acdis
Association of Clinical Documentation Integrity Specialists

Demystifying and communicating case-mix index

WHITE PAPER

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Introduction

Few metrics are as widely used—and as widely misunderstood—as case-mix index (CMI). Hospital leaders intensely scrutinize CMI because they often view it as a proxy for "financial performance." CDI leaders, meanwhile, use CMI to demonstrate the impact of their record reviews. CMI improvement allows CDI leadership to make the case for hiring more staff and investing in technology, allowing for expansion of a CDI program's breadth, scope, and organizational influence.

But CMI as a tool is both far blunter, and simultaneously more nuanced, than many realize. It is not a straight indicator of improved documentation and coding, although many organizations attempt to use it for this purpose. Several variables beyond documentation and coding practices influence the upward or downward movement of CMI. While CMI remains important, and most organizations continue to closely monitor it, in recent years CMI has conceded space to other priorities such as observed-to-expected mortality, which is measured and reported by public and private quality monitoring entities including CMS, Healthgrades, and U.S. News and World Report.

Understanding the complexities of CMI, and effectively communicating CMI trends and fluctuations with organizational administration, is still critical for CDI leaders. This paper offers a review of CMI basics before delving into its present use. It speaks to what CDI does and does not own, and to CMI's ongoing viability as a metric. It concludes with a discussion on how to effectively speak about CMI with organizational leadership and answer the tough questions that will inevitably arise.

What is CMI?

The U.S. healthcare system uses Medicare Severity Diagnosis-Related Groups (MS-DRG) to determine appropriate reimbursement. Each MS-DRG is assigned a relative weight, based on diagnosis and procedure codes, that indicates a patient's relative resource consumption.

CMI is the average relative weight of all inpatient DRGs in a patient population. It is calculated by adding the MS-DRG relative weights from a patient population during a certain period, and dividing the sum by the number of cases for that same patient group and time frame (see Figure 1).

FIGURE 1. **CMI FORMULA**

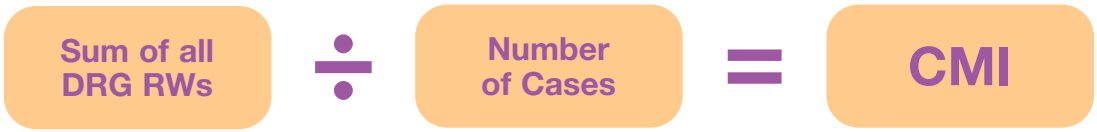


FIGURE 2. **SAMPLE CASE MIX INDEX CALCULATION** (Medical Patients)

DRG	DRG Description	RW	Multiply	Number of Discharges	=	Total RW
177	Respiratory Infections and Inflammations with MCC	1.8487	X	8	=	14.7896
189	Pulmonary Edema and Respiratory Failure	1.2258	X	7	=	8.5806
192	COPD without CC/MCC	0.6956	X	6	=	4.1736
193	Simple Pneumonia and Pleurisy with MCC	1.3117	X	9	=	11.8053
195	Simple Pneumonia and Pleurisy without MCC	0.6657	X	5	=	3.3285
871	Sepsis or Severe Sepsis with MCC without vent	1.8721	X	6	=	11.2326
		Total Discharges		**41**		**53.9102**

53.9102 ÷ 41 = 1.31488

Total RW ÷ Total Number of Discharges = CMI

FIGURE 3. **SAMPLE CASE MIX INDEX CALCULATION MEDICAL AND HIGH-WEIGHTED SURGICAL PATIENTS**

DRG	DRG Description	RW	Multiply	Number of Discharges	=	Total RW
177	Respiratory Infections and Inflammations with MCC	1.8487	X	8	=	14.7896
189	Pulmonary Edema and Respiratory Failure	1.2258	X	7	=	8.5806
192	COPD without CC/MCC	0.6956	X	6	=	4.1736
193	Simple Pneumonia and Pleurisy with MCC	1.3117	X	9	=	11.8053
195	Simple Pneumonia and Pleurisy without MCC	0.6657	X	5	=	3.3285
871	Sepsis or Severe Sepsis with MCC without vent	1.8721	X	6	=	11.2326
003	Tracheostomy with vent > 96 hrs with Major OR Procedure	19.1006	X	1	=	19.1006
004	Tracheostomy with vent > 96 hrs without Major OR Procedure	11.8787	X	2	=	23.7574
		Total Discharges		**44**		**96.7682**

96.7682 ÷ 44 = 2.1993

Total RW ÷ Total Number of Discharges = CMI

NOTE: Relative weights (RW) in these figures reflect FY 2022 values (subject to change).

