs and demands.

Demarco et al. (2012; 2023) showed that **tooth/restoration-level factors were the most prevalent risk factors** when compared to patient-level and dentist-level factors, especially the type of tooth restored, number of restored surfaces, position of the tooth in the mouth, and type of resin composite used. The most frequent patient-level factors investigated were their gender, age, and presence of caries and/or occlusal stress risks. **Dentist-level factors were far less prevalent than the other types**, the most frequently found types were the effect of different operators and the operator's experience.

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Appendix 4: Related Concept Data

Measure: Percentage of Total Crowns Placed Requiring Root Canal Treatment Subsequent to Placement (data provided by Data Partner 2)

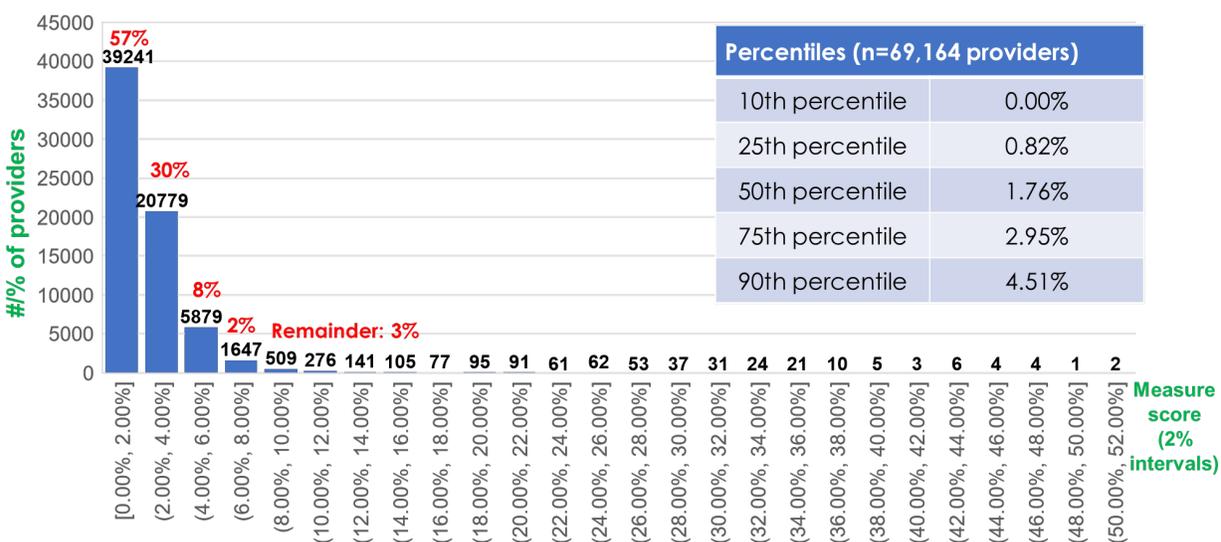
Numerator:

Count of unique patient/tooth combinations with D27xx (excluding D2799) with subsequent D3310, D3320, or D3330

Denominator:

Count of unique patient/tooth combinations with D27xx (excluding D2799)

**% crowns placed with subsequent root canal treatment
Histogram: #/% of Providers in Measure Score Range**



Measure: Percentage of Treated Teeth Subsequently Extracted (data provided by Data Partner 2)

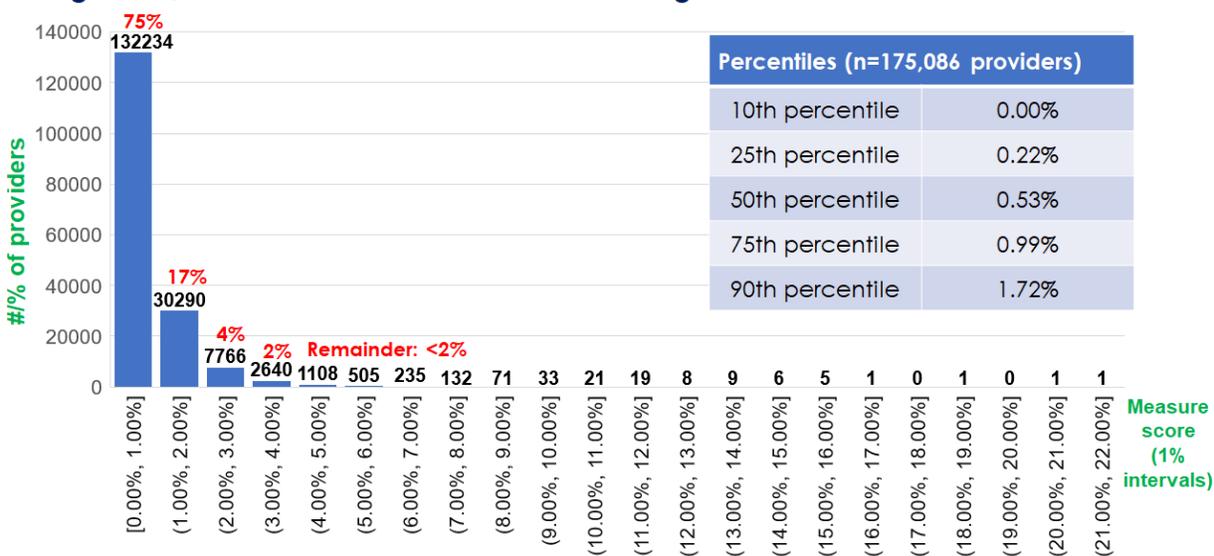
Numerator:

Count of unique patient/tooth combinations with D135x, D15xx, D2xxx, D3xxx, or D4xxx with subsequent D7140, D7210, or D7250 (primary teeth excluded)

Denominator:

