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Improving Oral Health Through Measurement

Risk Adjustment in Dental Quality Measurement

Discussion Document

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Purpose

This paper is intended as a ***discussion document*** for the oral health care performance measurement stakeholder community to begin consideration of potential risk adjusters and risk adjustment methodologies for dental quality measures, particularly outcomes and resource-based measures.

Introduction

Health care quality is defined as "the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[1] Quality *measures* "quantify the quality of a selected aspect of care by comparing it to an evidence-based criterion that specifies what is better quality."[2] The ultimate goal of quality measurement is to provide better, more affordable care that improves population health.[3] Health care quality measures include measures of access to care, processes of care, structures of care, patient experiences with care, outcomes of care, and efficiency of care delivery. Quality is measured at multiple levels of care including practices/clinics, managed care organizations (MCOs), medical/dental benefits administrators, public insurance programs, and public health programs. In this document, the term **provider** is used to encompass all of these levels of care. Thus, "providers" as it is used in this document includes Medicaid programs, health/dental plans, and clinics and practices.

There is increasing emphasis on using quality measures in "accountability" applications, such as public reporting (e.g., hospital, health care plan, or provider report cards for consumers) and value-based purchasing, which includes different methods of linking financial rewards or penalties to performance metrics.[3,4] Thus, a measured entity's performance is compared to national benchmarks or to peer organizations. For quality measures of *outcomes* and *efficiency*, there are often factors other than those attributable to the health care delivery system that may influence patient outcomes and resource use. These "other factors" include patient clinical and non-clinical (e.g., socioeconomic and demographic) characteristics.

Risk adjustment answers the following question:

How would the performance of units compare if hypothetically they had the same mix of patients?

-National Quality Forum[5]

When factors outside of the health care delivery system affect quality measure scores, risk adjustment is recommended to enable more accurate comparisons. The clinical and non-clinical characteristics of a group of patients are often referred to as the patient "case-mix" – the mix of patients with differing characteristics. For example, different dental practices may serve different types of patient populations. Some may specialize in pediatric care, some may specialize in serving individuals with special health care needs, some may serve a greater share of low-income patients, and so forth. The oral disease burden and oral health care needs of the populations served by each practice may be different.

There is a considerable literature on risk adjustment of medical quality of care and resource use indicators.[6] Dentistry only recently has established national, standardized, validated quality measures.[7] Initial measures were largely focused on process of care measures.[8] However, oral health care outcome measures more directly indicate whether the ultimate patient care goals are being met. Development of outcome measures requires consideration of whether and how to adjust for risk. The aims of this discussion document are to:

- describe the rationale for and purpose of risk adjustment,
- offer recommendations on how to identify and select potential risk adjusters,
- propose considerations in determining whether and how to risk adjust,
- identify current and future feasibility of risk adjusters in dentistry, and
- outline next steps to advance risk adjustment in dentistry.

Future reports will delve more deeply into the selection of specific risk adjusters in dentistry, resource requirements, and risk adjustment methodology.

Purpose of Risk Adjustment

What are health care outcome measures?

Clinical quality measures that fall into the domain of health care outcomes are measures of the health state of a patient *resulting from health care*. A patient's "health state":

- may include changes in health status,
- can be desirable or adverse, and
- may be identified through health care use as a proxy.[9]

Example of Health Care Outcome Measure

Quality indicator: Non-traumatic tooth extractions due to advanced decay

Connection to health care: Oral health care processes and interventions (prevention, early identification, and disease management) lead to fewer tooth extractions for advanced decay

Health state: Extractions due to untreated oral disease represents a deterioration in health status

Interpretation: Fewer extractions signals better oral health care quality

In the above example, a tooth extraction due to advanced decay is an example of a health care procedure that serves as a proxy for a deterioration in oral health status, or adverse health state, due to untreated oral disease.

Why are measures of health care outcomes often risk adjusted?

There are often factors other than those attributable to the health care delivery system that influence health outcomes. For example, a patient's oral health disease severity may influence whether a tooth saving procedure, such as a root canal treatment, is performed or whether a tooth is extracted.[10] When patient characteristics affect a measured outcome, providers that serve patient populations with greater disease severity and prevalence may have a lower performance on the outcome measure than they otherwise would if they served a lower risk population. Collectively, the grouping of patients with different risk characteristics within a unit is often referred to as the unit's "case-mix" – the mix of patients with differing characteristics. The purpose of risk adjustment is to enable more accurate comparisons. Risk adjustment allows one to answer the question: **"**How would the performance of various units compare if hypothetically they had the same mix of patients?"[5] Figure 1 illustrates the concept of patient "case mix" and the motivation for risk adjustment.