FIGURE 4. **SURGICAL DRG EXAMPLES**

DRG	Surgical DRG Description	RW
028	Spinal Procedures with MCC	5.8230
034	Carotid Artery Stent with MCC	3.9798
207	Respiratory Diagnosis with Vent > 96 hours	5.7329
216	Cardiac Valve with Cardiac Cath with MCC	10.0426
356	Digestive System Procedure with MCC	4.3087

NOTE: Relative weights (RW) in this figure reflect FY 2022 values (subject to change).

> **Surgical DRGs have higher relative weights, which means that surgical patient populations have a higher CMI.**

Hospitals typically choose how they use and trend CMI (see Figure 2). CMI can be calculated by physician, service line, medical patient population, or surgical patient population. Some hospitals opt to remove higher-weighted DRGs, such as heart transplant/heart assist systems, ECMO, and tracheostomies, to decrease variability when comparing data. The same consideration can also be applied to obstetric and newborn cases, as care for this population is so specific.

Figure 2 and Figure 3 show how adding only three discharges with higher-weighted surgical DRGs creates a significant increase in CMI (from 1.31488 to 2.1993). Removing such outliers allows for a better understanding of an organization's true trends in patient complexity and CMI.

Surgical DRGs have higher relative weights, which means that surgical patient populations have a higher CMI. Figure 4 includes examples of surgical DRGs with corresponding relative weights. Calculating medical and surgical cases together may cause the CMI to appear artificially inflated. Therefore, separating medical DRGs from surgical DRGs allows for a more accurate interpretation of the level of complexity for each patient population.

CMI reflects a patient population's acuity and severity of illness. It helps determine the proper allocation of resources to provide care for a specific group of patients. Hospitals can use CMI to compare their performance against facilities with similar medical and surgical acuity levels, thereby helping to determine a CMI goal.

FIGURE 5. **CMI ADJUSTED AVERAGE COST FORMULA**

FIGURE 6. **REIMBURSEMENT COMPARED TO CMI**

A hospital can divide its average cost per patient by its CMI to capture the adjusted average cost per patient, or per patient day (see Figure 5). The adjusted average cost allows hospitals to compare their costs of care against other organizations, even ones that may care for different populations or offer different services.

In general, a higher CMI reflects a more resource-intensive patient population. Higher-acuity patients require a longer length of stay. A lower CMI reflects a less resource-intensive patient population. Lower-acuity patients commonly have shorter lengths of stay. Facilities with a higher CMI and higher-acuity caseloads would anticipate reimbursement that accurately reflects the increased care their patients require (see Figure 6).

What CDI does and does not own

Many think the CDI department has complete control over CMI. Hospital leadership often assumes that when the CMI goes up, their CDI team is performing at a high level. Likewise, when the CMI goes down, leaders may assume the CDI department is not performing well. This rollercoaster can take a toll on CDI professionals. Although the CDI department does not own all aspects of CMI, it has the ability and obligation to own the *conversation* about CMI, transparently share details, and proactively set the agenda. This is by far preferable to being in a reactive mode when CMI fluctuations inevitably occur.

CFOs and executive leadership need to fully understand the impact of the CDI department, whether CDI's mission at a given hospital concentrates on financial outcomes, denials management, quality reporting, or a combination of these. CDI managers and directors must step up to be the subject matter experts in the room. The CDI department must create reports, share trends, and identify factors that positively and negatively influence the CMI.

CMI is subject to many factors outside of CDI's control. Say an organization has an orthopedic surgeon who normally contributes a high volume of inpatient surgical cases. If this surgeon is restricted from admitting a patient as an inpatient, takes a vacation, or leaves the organization, all of these occurrences will negatively impact

the CMI. A CDI department does not market, recruit, or hire specialty providers who attract patients to the hospital, nor does it control providers' schedules. CMI is also influenced by types of admissions, high and low observation rates, inpatient procedures that result in higher relative weights (i.e., tracheostomies, LVADs, organ transplants) and low-weighted DRGs such as chest pain, TIA, fever, and failure to thrive. When an organization has limited service lines, limited ability to perform surgical procedures, or a high/low volume of observation patients, its CMI will be influenced. Again, CDI has no control over these occurrences.