Count of unique patient/tooth combinations with D135x, D15xx, D2xxx, D3xxx, or D4xxx (primary teeth excluded)

% of treated teeth subsequently extracted
Histogram: #/% of Providers in Measure Score Range



Measure: Percentage of Total Crowns Requiring Extraction of the Tooth Subsequent to Placement (data provided by Data Partner 2)

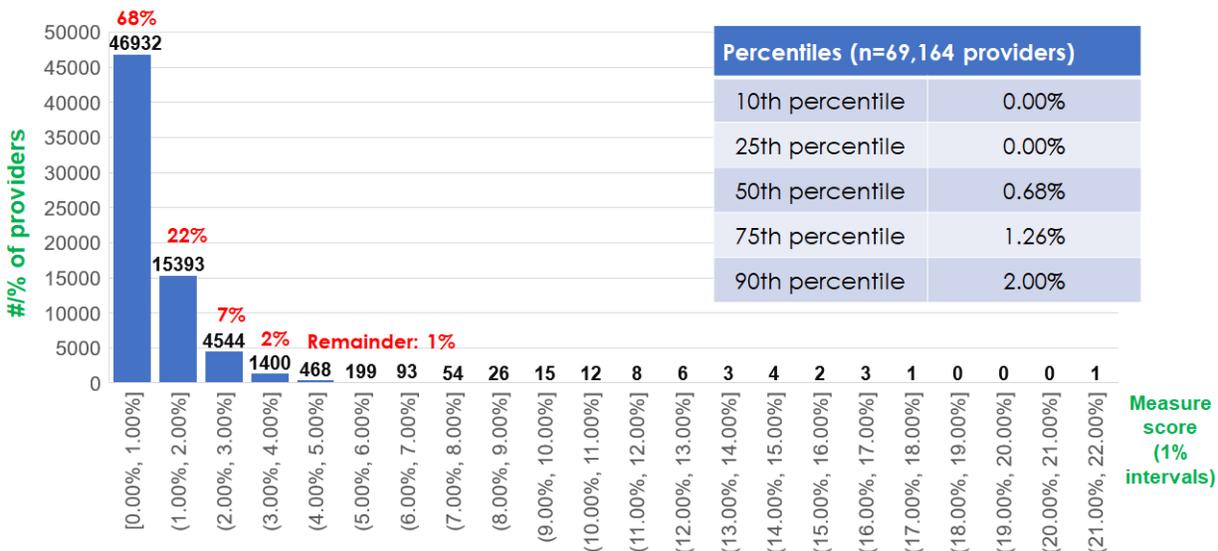
Numerator:

Count of unique patient/tooth combinations with D27xx (excluding D2799) with subsequent D7140, D7210, or D7250

Denominator:

Count of unique patient/tooth combinations with D27xx (excluding D2799)

% crowns placed with subsequent extraction
Histogram: #/% of Providers in Measure Score Range



Measure: Percentage of Implants Requiring Repair or Removal (data provided by Data Partner 2)

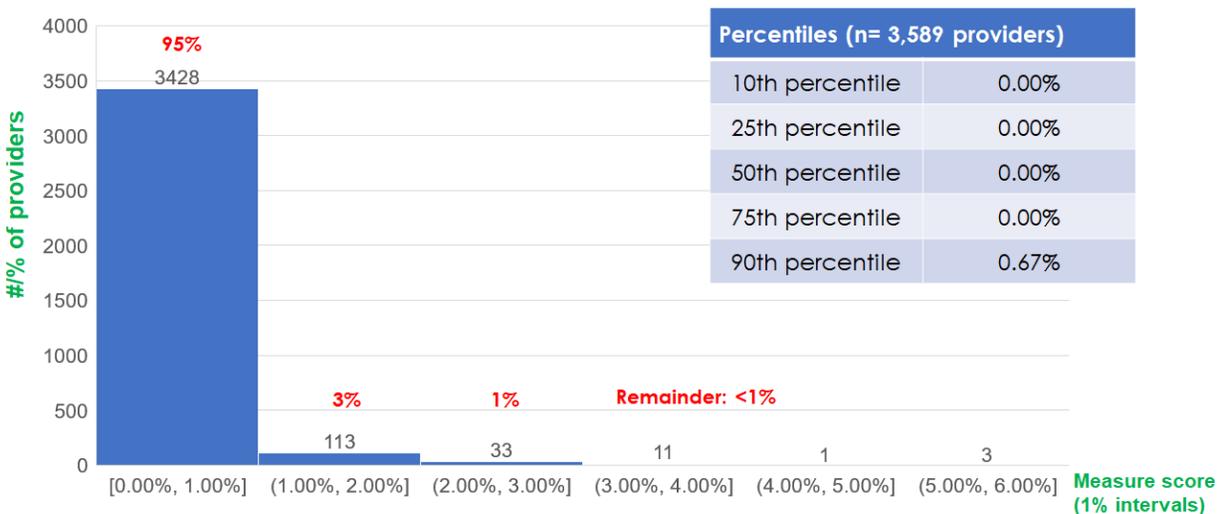
Numerator:

Count of unique patient/tooth combinations with D6010, D6013, D6040, D6050 with subsequent D6090, D6092, D6093, D6095, D6096, D6100, or D6105

Denominator:

Count of unique patient/tooth combinations with D6010, D6013, D6040, D6050

**% implants requiring repair or removal
Histogram: #/% of Providers in Measure Score Range**



Appendix 5: Restorations Following Sealant Placement Measure Specifications

*****NOTE: THESE SPECIFICATIONS WERE DEVELOPED SOLELY TO INFORM EVALUATION OF THIS CONCEPT. THESE SPECIFICATIONS ARE NOT APPROVED SPECIFICATIONS TO BE USED IN QUALITY IMPROVEMENT PROGRAMS.*****