Key Concept

Risk adjustment allows for more accurate comparisons between reporting entities by "adjusting" the quality measure score for patient-specific characteristics that influence the outcome but are not attributable to the health care delivery system.

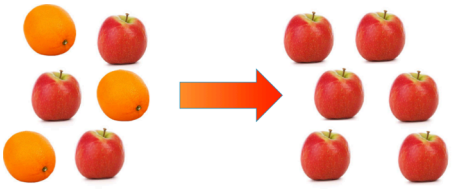
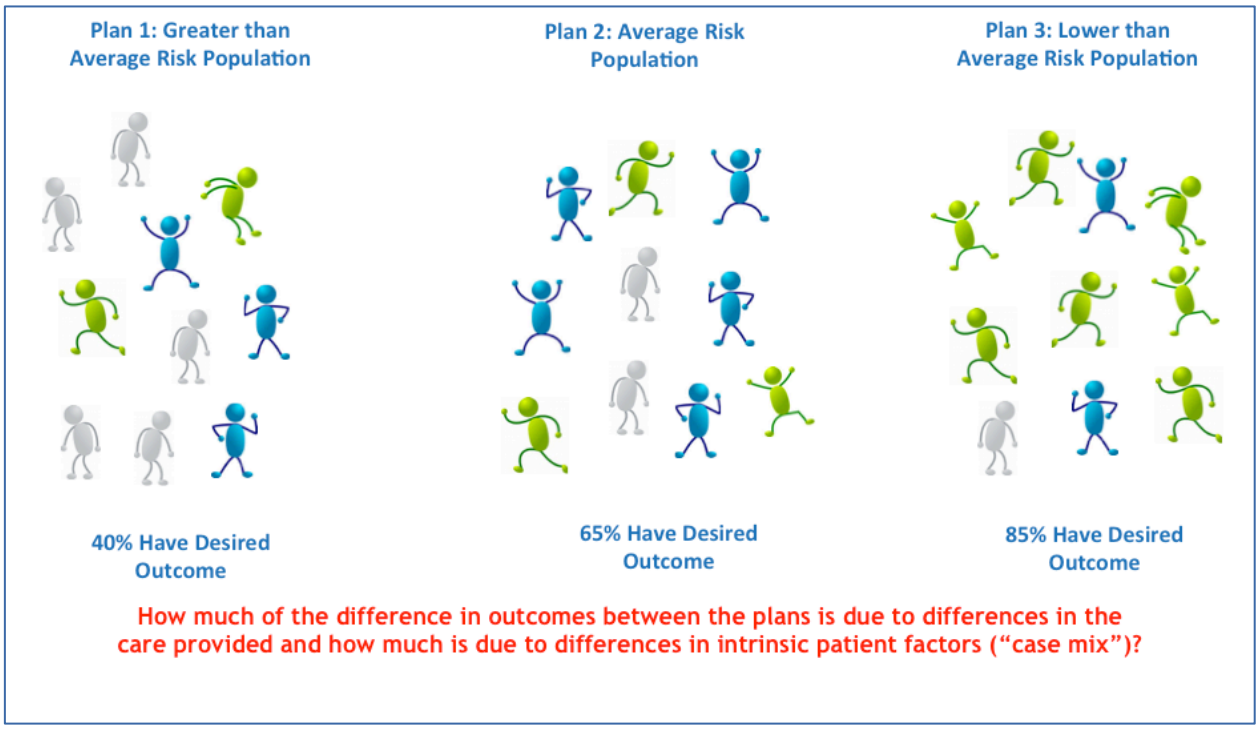