"Although hospitals work to provide healthcare, they are ultimately businesses. CDI departments must demonstrate their value through return on investment to avoid being seen simply as a line item on a budget.

CDI efforts that *can* influence CMI include the types of cases chosen for review, the focus/objective of the reviews, and the level of collaboration with the medical staff in support of documentation efforts. One of CDI's keys to impacting CMI is its efforts to move the needle in DRG assignment. However, moving the needle is only meaningful if a CDI department knows its starting point. CDI leaders should understand the organization's CMI budget. They should also consider past trends and impacts that may or may not be within the organization's direct control. For example, an organization's 2020–2021 data likely demonstrates unexpected trends related to the COVID-19 pandemic. Most hospitals responded to the lockdown by eliminating elective surgical cases, and because many people avoided hospital care during this time, facilities across the country noted a reduction of inpatient admissions for reasons other than COVID-19 and its corresponding complications.

Although hospitals work to provide healthcare, they are ultimately businesses. CDI departments must demonstrate their value through return on investment to avoid being seen simply as a line item on a budget. Queries should be tracked to demonstrate how they support a CDI department's chosen focus, whether that be clinical validation to avoid denials, capture of diagnoses to impact risk adjustment, quality measures, or DRG movement to influence CMI. Any query that results in an MS-DRG shift should be monitored and tracked. Comparison of a case's relative weight before and after CDI intervention can clearly show how CDI impacts the CMI, and thus the hospital's bottom line.

The following are examples of how CDI's efforts impact financial and quality documentation goals.

CDI financial impact example

A patient is admitted with fever (101.4°F), respiratory rate 30, WBC 15.2, and a chest x-ray showing pneumonia. The provider orders IV antibiotics and documents the diagnosis of pneumonia. A clinically minded CDI specialist identifies a systemic response in an infected patient and issues a query for sepsis. In response, the provider documents the diagnosis of sepsis, present on admission. This action changes the trajectory of the DRG. The impact of this intervention can be translated to dollars as follows:

- **Before CDI intervention:** DRG 192, Simple Pneumonia without a CC/MCC; relative weight 1.3120 (with no additional diagnoses noted to provide CC/MCC capture and no reimbursable procedure or mechanical ventilation beyond 96 hours).

- **After CDI intervention:** DRG 871, Septicemia or Severe Sepsis without MV >96 Hours with MCC; relative weight 1.8722 (with no additional reimbursable procedure or mechanical ventilation beyond 96 hours). The CDI financial impact is calculated as follows:
  - The relative weight prior to CDI intervention is subtracted from the relative weight after CDI intervention:
    - 1.8722 – 1.3120 = 0.5602
  - The 0.5602 is multiplied by the hospital's blended rate. This example uses a blended rate of $5,000.
    - 0.5602 x $5,000 = **$2,801 in CDI financial impact**

CDI quality documentation example

Using the same example above, the patient assigned to MS-DRG 871 requires major surgery and receives a tracheostomy due to inability to wean. With the additional procedures, the DRG shifts to DRG 003, ECMO or Tracheostomy with MV >96 Hours; relative weight 19.1006. This DRG is a single-level DRG, so the MCC of sepsis captured with the CDI query provides no change in weight. In this instance, the CDI department cannot take credit for the increased DRG weight, despite the additional diagnosis of sepsis, because DRG 003 would have been assigned without any intervention from CDI. However, the query for sepsis results in stronger documentation. The CDI department has ensured the chart is complete and tells the entire story of the patient's care.

CMI's viability as a continuing metric

Historically, leaders have used CMI to gauge the acuity of the patients in a facility, and they have often translated CMI into a measure of the organization's financial viability. This determination of reimbursement levels has influenced the use of CMI as a measure of CDI program performance. However, doing so paints a picture of CDI impact that is incomplete at best and misleading at worst. In today's healthcare environment, many competing factors influence CMI levels.