PRACTICE/CLINICIAN LEVEL MEASUREMENT: PROVISIONAL MEASURE CONCEPT SPECIFICATIONS FOR CONCEPT EVALUATION

CONCEPT: RESTORATIONS FOLLOWING SEALANT PLACEMENT

*****DRAFT SPECIFICATIONS: DO NOT SHARE*****

*****DATA TESTING PARTNERS: PLEASE DO NOT MAKE ANY ASSUMPTIONS. IF SOMETHING IS NOT CLEAR, THEN PLEASE CONTACT THE DQA AT DQA@ADA.ORG. ENSURING THE CLARITY AND UTILITY OF THE SPECIFICATIONS IS PART OF THIS PROCESS.*****

This report evaluates the percentage of active pediatric patients who received restorations following a sealant on the same tooth, using different follow-up time periods.

- **TESTING NOTES:**
 - We are testing four denominators and numerators that correspond to four different follow-up time frames: 6, 12, 24 and 36 months.
 - Please use CLAIMS data from 2016 through 2019.

- **Age**
 - Include children aged 6 through 18 years at time of sealant placement. Measure scores will be stratified by the following age groups based on the child's age at the time of sealant placement: 6-10; 11-14; 15-18.

- **Measuring Entity and Data Sources**
 - Third party [e.g., payer or business associate] using enrollment and claims data. **Claims data note:** Include both paid and unpaid claims (including pending, suspended, and denied claims).
 - Practice or provider or business associate with access to Practice Management System (PMS) and/or Electronic Dental Record (EDR) data. **Billing/EDR data note:** Include all posted procedures for completed treatment whether paid or unpaid. The code does NOT need to have been billed to an

insurance company. Do not include procedures for which treatment was not completed (i.e., planned treatment).

- Months to Days Conversion:** To accommodate months ranging from 28 to 31 days, the following standards apply:

Years	Months	Days
	1 month	30 days
	2 months	61 days
	3 months	91 days
	4 months	122 days
	5 months	152 days
	6 months	183 days
	7 months	213 days
	11 months	334 days
1 year	12 months	365 days
	13 months	395 days
2 years	24 months	730 days
3 years	36 months	1095 days
5 years	60 months	1826 days

- Level of Reporting:**

- Practice** (identified by TIN)

Note: When a single TIN is used across multiple locations within a group practice, the measure will result in an average score across locations. Conversely if one group practice uses individual TINs for each of its locations, then the measure will result in a score by location. Such contextual information will be useful in interpreting scores when used for comparisons.

- Clinician** (identified by Rendering Provider NPI)

Note: This measure specification should be used with an understanding of the context of the clinical workflow within the practice. For practices with a team-based approach to care (i.e., one dentist always performs the evaluation, and a second dentist or hygienist always performs the fluoride application), all patients will be attributed to the first dentist. The second dentist or hygienist cannot be “scored” based on these specifications even if they are responsible for applying the topical fluoride.

- **Sample Selection for Testing with Claims Data:**

- **Practice:** Randomly select at least 100 practices among those that have at least 100 patients who qualify for DEN 4.
- **Clinician:** Randomly select at least 100 providers among those that have at least 100 patients who qualify for DEN 4.
- **Note:** These samples will be used to calculate all four denominators.

Specification

Four denominators and numerators that correspond to four different follow-up time frames (6, 12, 24, and 36 months) will be evaluated.

DENOMINATOR 1: SEALANT IN 2016

Check if subject had a sealant placed in 2016.

1. Check if the subject meets age criterion:
 - a. If subject is ≥ 6 years AND < 19 years as of December 31st, 2016, then proceed to next step.
 - b. If the age criteria are not met or there are missing or invalid field codes (e.g., date of birth), then STOP processing. This subject is not counted in the denominator.
2. Check if subject has **any sealants** placed in 2016:
 - a. If [SERVICE CODE] = D1351 **AND**
 - b. If January 1, 2016 \leq [SEALANT DATE OF SERVICE] \leq December 31, 2016, then proceed to next step.
 - c. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 1.
3. Attribute subject to **all practices** that placed **sealants in 2016**:
 - a. Assign subject to the *unique TIN* associated with each practice that placed at least one sealant in 2016.
 - b. Include in **Denominator 1 for the practice**.

Note: In this step, all **claims** with missing or invalid CDT CODE, missing or invalid billing provider TIN should not be included in the denominator.

4. Attribute subject to **all clinicians** that placed sealants in 2016:
 - a. Assign subject to the * unique RENDERING PROVIDER NPI* associated with each clinician that placed at least one sealant in 2016.
 - b. Include in **Denominator 1 for the clinician**.

Note: In this step, all **claims** with missing or invalid CDT CODE, missing or invalid billing provider TIN should not be included in the denominator.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 1 (DEN1)

NUMERATOR 1: RESTORATION WITHIN 6 MONTHS OF SEALANT

For each practice and clinician: Among the subjects in Denominator 1, **for each SEALANT placed in 2016**, check if subject received any restoration in the same tooth as the sealant within 6 months of the sealant placement with any practice/clinician:

5. Select subjects in the practice-specific or clinician-specific Denominator 1.
6. For **each sealant placed in 2016**, check If subject has any occlusal/proximal restorations **in the same tooth within 6 months** (can be placed by any practice/clinician):
 - a. Check for occlusal/proximal restorations:
 - i. If [PREVENTIVE RESIN RESTORATION CODE] = [D1352]
 - OR**
 - ii. If any [RESTORATION CODE] = [D2140, D2150, D2160, D2161, D2391, D2392, D2393 or D2394, D2110, D2120, D2130, D2131, D2380, D2381, D2382, D2385, D2386, D2387, D2388] that includes OCCLUSAL TOOTH SURFACE = [O or MO or DO or MOD or MODL or MODBL or MOL or DOL or MOB or MODB or DOB or BO or LO]
 - OR**
 - iii. If any one code in range [D2410 through D2664]
 - b. Check if restoration is on the same tooth as the sealant within 6 months:
 - i. [RESTORATION TOOTH NUMBER] = [SEALANT TOOTH NUMBER]; AND
 - ii. $0 < [\text{RESTORATION DATE OF SERVICE}] - [\text{SEALANT OF SERVICE}] \leq 183$ days
 - c. If subject meets all criteria in (a) and (b), then **include in practice-specific or clinician-specific numerator 1**.
 - d. If subject does not meet all criteria in (a) and (b), then STOP processing; this subject is included in denominator 1, but will not be included in numerator 1.