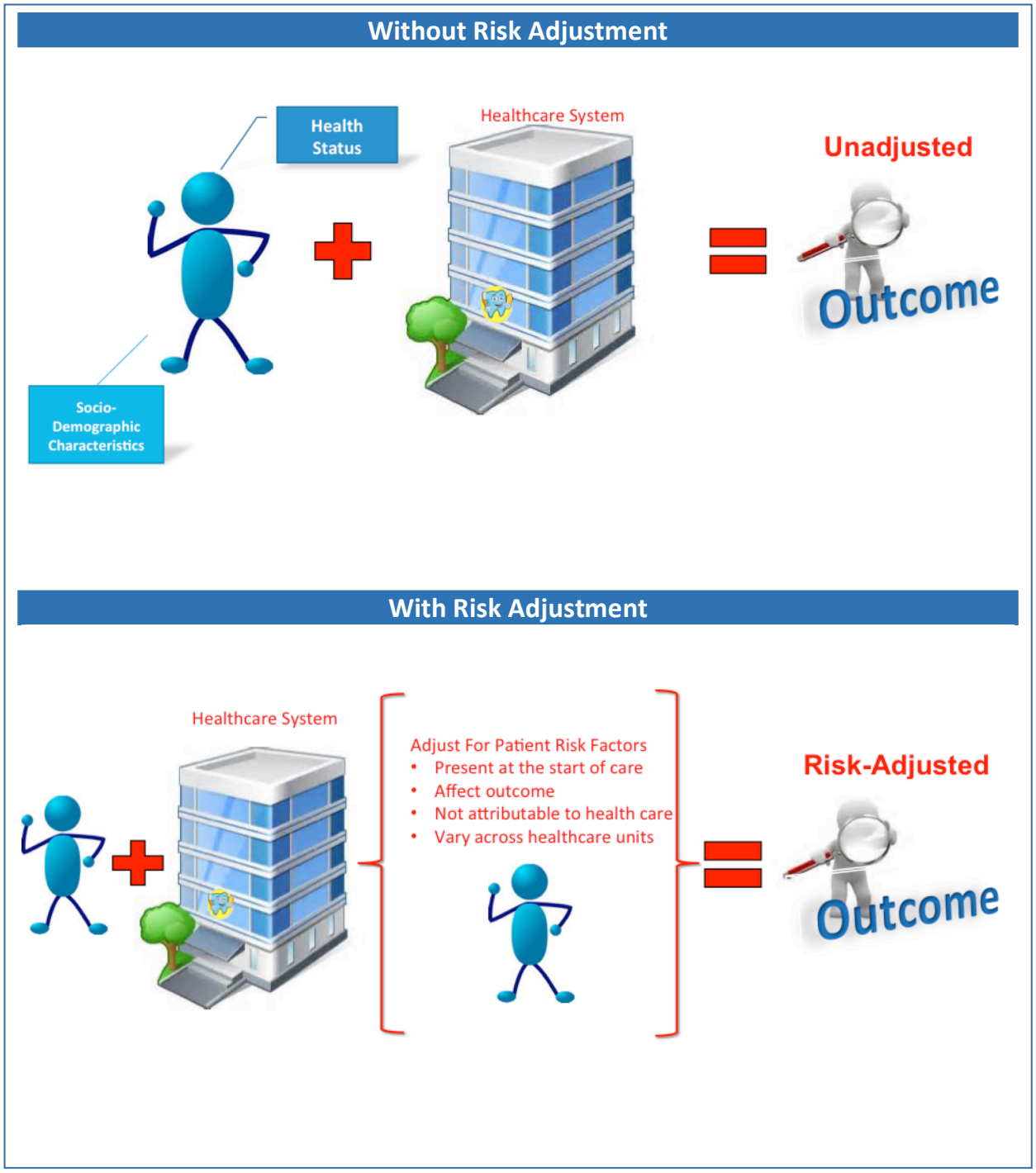
Figure 1. Illustration of Variation in Patient Case Mix



Three plans are illustrated in Figure 1. Plan 1 serves a relatively unhealthier, or higher risk, population compared to Plans 2 and 3. Plan 3 serves the relatively healthiest, or lowest risk, population compared to Plans 1 and 2. Plan 1, which serves the highest risk population, has the lowest percentage (40%) of patients obtaining the desired outcome. Plan 3, which serves the lowest risk population, has the highest percentage (85%) of patients obtaining the desired outcome. This raises the question of ***how much of the differences in outcomes between the plans is due to differences in the quality of care provided and how much is due to differences in intrinsic patient factors (i.e., the plan's "case mix")?*** Risk adjustment seeks to address this question.

Figure 2 illustrates the purpose of risk adjustment. Risk adjustment attempts to take into account the patient characteristics that influence the outcome and are not attributable to health care in order to isolate the care system effects.

Figure 2. Illustration of Purpose of Risk Adjustment



Identifying Risk Factors

What types of risk factors affect outcomes?