Importantly, outpatient encounters do not contribute to an organization's CMI metrics. Population shifts in the setting of care (inpatient and outpatient) can positively or negatively impact CMI numbers. For example, hospitals often experience medical necessity of care denials related to lower-weighted DRGs, with such encounters being reassigned to the outpatient setting as observation or ambulatory care. Such a shift should result in an increase in CMI, as well as a decrease in inpatient admissions. Comparatively, if a significant number of surgical patients shift from the inpatient setting to the outpatient setting, CMI—and revenue—will be negatively impacted since surgical DRGs normally provide a higher relative weight.

This example shows that CMI does not fully reflect the financial viability of an organization. Instead, CMI must be considered in relation to a number of other metrics.

Value-based purchasing (VBP) is a reimbursement model based on quality of care, focused on "better, smarter, healthier" health outcomes (CMS, 2022). VBP is aligned with the collection of social determinants of health; by gathering this information, our healthcare system can work to eliminate racial and ethnic disparities in patient care, strengthen its infrastructure and data systems, and better treat and prevent chronic diseases. VBP's end goal is the delivery of high-quality, affordable care.

The CMS Hospital VBP Program is designed to improve clinical outcomes for hospital patients, as well as improve their experience of care, all while reducing costs to make care more affordable. Specifically, the program seeks to incentivize hospitals to improve the quality and safety of inpatient acute care by:

- Eliminating or reducing the occurrence of adverse events (healthcare errors resulting in patient harm)
- Adopting evidence-based care standards and protocols that result in the best outcomes for the most patients
- Reengineering hospital processes to improve the care experience
- Increasing the transparency of care for consumers
- Recognizing hospitals that are involved in the provision of high-quality care at a lower cost to Medicare (CMS QualityNet, n.d.)

"CDI should strive to work outside its normal parameters and engage with case management. Capturing all relevant diagnoses in the ED or upon admission helps to prove the medical necessity of a patient's care.

Value-based reimbursement is rapidly gaining traction, while fee-for-service models of reimbursement are beginning to erode. This trend is made apparent through CMS' gradual removal of CC/MCC status from diagnoses, and the reduction in MS-DRG weights as providers are encouraged through incentives to focus on quality measures. CMI remains rooted in the fee-for-service model, with a focus on reimbursement that reflects expected resource consumption related to patient complexity. Despite recent VBP traction, CMI remains a gauge to assess financial sustainability. Balancing these two models—fee-for-service and value-based purchasing—requires thinking outside the box.

Outside of traditional CC/MCC capture rate metrics and MS-DRG shifts, all CDI departments should monitor observed-to-expected mortality ratios and length of stay index. CDI reviews affect expected mortality and thus they can showcase the impact of a CDI program. CDI should strive to work outside its normal parameters and engage with case management. Capturing all relevant diagnoses in the ED or upon admission helps to prove the medical necessity of a patient's care.

The denial rate is often a forgotten metric. While a high CMI on the front end is desirable, a question lingers: How much loss does the facility incur when high-value MS-DRGs are denied? This impact should be measured, and CMI readjusted, to account for DRG adjustments following denials.

While most hospitals still scrutinize their CMI, many CDI programs now treat other measures with equal or greater importance. Such measures include:

- APR-DRG improvement
- CC/MCC capture

- DRG denial improvement/overturn
- HCC capture/RAF scoring
- Hospital quality ranking/peer-to-peer improvement (U.S. News and World Report, Leapfrog, Vizient, Healthgrades, etc.)
- Observed-to-expected length of stay improvement
- Observed-to-expected mortality reduction
- PSI rate improvement
- UM outcomes (status reviews, peer-to-peers, back-end appeals)

In summary, CMI is best viewed holistically, weighed against all other metrics mentioned above. Together, these measures offer a better representation of a CDI program's value and a clearer picture of organizational performance.

How do hospitals currently use CMI?

Hospitals use CMI in a variety of ways. Some organizations trend its rise and fall vs. long haul. Long-haul sustainability emphasizes the patient population significant to a facility. Analyzing CMI trends within a focused population (service line, department, base DRG) may provide a more accurate reflection of the quality of documentation. CMI tracked by service line may indicate trends related to patient severity of illness and care provided, but leaders should understand that CMI is a rudimentary proxy for severity of illness and may not parallel true risk adjustment. It is important to consistently view CMI within a broader context of other influencing factors.