NOTES:

- The restoration procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the sealant in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 1, but is not included in numerator 1.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 1 (NUM 1)

7. Report (using reporting template):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 2: SEALANT IN 2016 AND ANY DENTAL SERVICE IN 2017

Among those subjects in **Denominator 1**, select those who also have any dental service in 2017. The dental service in 2017 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2017 (where the dental service in 2017 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND
 - c. If [DATE OF SERVICE] >= January 1, 2017 AND <= December 31, 2017, then include in **Denominator 2 for the practice**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 2.

NOTE: The dental service in 2017 can be with any practice. It does not need to be with the practice that provided the index sealant in 2016.

2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2017 (where the dental service in 2017 is not restricted to the same clinician):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
 - c. If [DATE OF SERVICE] >= January 1, 2017 AND <= December 31, 2017, then include in **Denominator 2 for the clinician**.

- d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 2.

NOTE: The dental service in 2017 can be with any clinician. It does not need to be with the clinician that provided the index sealant in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 2 (DEN2)

NUMERATOR 2: RESTORATION WITHIN 12 MONTHS OF SEALANT

For each practice and clinician: Among the subjects in Denominator 2, **for each SEALANT placed in 2016**, check if subject received any restoration in the same tooth as the sealant within 12 months of the sealant placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 2.
 4. For **each sealant placed in 2016**, check If subject has any occlusal/proximal restorations **in the same tooth within 12 months** (can be placed by any practice/clinician):
 - a. Check for occlusal/proximal restorations:
 - i. If [PREVENTIVE RESIN RESTORATION CODE] = [D1352]

OR

 - ii. If any [RESTORATION CODE] = [D2140, D2150, D2160, D2161, D2391, D2392, D2393 or D2394, D2110, D2120, D2130, D2131, D2380, D2381, D2382, D2385, D2386, D2387, D2388] that includes OCCLUSAL TOOTH SURFACE = [O or MO or DO or MOD or MODL or MODBL or MOL or DOL or MOB or MODB or DOB or BO or LO]

OR

 - iii. If any one code in range [D2410 through D2664]
- b. Check if restoration is on the same tooth as the sealant within 12 months:
 - ii. [RESTORATION TOOTH NUMBER] = [SEALANT TOOTH NUMBER]; AND
 - iii. $0 < [\text{RESTORATION DATE OF SERVICE}] - [\text{SEALANT OF SERVICE}] \leq 365$ days
- c. If subject meets all criteria in (a) and (b), then **include in practice-specific or clinician-specific numerator 2**.
- d. If subject does not meet all criteria in (a) and (b), then STOP processing; this subject is included in denominator 2, but will not be included in numerator 2.

NOTES:

- The restoration procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the sealant in 2016.

- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 2, but is not included in numerator 2.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 2 (NUM 2)

5. Report (using reporting template):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 3: SEALANT IN 2016 AND ANY DENTAL SERVICE IN 2018

Among those subjects in **Denominator 1**, select those who also have any dental service in 2018. The dental service in 2018 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2018 (where the dental service in 2018 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND
 - c. If [DATE OF SERVICE] >= January 1, 2018 AND <= December 31, 2018, then include in **Denominator 3 for the practice**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 3.

NOTE: The dental service in 2018 can be with any practice. It does not need to be with the practice that provided the index sealant in 2016.

2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2018 (where the dental service in 2018 is not restricted to the same clinician):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
 - c. If [DATE OF SERVICE] >= January 1, 2018 AND <= December 31, 2018, then include in **Denominator 3 for the clinician**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 3.

NOTE: The dental service in 2018 can be with any clinician. It does not need to be with the clinician that provided the index sealant in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 3 (DEN3)

NUMERATOR 3: RESTORATION WITHIN 24 MONTHS OF SEALANT

For each practice and clinician: Among the subjects in Denominator 3, **for each SEALANT placed in 2016**, check if subject received any restoration in the same tooth as the sealant within 24 months of the sealant placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 3.
4. For **each sealant placed in 2016**, check if subject has any occlusal/proximal restorations **in the same tooth within 24 months** (can be placed by any practice/clinician):
 - a. Check for occlusal/proximal restorations:
 - i. If [PREVENTIVE RESIN RESTORATION CODE] = [D1352]

OR

- ii. If any [RESTORATION CODE] = [D2140, D2150, D2160, D2161, D2391, D2392, D2393 or D2394, D2110, D2120, D2130, D2131, D2380, D2381, D2382, D2385, D2386, D2387, D2388] that includes OCCLUSAL TOOTH SURFACE = [O or MO or DO or MOD or MODL or MODBL or MOL or DOL or MOB or MODB or DOB or BO or LO]

OR

- iii. If any one code in range [D2410 through D2664]
- b. Check if restoration is on the same tooth as the sealant within 24 months:
 - i. [RESTORATION TOOTH NUMBER] = [SEALANT TOOTH NUMBER]; AND
 - ii. $0 < [\text{RESTORATION DATE OF SERVICE}] - [\text{SEALANT OF SERVICE}] \leq 730$ days
- c. If subject meets all criteria in (a) and (b), then **include in practice-specific or clinician-specific numerator 3**.
- d. If subject does not meet all criteria in (a) and (b), then STOP processing; this subject is included in denominator 3, but will not be included in numerator 3.