A broad range of patient factors may influence health outcomes.[6,11] These patient-related factors are often grouped into two broad categories of clinical and non-clinical factors (Figure 3). Although factors tend to be grouped into categories for ease of consideration, individual factors and categories are not mutually exclusive; often, they are overlapping and inter-related. Moreover, identifying and understanding the ways in which a factor may influence a health care outcome may be complex.[6,12,13]

Clinical Factors

Clinical factors that may influence outcomes include the patient's primary diagnosis and condition severity, comorbid physical, mental and behavioral health conditions, and functional status.[6,10] For example, in a study of Department of Veterans Affairs dental care patients, Jones et al. found that tooth extractions were more likely to be performed than root canal therapy among patients with: (1) periodontitis compared with those with less severe periodontal conditions (e.g., gingivitis); (2) more severe dental disease (e.g., cellulitis with abscess) compared with those with less severe dental disease (e.g., pulpitis or necrosis); (3) severe medical comorbid illness compared with those with moderate or mild medical comorbidity; and (4) alcohol dependence compared with those without alcohol dependence.[10] Age, although it is a demographic variable, also is commonly used as a clinical risk adjustment variable because of its significant positive association with the likelihood and severity of illness.[5,6]

Risk adjustment of outcome measures for clinical factors is a widely accepted practice and is considered important for providing more accurate comparisons between reporting entities. In medical databases, many of the important clinical factors can be captured through diagnosis codes providing high feasibility for implementation of risk adjustment. **A current significant limitation in dental databases for risk adjustment is the lack of consistent capture of diagnosis codes.**