When tracking by service line and/or provider, use case studies of specific diagnoses that may support a higher level of documentation and a higher overall CMI by volume of patients. For example, if a practitioner does not document hyponatremia, types of malnutrition, or specific fractures, the CMI will not reflect the care provided and resources utilized to treat these diagnoses.

The COVID-19 pandemic has led many organizations to think their CMI is trending upward, when in reality the CMI has been inflated due to the nature of the patient population. For example, many facilities have experienced a higher prevalence of tracheostomies, mechanical ventilation of 97 hours or greater, and complex rather than simple pneumonias. These three areas impact CMI dramatically and can create a false impression that an organization has moved its CMI needle. We recommend pulling out all outliers and recalculating CMI to ensure the data is accurate as COVID-19 cases decline.

Trending CMI over time helps determine support for facility initiatives such as adding service lines and increasing specialty care. It helps financial leaders visualize the health of the patient population. As more organizations move to robust ambulatory CDI programs, patients are receiving more care in the outpatient setting, including ongoing chronic care management. Treating patients in a clinic setting via preventive medicine removes patients who are less resource-intensive from the inpatient census. This results in a CMI that reflects the very sick patients who are admitted with a true need for inpatient care.

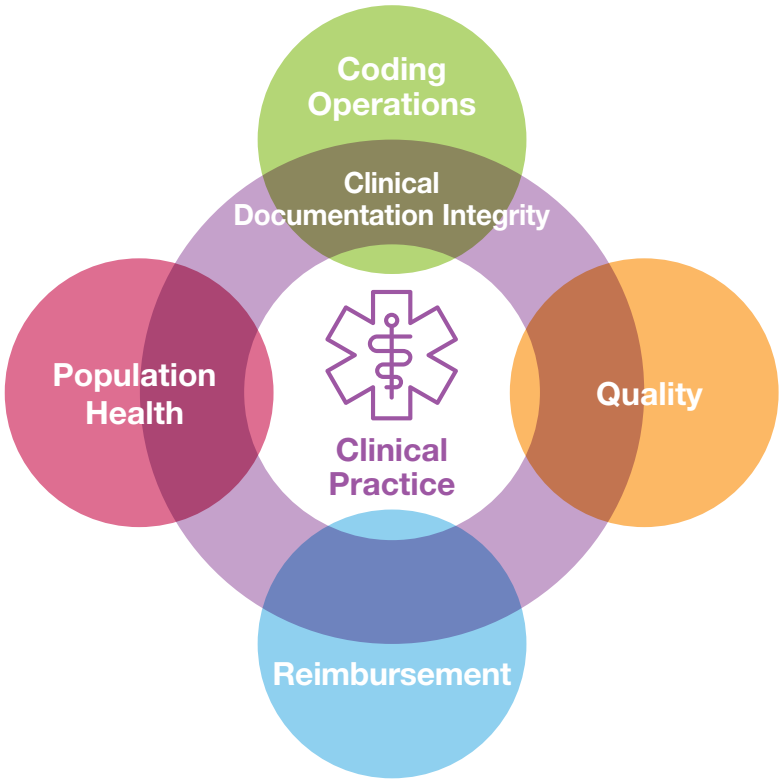
Transparently sharing CMI need not be expensive or burdensome. Consider internal tools such as Microsoft Teams® and monthly emails. Conduct quarterly meetings to discuss CMI at the department level, physician leader level, and middle/senior leadership levels. We recommend that CDI departments trend CMI month-over-month with appropriate groupings (medicine vs. surgery, department level, etc.). Any significant variances should be examined to determine the root cause (i.e., is this a CDI issue or something else?) This monitoring supports work that impacts other areas in the facility, such as length of stay, readmissions, mortality, and budgeting. Calculating the equivalent of a 0.01 move in CMI for an organization can help service lines and practitioners see the ROI of clear and concise documentation that supports patient care and resource intensity.

To drive these initiatives, CDI departments need strong leadership and support for a culture of teamwork (see Figure 7). Here are a few suggestions on being an impactful leader:

- Challenge departments to focus on two or three action items per month or quarter
- Follow up with teams and share the impact of their work (kudos and opportunities)
- Facilitate partnerships between coders and clinical documentation educators

> **Conduct quarterly meetings to discuss CMI at the department level, physician leader level, and middle/senior leadership levels.**

FIGURE 7. **TEAMWORK**



- Reiterate why timely query response is important (drives down DNFB, supports severity of illness and care)
- Engage with EHR initiatives and adopt technology solutions including note templates, dot phrases/smart phrases within templates, and documentation workflow optimization

How to use CMI and communicate with organizational leadership

So what are we to take from the complexities of CMI described above? How can CMI be discussed with organizational leadership in an accurate, truthful manner that is not overwhelming?