NOTES:

- The restoration procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the sealant in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 3, but is not included in numerator 3.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 3 (NUM 3)

5. Report (using reporting template):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

DENOMINATOR 4: SEALANT IN 2016 AND ANY DENTAL SERVICE IN 2019

Among those subjects in **Denominator 1**, select those who also have any dental service in 2019. The dental service in 2019 is not restricted to the same practice or clinician. It is simply to establish that the patient is still active in the database.

1. **For each practice**, select subjects in Denominator 1 who also have any dental service in 2019 (where the dental service in 2019 does not need to be restricted to the same practice):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any practice** AND
 - c. If [DATE OF SERVICE] >= January 1, 2019 AND <= December 31, 2019, then include in **Denominator 4 for the practice**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 4.

NOTE: The dental service in 2019 can be with any practice. It does not need to be with the practice that provided the index sealant in 2016.

2. **For each clinician**, select subjects in Denominator 1 who also have any dental service in 2019 (where the dental service in 2019 is not restricted to the same clinician):
 - a. If subject is in Denominator 1 **AND**
 - b. If [SERVICE CODE] = [D0100 – D9999] **with any clinician** AND
 - c. If [DATE OF SERVICE] >= January 1, 2019 AND <= December 31, 2019, then include in **Denominator 4 for the clinician**.
 - d. If either SERVICE CODE or DATE OF SERVICE is not met, or there are missing or invalid field codes (e.g., date of service), then STOP processing. This subject is not included in denominator 4.

NOTE: The dental service in 2019 can be with any clinician. It does not need to be with the clinician that provided the index sealant in 2016.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC DENOMINATOR 4 (DEN4)

NUMERATOR 4: RESTORATION WITHIN 36 MONTHS OF SEALANT

For each practice and clinician: Among the subjects in Denominator 4, **for each SEALANT placed in 2016**, check if subject received any restoration in the same tooth as the sealant within 36 months of the sealant placement with any practice/clinician:

3. Select subjects in the practice-specific or clinician-specific Denominator 4.
4. For **each sealant placed in 2016**, check If subject has any occlusal/proximal restorations **in the same tooth within 36 months** (can be placed by any practice/clinician):
 - a. Check for occlusal/proximal restorations:
 - i. If [PREVENTIVE RESIN RESTORATION CODE] = [D1352]
 - OR**
 - ii. If any [RESTORATION CODE] = [D2140, D2150, D2160, D2161, D2391, D2392, D2393 or D2394, D2110, D2120, D2130, D2131, D2380, D2381, D2382, D2385, D2386, D2387, D2388] that includes OCCLUSAL TOOTH SURFACE = [O or MO or DO or MOD or MODL or MODBL or MOL or DOL or MOB or MODB or DOB or BO or LO]
 - OR**
 - iii. If any one code in range [D2410 through D2664]
 - b. Check if restoration is on the same tooth as the sealant within 36 months:
 - i. [RESTORATION TOOTH NUMBER] = [SEALANT TOOTH NUMBER]; AND
 - ii. $0 < [\text{RESTORATION DATE OF SERVICE}] - [\text{SEALANT OF SERVICE}] \leq 1,095$ days
 - c. If subject meets all criteria in (a) and (b), then **include in practice-specific or clinician-specific numerator 4**.
 - d. If subject did not meet all criteria in (a) and (b), then STOP processing; this subject is included in denominator 4, but will not be included in numerator 4.

NOTES:

- The restoration procedure can be with any practice or clinician. It does not need to be with the practice/clinician that provided the sealant in 2016.
- If either SERVICE CODE or DATE OF SERVICE criteria are not met, or there are missing or invalid field codes (e.g., TOOTH NUMBER), then STOP processing. This subject is included in denominator 4, but is not included in numerator 4.

YOU NOW HAVE THE PRACTICE-SPECIFIC AND CLINICIAN-SPECIFIC NUMERATOR 4 (NUM 4)

5. Report ([using reporting template](#)):
 - a. Number of patients in practice-specific or clinician-specific denominator, overall and by age stratification category
 - b. Number of patients in practice-specific or clinician-specific numerator, overall and by age stratification category

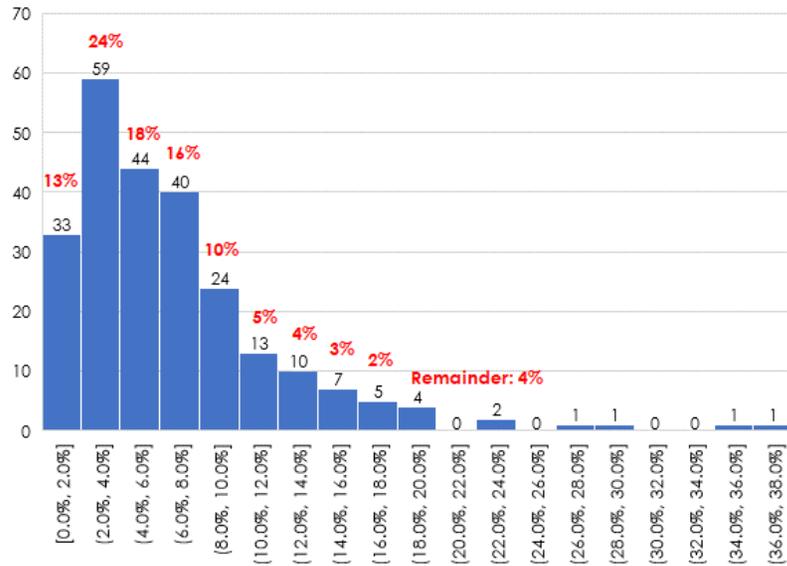
Appendix 6: Restorations Following Sealant Placement Practice and Clinician Rates