Figure 3. Clinical and Non-Clinical Patient Factors that May Influence Outcomes

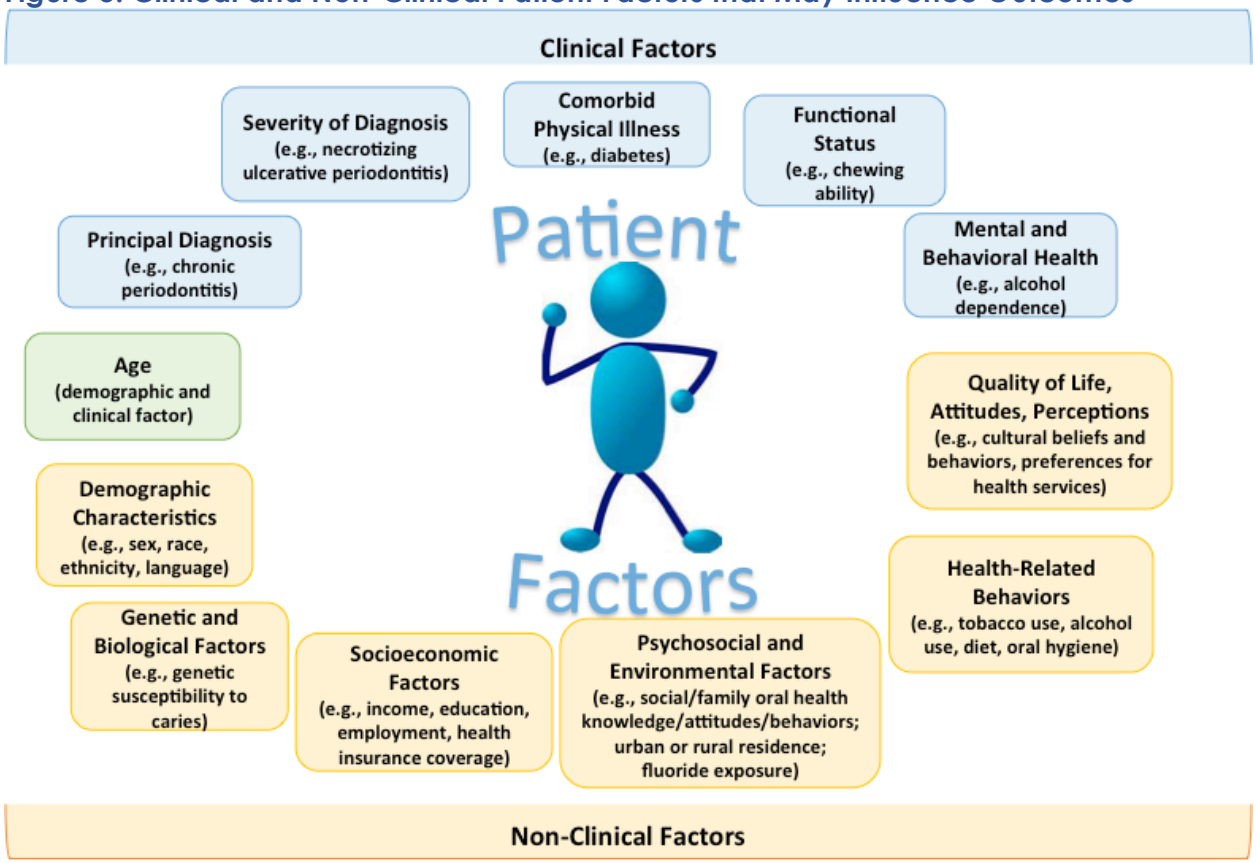


*Figure adapted from Iezzoni (2003).[14]

Non-Clinical Factors

Non-clinical factors that may influence outcomes include genetic, biological, demographic, socioeconomic, environmental, and psychosocial factors; health-related behaviors; and attitudes, preferences and perceptions regarding health care.[6,10,11] Risk adjustment for non-clinical factors is less common and more controversial compared with risk adjustment for clinical factors. Currently, there are significant feasibility and reliability challenges with risk adjustment for non-clinical factors. Other than age, sex, and address (to derive information about urban/rural residence and geographic region), there are few patient-level non-clinical factors that are collected consistently and in a standardized format. For example, despite national efforts to standardize and promote collection of race and ethnicity, these data currently are not captured in many databases and, when captured, there remains variability in data completeness and reliability.[15]

Balancing "leveling the playing field" for care providers with "avoiding masking disparities" for patients

Conceptually, there are broader concerns with risk adjusting outcomes for non-clinical patient factors, such as race, ethnicity, and socioeconomic status. A central concern is that disparities in care between these factors will no longer be transparent because they are "adjusted away." This may lead to both obscuring adverse effects of intentional care delivery choices on disparities and decreasing incentives to implement care processes that reduce disparities.[16] For example, Romano has remarked: "If culturally sensitive, readily accessible systems of care can eliminate or substantially reduce sociodemographic disparities. . . then adjusting for case mix would implicitly 'excuse' health plans for failing to implement disparity-reducing innovations."[16] A related concern is that risk adjustment may result in a lower quality threshold for disadvantaged populations, such that the expectations for quality are lower.[6]

Ostensibly, risk adjustment for demographic and socioeconomic characteristics would seem to be at odds with the Institute of Medicine quality dimension of **equity**:

> "The availability of care and quality of services should be based on individuals' particular needs and not on personal characteristics unrelated to the patient's condition or to the reason for seeking care. In particular, the quality of care should not differ because of such characteristics as gender, race, age, ethnicity, income, education, disability, sexual orientation, or location of residence."
>
> (IOM, *Crossing the Quality Chasm*, p. 53)[1]

In keeping with this perspective, in their study of tooth retention versus tooth loss among Veterans Administration patients, Jones et al. elected to limit their risk adjustment of the outcomes examined to clinical factors because "clinical factors are the most important determinants of the dental care received, and that veterans should receive quality dental care no matter who they are, who provides the treatment, or where it is provided."[10]

However, there also are concerns that **not** risk adjusting could exacerbate access limitations and allocation of health care resources to disadvantaged populations by disincentivizing providers from serving patients whose individual circumstances may predispose them to worse outcomes even when receiving the same quality of care. Financial rewards based on performance outcomes could divert resources away from

disadvantaged populations for whom it is more difficult to attain better outcomes if the providers who serve those populations are less likely to receive incentives or more likely to be penalized based on their performance on unadjusted outcomes. But these disadvantaged populations are likely to require greater, not fewer, resources.[13,17] These concerns led a National Quality Forum Expert Panel on Risk Adjustment for Socioeconomic Status or Other Sociodemographic Factors to determine that the potential downside to not risk adjusting for socio-demographic factors was sufficiently great that it is asking measure developers to evaluate the appropriateness of risk adjustment for socio-demographic factors as well as clinical factors and will be monitoring measures that include socio-demographic factor adjustment.[5]