First, CMI should only be used in conjunction with the following four variables:

1. Mix of cases. This is largely beyond CDI control. For example, one month may include a high number of transplant cases or tracheostomies, and the next month may include a lower number, resulting in large month-to-month CMI variation regardless of CDI review.
2. CMS changes. Specifically, this variable is CMS' annual adjustment of DRG relative weights, which as noted above are part of the CMI calculation. Like mix of cases, it is beyond CDI control.
3. CC/MCC capture rate. This is within CDI control (i.e., can be improved through the query process). Show this at the MS-DRG family level.
4. Industry changes. Examples include shifts from inpatient to outpatient care (especially for lower-weighted DRGs), changes in the inpatient-only surgical list, and so on. Such changes are beyond CDI control.

When reporting CDI-driven CMI shifts, adjust for relative weight changes and mix of cases. The goal is to isolate CC/MCC capture rate from the other three variables. Compare the difference in DRG weight by family year-over-year. That tells administrators the difference in CMI achieved through CDI impact. It helps break down to leadership: "Don't look at CMI as a whole; look at this one piece of it. Here is how CDI drove that change."

Adjust for volumes. If CMI is lower in a given month or quarter due to a high number of lower-weighted cases, show hospital administration the data. Break out the cases by length of stay, detailing the number of one-day, two-day, and longer stays. Management will nod their heads and say, "OK, I can see why our CMI is lower—it's driven by these cases with short lengths of stay."

Be prepared to talk about nuances. For example, the organization may perform a high proportion of joint replacements. The CC/MCC capture rate on these cases is typically low, sometimes as low as 1%–3%, because these patients are often healthier than patients admitted through the ED. But, since they fall into a surgical DRG, their CMI will be higher.

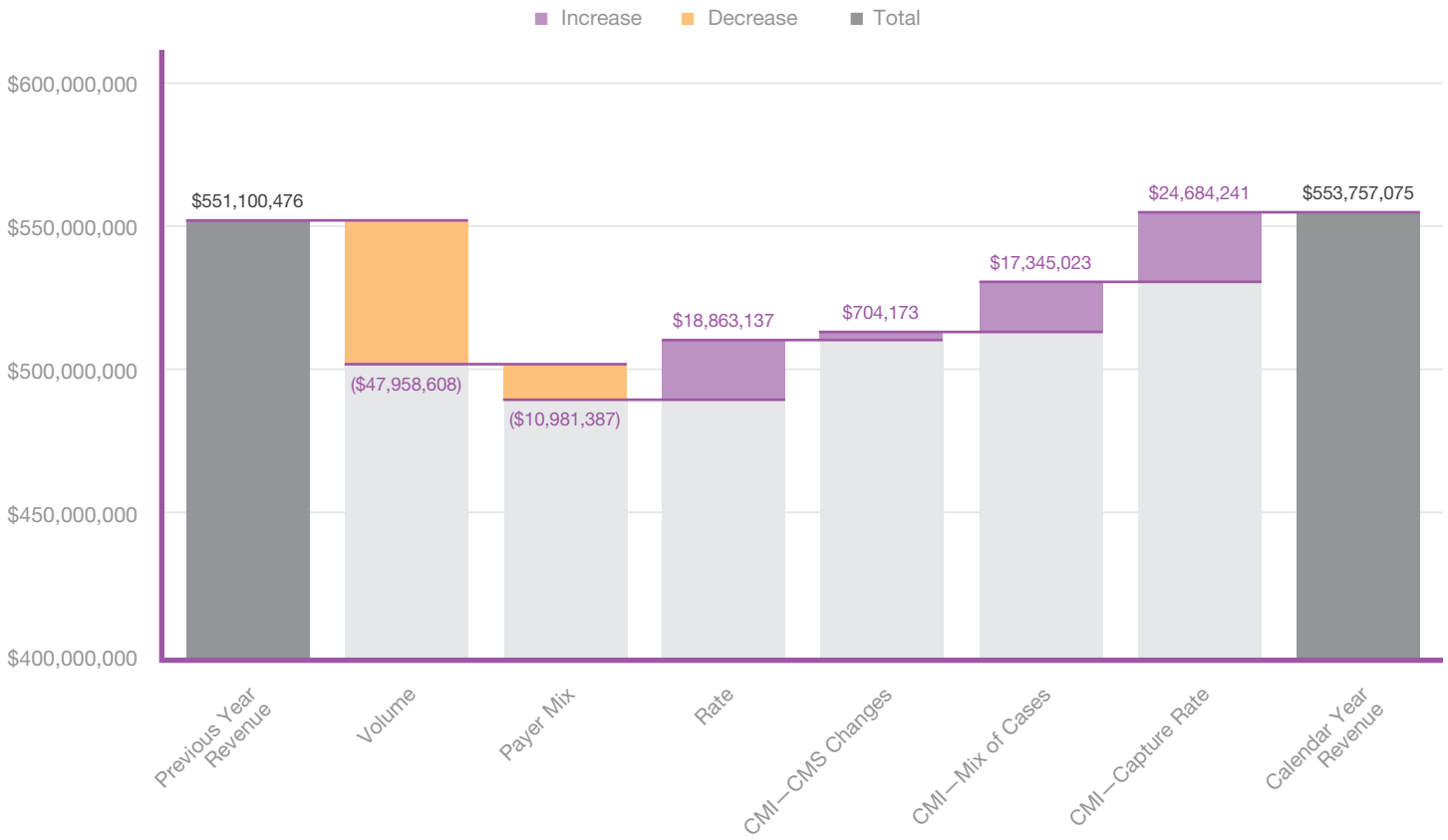
Discussions should include total revenue. An organization may have a high volume of Medicaid patients who don't have an associated CMI, but are measured through APR-DRG or another risk-adjusted model. While the MS-DRG may be lower for some of these patients, the organization may be paid a higher amount due to the way the case was coded in the APR-DRG model. This requires refinement at the payer level.