Restorations Following Sealant Placement (within 36 months): Percentiles

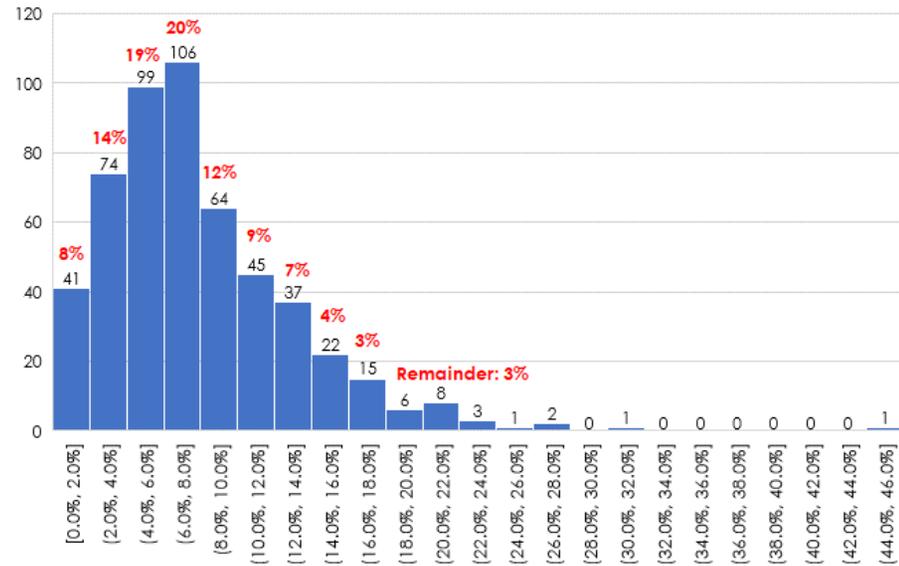
Distribution by Percentiles		
Data Partner 1	Practice (n=245)	Clinician (n=199)
10th percentile	1.7%	1.6%
25th percentile	3.0%	2.6%
50th percentile	5.5%	4.6%
75th percentile	8.8%	7.2%
90th percentile	12.7%	11.5%
Data Partner 2	Practice (n=525)	Clinician (n=431)
10th percentile	2.6%	2.7%
25th percentile	4.4%	4.5%
50th percentile	6.8%	7.1%
75th percentile	10.4%	10.9%
90th percentile	14.7%	15.4%

Restorations Following Sealant Placement (within 36 months): Histograms – N/% of Practices by Measure Score Range

Data Partner 1, Restorations after Sealants
Practice (n=245)
36-month Follow-up

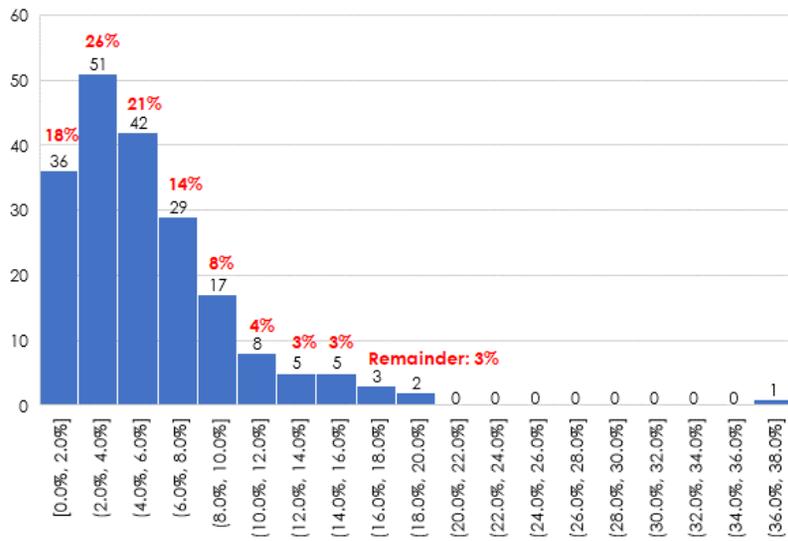


Data Partner 2, Restorations after Sealants
Practice (n=525)
36-month Follow-up

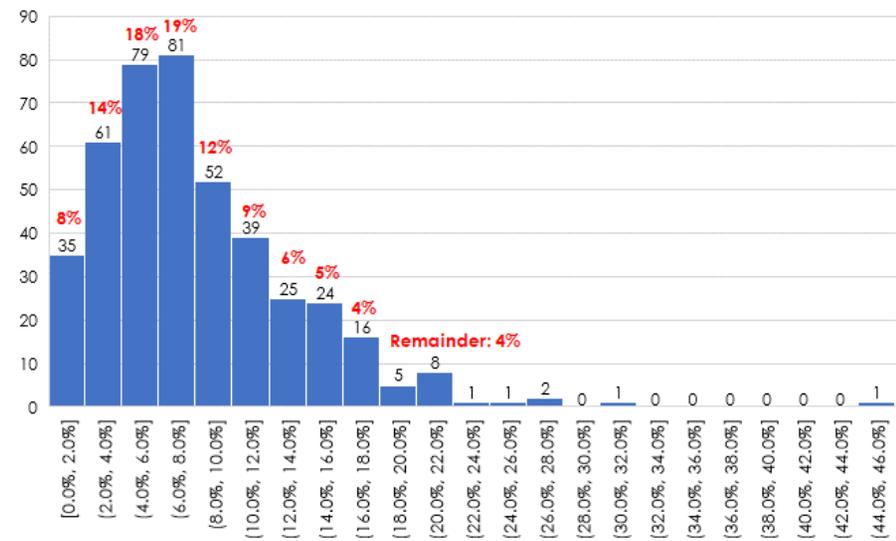


Restorations Following Sealant Placement (within 36 months): Histograms – N/% of Clinicians by Measure Score Range

