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Calculating Accurate Metrics for the Actuarial Cost Model

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Introduction

Calculating metrics for an actuarial model sounds simple enough (just sum up the data!), but if proper care is not taken, it can lead to significant data quality issues and result in an inaccurate portrayal of business performance. Claims data can be very messy. Before data can be prepared for use in a model, the actuary must take steps to ensure that they are comfortable enough with the data that they can extract accurate and reliable information from the data.

This includes (but certainly not limited to) spending enough time exploring the data to become thoroughly familiar with the data source, understanding the limitations of the data (and its quirks!), how to reconcile the data against other sources, and validate it with their business knowledge (e.g., reasonability checks). Only after acquiring a high level of comfort with the data, the actuary can develop methodologies to bypass the quirks inherent within the data source, and then calculate accurate and reliable metrics. If multiple data sources need to be used, each data source will likely have its own unique quirks that must be considered. Do not assume that all data sources have the same issues.

Below is a list of metrics that are commonly aggregated directly from claims and eligibility data that then get included in the actuarial cost model:

Eligibility

1. Member-Month Exposure
2. Earned Premium

Claim Amounts

3. Claim Payments
4. Allowed Charges
5. Billed Charges
6. Non-Claim Payments (e.g., capitation, invoices)

Utilization Counts

7. Admissions
8. Bed Days
9. Visits
10. Procedures
11. Prescriptions Dispensed
12. Day Supply
13. Other Units

The above metrics are then used to derive the following summary metrics that are the focal points of the actuarial cost model.

Summary Metrics

14. Claim PMPM
15. Utilization Frequency
16. Unit Cost

17. Provider Discount
18. Actuarial Value (AV)
19. Medical Loss Ratio (MLR)

These metrics are highly scrutinized by health plan leadership, and serve as the basis for several important business decisions. Because of the high visibility and scrutiny of these metrics, it is imperative to accurately calculate the eligibility, claim amount, and utilization metrics from the data.

The remainder of the article will provide an overview of each metric, the calculation of the metric, and common data issues.

Eligibility Metrics

Eligibility metrics represent any quantifiable characteristics of the insured population. This typically includes the number of enrolled members and the amount of premium revenue, but it may also other numerical metrics such as age-gender scores, risk scores, etc.

1. Member-Month Exposure

The member-month exposure is simply a count of the number of members that are eligible to receive health care benefits for a given month. In a 12-month period (health plan contracts are usually 1-year in duration), each member will have 1 exposure for each month of eligibility. Eligibility is typically determined by the payment of premium for the corresponding month. For example, a group of 100 members has a member-month exposure of 1,200 if each member was eligible for the entire duration of a 1-year contract. If some members either started (or lapsed) coverage mid-year, then there would be less than 1,200 member-months.

The number of exposures may differ by the type of health care benefit if separate premiums are paid. For example, with the group of 100 members, 90 members may sign-up for medical benefits (i.e., hospital and physician), 50 members may sign-up for pharmacy benefits, and 75 may sign-up for dental benefits.

It is important to correctly calculate the member-month exposure because this metric is then used to calculate PMPM's and utilization frequency. If an incorrect assumption is made that all members are eligible for the entire contract period and eligible for all benefits, then the member-month exposure calculation will be over-stated which will lead to under-stating the PMPM and utilization frequency calculations. Under-stating those metrics can have adverse implications when pricing and forecasting benefit plans.

2. Earned Premium

Earned premium is the amount that the member is required to pay to receive benefit coverage. The health plan will earn 1-month of premium for each 1-month increment of benefit coverage. Despite when the premium is paid, premium amounts need to be allocated to the corresponding coverage period. For example, if 6 months of premium is paid on 1/1/2017 for a 1/1/2017-

6/30/2017 coverage period, then 1/6th of the total premium paid is allocated to each of the 6 months in the coverage period.

Correctly calculating the earned premium is important because it impacts the MLR calculation. The MLR calculation notifies plan leadership how much of the total premium is spent on health benefits, and most benefit plans have a minimum MLR guarantee where the health plan must pay back a portion of premiums if their MLR is below a certain level.

Claim Amount Metrics

Claim amount metrics represent any element of a health care service that is quantified as a dollar amount. For medical claims this will typically include billed charges, allowed charges, health plan paid amount, member out-of-pocket amount, and capitation. For prescription drug claims, it may also include ingredient costs, dispensing fees, rebates, average wholesale price (AWP), average sale price (ASP), maximum acquisition cost (MAC), etc.

3. Claim Payments

The claim payment amount is simply the amount of liability that the health plan has incurred for eligible services provided to their members. Since this is the amount paid by the health plan, the amount should be easily reconcilable to the health plan's general ledger. For each claim paid, there should be an entry in the general ledger (on the date payment was made) for the payment amount. After the payment amount is reconciled to the general ledger, the claims must be attributed to the date that liability was established (i.e., service date). The liability date may vary by the type of claim. For inpatient claims, the liability date is usually the admission date. Whereas with pharmacy claims, the liability date is the date the prescription is dispensed. For all other claims, the liability date is typically the date services are provided.