Risk stratification as an alternative or complement to risk adjustment

Risk stratification is recommended as an approach that allows for a transparent comparison of outcomes between population sub-groups for risk factors that may also be associated with disparities in care such as race and ethnicity.[6] To stratify an outcome, the denominator population is divided into subsets (strata), and the measure results are reported for each sub-population within the stratification category. For example, ethnicity may be the stratification category with separate reporting for the sub-populations of Hispanic and non-Hispanic. Stratification is a relatively straightforward process to implement. As an **alternative** to risk adjustment, stratification works best when there are few risk factors.[5] Stratification can also be used as a **complement** to risk adjustment.[5,6] For example, Fiscella has recommended that health plans stratify quality measures by socioeconomic status, race, and ethnicity to "ensure accountability for care provided" to at-risk populations.[18] Fiscella also recommends adjustment of population-based performance measures by socioeconomic status, race, and ethnicity to allow for "more meaningful comparisons among health care organizations" but only after "appropriate measures for monitoring care to vulnerable groups have been fully implemented to avoid institutionalizing substandard care."[18] Another approach is to risk adjust a measure for clinical factors and then report the risk-adjusted outcome measure score overall and stratified by non-clinical factors.[6] NQF recommends that measures risk-adjusted for socio-demographic factors also include companion specifications for a version of the measure that is risk adjusted only for clinical factors and stratified by the socio-demographic factors used in the full risk adjustment model.[5] The purpose of the additional stratification is to facilitate the identification of disparities.

How to determine which factors to include in risk adjustment?

Risk adjustment should be evidence-based and clinically meaningful

> **Key Concept**
>
> **One size does NOT fit all.**
> Each measure should be evaluated for whether and how to risk adjust. Risk factor selection should be individually conducted for each measure.

Patient factors selected for risk adjustment should have a strong **conceptual relationship** as characteristics that directly or indirectly impact the outcome.[5] The conceptual basis for a risk factor also should be clinically meaningful. For example, Jones et al. hypothesized that patients with schizophrenia or alcohol dependence would be less likely to make multiple visits associated with tooth saving procedures and, therefore, would be more likely to have a tooth extracted.[10] Risk factors with conceptual relationships to the outcome can be identified through literature reviews and from clinical experts.[6] For example, Jones et al. used an expert panel of dentists to identify existing dental diagnoses that were likely to affect the type of dental treatment provided.[10] In addition to a conceptual relationship, there must also be evidence of a statistically significant association between the risk factor and the outcome.[5] It is critical, however, to start with the **clinical conceptual basis** of a relationship between the proposed risk factor and outcome before beginning data analyses. It is not appropriate to "mine data" to identify potential risk factors without first identifying clinically meaningful relationships.[6]

Factors used for risk adjustment should be present at the start of care

Risk adjustment should account only for patient-specific factors that are not attributable to the delivery care system.[5] Thus, candidate risk factors should be present at the start of care, not arise during care, or be the result of care. For example, an infection that results from a tooth extraction is not appropriate for inclusion in risk adjustment.

Risk factors should contribute to variation across reporting entities

There should be statistical evidence that the risk factor contributes to variation in the outcome between measured entities.[5] If data testing finds that there is no variation in a candidate risk factor between reporting entities, then there is no need for adjustment.[5]

Risk adjustment should be resistant to manipulation

Risk adjustment should not include factors that can be easily manipulated or "gamed" by the entities being evaluated. Thus, procedures, treatments or other direct care processes are typically not included as risk adjusters since these can be directly affected by providers.[5,6]

Risk adjustment should take into account feasibility and the potential for consistent implementation across targeted measure implementers

Data elements used to conduct risk adjustment need to be available across reporting entities and captured in a consistent manner. One of the biggest challenges to robust risk adjustment currently (including for medical outcomes) is limited data availability, particularly for non-clinical factors.[5,6] Although it may be possible conceptually to identify a broad range of factors that could affect outcomes, there is a core subset that is standardly used in practice due, in part, to data limitations. **Despite the recommendations for risk adjustment and a fairly extensive literature, in practice, most outcome quality measures are risk adjusted using a limited number of variables. While it is important to acknowledge data limitations and their implications, adjusting for every patient characteristic is not necessary. The question that must be answered is whether the risk factors that can be feasibly and reliably collected provide an adequate basis for adjustment given the purpose and intended use of measurement.**[6]

Assessing Sufficiency of Available Risk Factors

Key Question: *Do the included risk factors capture "sufficient information to convey clinical expectations about patients"?*

Assessing sufficiency:

1. Develop an *a priori* conceptual model of what risk factors should be considered.
2. Identify what risk factors can be included in the risk adjustment model.
3. Evaluate whether a risk model that adjusts for the factors that can be included, but omits other conceptually important factors, provides credible and clinically meaningful results.