Data Partner 1, Restorations after Sealants
Clinician, (n=199)
36-month Follow-up



Data Partner 2, Restorations after Sealants
Clinician (n=431)
36-month Follow-up



PRACTICE- AND CLINICIAN-LEVEL DENTAL QUALITY MEASURE DEVELOPMENT REPORTS

Restorations Following Sealant Placement, Practice and Clinician Rates, Stratified by Age

Restorations Following Sealant Placement													
Practice													
		DEN1 #pnts w/ Sealant in 2016	NUM1 #pnts w/ restorations within 6 mos.	RATE1	DEN2 #pnts w/ Sealant in 2016 & Any Dental	NUM2 #pnts w/ restorations within 12 mos.	RATE2	DEN3 #pnts w/ Sealant in 2016 & Any Dental	NUM3 #pnts w/ restorations within 24 mos.	RATE3	DEN4 #pnts w/ Sealant in 2016 & Any Dental	NUM4 #pnts w/ restorations within 36 mos.	RATE4
6-18 Years (total, nonstratified)													
Data Partner 1 (n=245)	Min	113	0	0.0%	104	0	0.0%	103	0	0.0%	100	0	0.0%
	Max	3,462	10	2.6%	3,287	41	11.1%	3,086	175	36.6%	2,951	175	36.4%
	Ave	230	1	0.3%	218	4	1.6%	202	13	6.3%	190	13	6.8%
	Median	178	0	0.0%	170	2	1.1%	155	8	5.2%	146	8	5.5%
Data Partner 2 (n=525)	Min	145	0	0.0%	121	0	0.0%	102	0	0.0%	100	0	0.0%
	Max	1,334	26	6.1%	1,041	53	11.5%	855	83	30.9%	761	95	44.4%
	Ave	342	2	0.6%	268	5	1.7%	215	11	4.8%	181	14	7.9%
	Median	297	1	0.4%	226	3	1.2%	184	8	4.0%	156	11	6.8%
6-10 Years - DEN4>=100													
Data Partner 1 (n=88)	Min	109	0	0.0%	105	0	0.0%	102	0	0.0%	100	0	0.0%
	Max	2,193	4	1.7%	2,090	19	8.2%	1,982	87	24.4%	1,913	87	23.0%
	Ave	207	1	0.3%	198	2	1.3%	186	10	5.4%	177	10	5.7%
	Median	157	0	0.0%	148	2	1.0%	137	7	5.0%	132	7	5.3%
Data Partner 2 (n=225)	Min	127	0	0.0%	105	0	0.0%	103	0	0.0%	100	0	0.0%
	Max	662	17	6.4%	526	24	11.1%	422	38	20.6%	385	37	23.8%
	Ave	259	1	0.5%	205	3	1.6%	168	7	4.3%	144	10	7.0%
	Median	235	1	0.4%	187	2	1.1%	149	5	3.2%	129	8	6.0%
11-14 Years - DEN4>=100													
Data Partner 1 (n=30)	Min	109	0	0.0%	107	0	0.0%	99	1	0.9%	100	1	1.0%
	Max	1,083	5	2.5%	1,020	18	10.0%	949	73	29.5%	904	73	34.5%
	Ave	204	1	0.4%	192	4	2.1%	178	13	7.6%	169	13	8.0%
	Median	146	0	0.0%	142	3	1.8%	128	12	6.7%	119	12	7.0%
Data Partner 2 (n=74)	Min	147	0	0.0%	130	0	0.0%	108	0	0.0%	101	0	0.0%
	Max	567	11	3.3%	446	18	11.2%	365	36	28.7%	330	48	44.0%
	Ave	247	1	0.5%	201	3	1.7%	163	9	5.4%	139	12	8.7%
	Median	227	1	0.4%	180	2	1.1%	149	6	4.2%	125	10	7.1%
15-18 Years - DEN4>=100													
Data Partner 1 (n=1)	Min	186	1	0.5%	177	4	2.3%	155	15	9.7%	134	15	11.2%
	Max	186	1	0.5%	177	4	2.3%	155	15	9.7%	134	15	11.2%
	Ave	186	1	0.5%	177	4	2.3%	155	15	9.7%	134	15	11.2%
	Median	186	1	0.5%	177	4	2.3%	155	15	9.7%	134	15	11.2%
Data Partner 2 (n=1)	Min	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Max	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Ave	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Median	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%