The claim payment amount is used to calculate PMPM's, MLR, and AV. To accurately calculate those important metrics, it is imperative that the claim payment amounts are properly reconciled to the general ledger and attributed correctly to the liability date.

4. Allowed Charges

Allowed charges represent the contracted amounts that providers are eligible to receive for services provided. The amount is equal to the health plan payment, plus any member out-of-pocket (OOP) payments, plus any coordination of benefits (COB). Unlike the claim payments, the allowed charges are not entered in the general ledger, making it impossible to achieve an exact reconciliation. However, there are reasonability checks that can be performed. At the claim level, the allowed amount should always be equal or greater than the payment amount. At the aggregated plan design level, the aggregated allowed amount should reflect a reasonable AV when compared to the aggregated payment amount.

To accurately calculate the allowed amount from claims data, claim reversals and adjustments must be properly handled. Since the allowed amounts are not a health plan liability, there is not a financial incentive to ensure the appropriate reversal and adjustment of these amounts. The below

example illustrates a typical data issue that I encounter with claim reversals and adjustments. The payment amounts are reversed and adjusted properly, but the billed charge and allowed charge amounts are not. If a simple summation is calculated, the total allowed charges in this example will be under-stated by $10 since the reversal and adjustment amounts were based on the payment amount and not the allowed amount.

Claim Number	Liability Date	Payment Date	Claim Status	Billed Charge	Allowed Charge	Payment Amount
123456789	1/1/17	2/1/17	Original	$200	$100	$80
123456789	1/1/17	3/1/17	Reversal	$0	($80)	($80)
123456789	1/1/17	3/1/17	Adjustment	$200	$70	$70

	Billed Charge	Allowed Charge	Payment Amount
Record Sum	$400	$90	$70
Corrected	$200	$100	$70

It is important to correctly calculate the allowed charges since it represents the denominator in the AV calculation, and the AV is supposed to reflect the plan design. Under-stating the allowed charges will over-state the AV; providing false information about the benefit richness. In the ACA individual and small group markets, plans are required to have a certain AV ranges. For example, a gold plan is supposed to target an 80% AV. If 90% AV is incorrectly calculated from the experience data, it provides false information that either the product was priced incorrectly or the product experience anti-selection.

The allowed charges are also important for provider contracting analysis since they represent the contracted reimbursement amounts. The under-stating of allowed charges gives a false sense of higher provider discounts, which can lead to incorrect assumptions if used for pricing or forecasting.

5. Billed Charges

Like the allowed charges, billed charge amounts are not always reversed and adjusted properly in the claims data. In the prior illustration, the billed charges are captured correctly in the original and adjusted records but not in the reversal record. In this example, the summation of billed charges will double the actual amount. If this issue is not fixed, it will further compound the provider discount calculation error.

6. Non-Claim Payments

To get a complete picture of all benefit expenses, all non-claim payments must be captured. This would include any capitation arrangements, provider bonuses, sub-contractor invoices, or claims paid manually. Not capturing these amounts will under-state the calculations for PMPM, MLR, and AV.

Utilization Count Metrics

Utilization count metrics represent any grouping of healthcare services (and corresponding costs) into mutually exclusive units. Some of the common groupings include admissions or bed-days (for inpatient services), visits (for outpatient or office services), procedures (lab and radiology), and prescriptions and day supply (for pharmacy).

Before I get into each type of utilization count, I want to briefly discuss grouping claims into homogeneous categories. Several utilization metrics can be calculated for each claim. It must be decided which utilization metrics provide the most beneficial information for each claim, and then group claims into categorizes based on the chosen metric(s). Below is an example of the utilization metrics that are the most practical for various benefit categories. Some benefits have multiple metrics that are important in describing the utilization (e.g., inpatient reports both admissions and bed days).

- Admissions: Facility Inpatient
- Bed Days: Facility Inpatient, Nursing Facility
- Visits: Emergency Room, Non-Inpatient Surgery, Office
- Procedures: Office, Radiology, Lab
- Prescriptions Dispensed: Retail Pharmacy, Mail-Order Pharmacy
- Day Supply: Retail Pharmacy, Mail-Order Pharmacy
- Other Units: Ambulance, Therapeutic Injections

Because of reversal and adjustments in the data, it is also important to decide if it most appropriate to calculate the utilization metrics based on billed charges, allowed charges, or payments. There will be instances where there are billed charges for an admission, but none of the charges are allowable. Similarly, there will be instances where an admission has allowed charges, but no payment owed by the health plan due to member cost-sharing. I like to use allowed charges as the default, but will sometimes use either billed charges or paid amounts depending on what makes the most sense for the analysis. Whichever cost metric is chosen; it is important to have a scheme to properly count utilization. If the cost is less than -$1 (< -$1), then count a negative utilization. If the cost is greater than $1 (> +$1) then count a positive utilization. If the cost is between -$1 and $1 (-$1 < x < +$1), the count the utilization as 0. Remember from earlier that if billed or allowed amounts are used, those amounts may need to first be fixed before accurate utilizations can be counted. If reversals and adjustments are not properly accounted for, the utilization frequency calculations will be over-stated and unit cost calculations will be under-stated.