(Adapted from Iezzoni, 2013[6])

Candidate Risk Factors for Adjusting Dental Outcome Measures

What candidate risk factors may be applicable to dental outcome measures and are currently available?

Clinical Factors. The main clinical factor that is consistently and reliably captured across data systems is patient age. In select databases, such as the Veteran's Administration, diagnoses are also available and can be used for risk adjustment. However, diagnostic data are not currently widely available across dental practice settings.

Non-Clinical Factors. The main non-clinical factors that are consistently and reliably captured across data systems are similar to those for medical systems: sex and geographic location. In some databases, race and ethnicity are well captured but as noted above, this is not consistently the case across dental practice settings.

What data are needed?

The single, largest current limitation in dental clinical data is the lack of consistent, standardized, and widespread reporting of dental diagnoses. This limitation affects not only the ability to risk adjust outcomes, but to develop meaningful outcome measures. Diagnostic codes are critical for assessing a patient's current and historical disease status, the appropriateness of treatment, and oral health outcomes.

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Risk Adjustment Implementation: Practical Considerations

How do risk adjustment methodologies get implemented across reporting entities?

Unlike risk adjustment that is conducted for research purposes, there is the practical consideration that must be addressed of how a risk adjustment methodology would be implemented across quality measure reporting entities – for example, across Medicaid programs, dental plans, or dental practices. The following approaches have been used for other quality measures:

1. **Risk adjustment by a central entity.** The Centers for Medicare and Medicaid Services (CMS) collects data from hospitals on 30-day mortality after hospitalization of patients for heart attack, heart failure, and pneumonia and risk adjusts these indicators.[19] This requires a central entity with the willingness, capability, and authority to collect data from reporting entities and the resources to conduct risk adjustment. This approach requires the least amount of risk adjustment expertise by measure implementers.
2. **Risk adjustment software.** The Agency for Healthcare Research and Quality (AHRQ) provides software to calculate its Inpatient Quality Indicators and Patient Safety Indicators, which includes risk adjustment.[20] This approach requires an entity with the capability to develop, update, and maintain the risk adjustment software as well as the resources to provide technical assistance to users. This requires an intermediate level of technical expertise by measure implementers, including the technical capability to implement the software code along with appropriate data collection and preparation
3. **Risk adjustment following risk adjustment methodology specifications.** The National Committee for Quality Assurance provides technical specifications for how to risk adjust the utilization measures Inpatient Hospital Utilization and Emergency Department Utilization.[21] This approach requires the greatest level of technical expertise among measure implementers and may have the greatest risk of variability in implementation.

Advancing Risk Adjustment in Dentistry

- **Identify outcome measure.** Before testing any risk adjustment methodology, a strong outcome measure must be identified.
- **Include clinical and methodological experts**. Recognized clinical and methodological experts should be included in the development of the risk adjustment methodology. Methodological experts should include individuals with knowledge of dental care and dental data as well as individuals with expertise in risk adjustment methodologies.
- **Conduct extensive testing.** Rigorous testing using representative data and replicated in multiple settings is required to ensure reliable and valid methodology. Risk adjustment must meet both methodological standards and clinical face validity of both the methodology and the results.
- **Address feasibility of implementation.** The feasibility and reliability of implementation across reporting entities must be assessed.
- **Repeat for each outcome measure.** Every outcome measure requires independent risk adjustment testing.

Risk Adjustment is . . .

Challenging. Developing a reliable and valid risk adjustment model that can be implemented across care settings is challenging. Iezzoni has commented that "development of risk adjusters *de novo* is complicated and often frustrating. We generally recommend taking methods 'off the shelf' if their attributes match a project's goals reasonably well."[6] Within dentistry, there is insufficient work to date to adopt "off the shelf" approaches. Therefore, significant testing with appropriate expertise is required.

Evolving. Despite widespread use of risk adjustment in health care, both science and implementation continue to evolve. There is still much left to learn, and dentistry has the opportunity to make significant contributions.

Consequential. Getting it right is important. Risk adjustment has significant implications for how care delivery is evaluated and (dis)incentivized with consequent effects on health care system participants.

Endnotes

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