PRACTICE- AND CLINICIAN-LEVEL DENTAL QUALITY MEASURE DEVELOPMENT REPORTS

Restorations Following Sealant Placement													
Clinician													
6-18 Years (total, nonstratified)													
Data Partner 1 (n=199)	Min	111	0	0.0%	104	0	0.0%	103	0	0.0%	100	0	0.0%
	Max	972	6	2.6%	937	22	11.1%	898	68	36.6%	874	68	36.4%
	Ave	196	1	0.3%	187	3	1.3%	175	10	5.4%	167	10	5.7%
	Median	160	0	0.0%	151	1	0.9%	143	7	4.2%	135	7	4.6%
Data Partner 2 (n=431)	Min	145	0	0.0%	121	0	0.0%	102	0	0.0%	100	0	0.0%
	Max	1,267	24	6.1%	1,138	43	11.5%	1,044	69	30.9%	966	95	44.4%
	Ave	302	2	0.5%	240	4	1.8%	195	10	5.0%	165	13	8.2%
	Median	266	1	0.4%	210	3	1.3%	169	8	4.2%	142	11	7.1%
6-10 Years - DEN4>=100													
Data Partner 1 (n=59)	Min	109	0	0.0%	105	0	0.0%	103	0	0.0%	100	0	0.0%
	Max	505	4	1.7%	488	12	5.2%	467	34	15.4%	460	34	14.9%
	Ave	183	0	0.2%	174	2	1.2%	166	8	4.9%	159	8	5.2%
	Median	152	0	0.0%	146	1	0.8%	137	6	4.3%	131	6	4.6%
Data Partner 2 (n=143)	Min	127	0	0.0%	114	0	0.0%	105	0	0.0%	100	0	0.0%
	Max	659	15	5.7%	595	24	11.1%	546	35	20.6%	510	50	19.8%
	Ave	241	1	0.5%	193	3	1.7%	159	7	4.5%	138	10	7.3%
	Median	217	1	0.3%	174	2	1.2%	143	6	3.9%	123	8	6.5%
11-14 Years - DEN4>=100													
Data Partner 1 (n=18)	Min	109	0	0.0%	107	0	0.0%	104	2	1.7%	103	2	1.8%
	Max	382	3	1.1%	369	9	4.6%	359	26	14.8%	346	26	15.5%
	Ave	177	1	0.3%	169	3	2.0%	160	12	7.7%	152	12	8.0%
	Median	145	0	0.0%	139	3	2.0%	126	12	7.2%	120	12	7.5%
Data Partner 2 (n=38)	Min	144	0	0.0%	126	0	0.0%	108	1	0.8%	100	1	0.9%
	Max	512	11	3.9%	456	18	11.2%	421	31	28.7%	385	48	44.0%
	Ave	256	1	0.5%	209	4	2.1%	168	10	6.0%	145	14	9.8%
	Median	231	1	0.4%	181	3	1.4%	147	7	4.6%	125	11	7.9%
15-18 Years - DEN4>=100 sizes													
Data Partner 1 (n=0)	Min	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Max	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Ave	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Median	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Data Partner 2 (n=1)	Min	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Max	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Ave	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%
	Median	193	6	3.1%	151	11	7.3%	115	17	14.8%	103	22	21.4%

Appendix 7: Public Comments

COMMENT	SUBMITTED BY
<p>I agree with the conclusions of the committee.</p> <p>I would add that, depending on the data sources and assuming they are Payors, it might be statistically relevant to suggest that the original (not advanced) treatment for the tooth may not have met criteria for such a benefit if the claim was auto adjudicated and not human reviewed. This can create confounding without the use of appropriate and validated AI models.</p> <p>Another confounder might be the choice taken by the patient (advanced care) for any number of reasons...including financial etc....</p> <p>Internally, though, all of this data can be useful.</p>	<p>Stephen J. Canis DMD, CDC</p> <p>Chief Dental Officer</p> <p>Progressive Dental Concepts</p>
<p>First, NNOHA would like to thank the DQA for the scientific, thoughtful, and rigorous approach taken to evaluate these measurement concepts and their commitment to develop practice- and clinician-level dental quality measures and we are generally in support of the conclusions of the workgroup. o NNOHA agrees with the DQA’s prioritization of the development of standard measures that enable comparison between entities and offer the greatest public health impact.</p> <ul style="list-style-type: none"> • NNOHA commends and supports the DQA in recognizing the differences in quality assurance and quality improvement and the need for both when discussing overall “Quality” in dentistry. • NNOHA agrees with the conclusion that while these measures may have utility for organizations engaged in internal quality assurance programs, they are not ideal for comparing an organization’s performance against the results of other organizations. • NNOHA agrees that while these measures could be used to identify “statistical outliers” in performance, the measures do not provide a clear indication of performance quality. There could be several factors that influence performance, such as working with a higher risk patient population or providing a broader scope of services. These factors would need to be accounted for in the performance evaluation. • NNOHA commends the DQA in recognizing that these measures could be influenced by social determinants of health or overall risk stratification of the patient population. 	<p>National Network for Oral Health Access (NNOHA)</p> <p>- Ramona English, DMD, MPH, NNOHA Quality Committee Chair</p> <p>- Lindsay Sailor, MPH, NNOHA Quality Committee Co-Chair</p> <p>- Phillip Thompson, MS, NNOHA Executive Director</p>

NNOHA would like to make the following suggestions to the DQA in response to these reports:

- The data collection for these measures all occurred before the COVID-19 pandemic. NNOHA is curious to see if results would be different on data collected after 2021, since many patients may have been unable to receive dental care during 2020-21.
- The data for these measures is completely based on CDT codes and claims data for health centers in some states (such as California) do not contain CDT codes. Those states would not be represented in any claims data when utilizing CDT codes, which supports the adoption of diagnostic codes as an alternate methodology for tracking outcomes-based data.
- NNOHA recognizes that there is a need for an increased focus on the creation, implementation, and adoption of measures clearly tied to evidence and evidence-based practice guidelines, which more overtly drive improvements in oral health outcomes.
- Additionally, NNOHA supports the adoption and implementation of diagnostic codes as a mechanism to drive higher levels of transparency, quality, and evidence-based standardization in dentistry and within a larger healthcare context. Widespread adoption of standardized diagnostic codes could enable the field of dental quality to move beyond plan-level and delivery-based procedurally-focused measures to one that can speak more robustly of population health and quality improvement at both system and practice levels. This is an area of work for which there is significant opportunity for partnership between NNOHA and DQA.