After the units are counted, it is wise to check the unit cost (# units/cost amount) for reasonableness. For example, the allowed charge for an average day in the hospital inpatient should be several thousand dollars (e.g., $3-5k), so if your average allowed charge per day is less than $1,000 then you will want to investigate the data deeper or check your methodology for errors.

7. Admissions

Admissions are a count of the number of unique facility inpatient claims. To be considered an inpatient, the patient must formally be admitted into the hospital, and it will typically require

a pre-authorization from the patient's health plan. I find that using the type of bill (TOB) code from the UB claims form is the best way to flag inpatient claims. The TOB code is populated on all facility claims, with some codes representing inpatient claims and other codes representing outpatient claims. An admission is counted as a unique instance of (a) patient, (b) facility, (c) admission date, and (d) discharge date. Then I apply the reversal/adjustment counting rule based on the total cost of the admission.

8. Bed-Days

The length of stay (LOS) of the admission is determined by looking at the admission and discharge dates of an inpatient claim. There is a gray area when it comes to correctly calculating the number of bed-days. Ideally it would be most accurate to count 1 bed-day as every 24-hour incremental stay in the hospital, and then pro-rate the bed-day count by the number of hours in the hospital. For example, a 54 hour stay in the hospital would equate to 2.25 bed-days. Unfortunately, the times of admission and discharge are not always available. I find that the most unbiased approximation is to count the number of midnights stayed in the hospital (i.e., discharge date – admission date). Assuming the average time of admission and average time of discharges are equal, then counting the number of midnights would closely approximate the number of bed-days. The last step is to apply the reversal/adjustment counting rule based on the total cost of the admission.

9. Visits

Visits are the counter-parts of admissions for outpatient and office visits. I flag outpatient claims based on the TOB code from the UB claim form, and flag office visits based on a combination of CPT code, place of service code, and provider specialty from the 1500 claim form. Although there are a couple exceptions, the general rule is that a visit is counted as a unique instance of (a) patient, (b) provider, and (c) service date. Common examples of an except to this rule are hospital observation and overnight surgery. Even though the patient stayed in a facility overnight, the patient has not necessarily been admitted to the hospital. I flag these exceptions by looking for claims that have revenue codes for observation and surgery, and then analyze to see if there are claim numbers that have lines with different service dates. There are also cases where a single claim may represent multiple visits (e.g., physical therapy). It is imperative to be aware of the exceptions to the general rule so visits are not either under-stated or over-stated. After properly identifying unique visits in the data, the last step is to apply the reversal/adjustment counting rule based on the total cost of the visit.

10. Procedures

Professional claims and most outpatient claims are paid on a fee schedule (i.e., paid by the CPT/HCPCS that represent the services provided). In the claims data, these codes are populated at the line level. A procedure is counted as unique instances of (a) patient, (b) provider, (c) service date, and (d) CPT/HCPCS. Sometimes there are instances where the provider performs the same procedure multiple times and all are represented on the same claim line. In those cases, look on the data to see if there is a field that indicates the number of procedures reported on the line. After properly identifying unique procedures in the data, the last step is to apply the reversal/adjustment counting rule based on the total cost of the procedure.

11. Prescriptions Dispensed

The primary utilization metric for prescription drug is to count the number of prescriptions dispensed. A prescription is counted as unique instances of (a) patient, (b) pharmacy, (c) filled date, and (d) NDC. There may be instances where the patient filled multiple prescriptions for the same drug at the same time. Look on the data to see if there is a field that indicates the number of prescriptions reported on the line. After properly identifying unique prescriptions in the data, the last step is to apply the reversal/adjustment counting rule based on the total cost of the prescription.

12. Day Supply

Along with the prescription count, the day supply is an important metric because most retail prescriptions are 30-day supply whereas most mail-order prescriptions are 90-day supply. The dispense count alone will not recognize the mix of retail vs mail-order unless they are split into separate categories. There will typically be a field on the pharmacy data that represents day supply. Like the billed and allowed charge example illustrated earlier in this article, check to see if the day supply for reversed and adjusted records is represented correctly. If not, then those records will need to be fixed before calculating the total day supply. After any necessary fixing, simply aggregate the day supply across all prescriptions, and applying the reversal/adjustment counting rule based on the total cost of the prescription.

13. Other Units

There are a few medical services that are best represented by reporting a utilization metric other than one of those previously discussed. Examples that come to mind are ambulance and therapeutic injections. For ambulance services, it may be more informative to report either the number of one-way trip or the number of miles traveled. For therapeutic injections, it may be more informative to report the dosage of drug (e.g., milligrams or cc's). Ultimately any metrics reported are limited to the elements that are available in the data. If there is a "units" field in the data, I would only trust it if there is also a field that describes the metric of the units being counted. And of course, the last step is to apply the reversal/adjustment counting rule based on the total cost of the procedure.

Conclusion

Calculating accurate metrics may have its complications, but by being aware of the quirks in each data source and having the correct procedures in place, you can be assured that your actuarial models are presenting an accurate and reliable picture of the business. The models can then be trusted by health plan leadership as the source of truth for analytical reporting, and can be a crutch in helping to support many important business decisions.

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