Isolating cases that have, and have not, been touched by CDI year-over-year can help CDI leaders make the case for additional CDI staff or investment in new technologies.

Some final takeaways:

- Never look at CMI in an isolated manner, as a single fixed number.
- Consider using a waterfall chart to show the above variables (see Figure 8). This provides an easy-to-understand, arresting visual. The chart may show declines in total revenue due to lower volume and payer mix, and gains due to payer rate, mix of cases, and CMS changes. The final bar in the chart will be capture rate.

FIGURE 8. **HOSPITAL REVENUE INFLUENCING FACTORS**



- Be patient. Be prepared to discuss what capture rate is, and what CMI is, from meeting to meeting. A little bit of knowledge is dangerous for hospital leadership—don't assume they know the variables that go into CMI. Monthly meetings are recommended.
- If it proves difficult to get an audience with hospital administration, look for an ally—someone whom leadership already meets with and respects regarding similar topics, such as a revenue cycle director or a clinician lead connected to finance. Partner with them—it's far easier to join a meeting than establish a new meeting cadence with the C-suite.

References

CMS. (2022, June 10). *What is the CMS National Quality Strategy?* *https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/CMS-Quality-Strategy*

CMS QualityNet. (n.d.). *Hospital Value Based Purchasing (HVBP) Program.* *https://qualitynet.cms.gov/inpatient/hvbp*

Acknowledgements

ACDIS would like to thank the following Advisory Board members for their principal writing:

- Sheri Blanchard
- Tracy Boldt
- Chinedum Mogbo
- Chris Petrilli
- Kelly Sutton
- Vaughn Matacale

Second reviewers and editors included Brian Murphy, Laurie Prescott, and Adam Carroll.

Special thanks to the following ACDIS Advisory Board members for their reviews:

- Jennifer Eaton
- Emily Emmons
- Susan Fantin
- Autumn Reiter
- Aimee Van Balen
- Lena Wilson

What is an ACDIS White Paper?

An ACDIS white paper discusses CDI best practice, advances new ideas, increases knowledge, or offers administrative simplification. It can be written by an ACDIS Advisory Board member or a smaller subset of the board, or written by external sources subject to board approval. It is less formal than a position paper.