Intermediate Level Analysis:

Issues for Children’s Hospitals in

DRG Based Prospective Payment Systems

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Table of Contents

I. Overview of DRG Classification Systems and Prospective Payment Systems
   1. What are DRG Systems
   2. Uses of DRGs
   3. DRGs and Prospective Payment Systems (PPS)
   4. Approaches to PPS
   5. Overview of Issues for Children’s Hospitals

II. Summary Description of the Two Most Commonly Used DRG Systems
   1. Medicare Severity Diagnosis Related Groups (MS-DRGs)
   2. All Patient Refined Diagnosis Related Groups (APR-DRGs)

III. Pediatric Inpatient Hospitalization and Role of Children’s Hospitals
   1. Regionalization
   2. Highlights of Children’s Hospitals
   3. Role of Children’s Hospitals in Regionalized Delivery System

IV. Issues for Children’s Hospitals in DRG Prospective Payment Systems
   1. Costing
   2. Wage Index Adjustments
   3. DRG Classification Systems and Systematic Risk
   4. Outliers
   5. Relative Costs Weights
   6. Transfer-in Patients
   7. Transfer-Up versus Transfer-Back Patients
   8. Standard Payment Amount or Multiplier
   9. Annual Update Factor/Rebasing
   10. Graduate Medical Education Costs
   11. Indirect Costs of Graduate Medical Education, Disproportionate Share of Low Income Patients, and Standby Capacity
   12. Competitive Market Forces and Standard Rate PPS
   13. Overall Assessment
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I. Overview of Classification DRG Systems and Prospective Payment Systems

1. **What are DRG Systems:** Diagnosis Related Groups are classification systems developed from ICD-9-CM discharge data that group 14,000 diagnoses and 2,400 operating room procedures into 300 to 400 medical and surgical categories. These DRG categories are often further subdivided into 2 or 3 or 4 severity subclasses based upon lists of complicating/comorbid conditions or in some systems by a multi-step severity algorithm. The categories and subclasses of a DRG system attempt to classify together groups of patients who have similar clinical characteristics and resource utilization.

2. **Uses of DRGs:** DRG classification systems have been used for a number of purposes for acute care hospitals including: measurement of case mix, utilization management, comparative reporting, price negotiations, and prospective payment systems. For each application, it is critical to understand the strengths and weaknesses of the DRG system and underlying ICD-9-CM codes, the intended patient population, and the methodologies and policies needed to implement the application in a valid and meaningful way.

3. **DRGs and Prospective Payment Systems (PPS):** It is important to understand the design and limitations of the DRG classification system, but it is even more important to understand that the DRG system is only one of many components of an inpatient hospital PPS. There are many ways to design each component of a PPS and what matters most is how well all the components fit together and link payment to cost for various groups of patients and hospitals. This needs to be fully tested and evaluated.

   It is also important to recognize that while there are many technical aspects of DRG based prospective payment systems, ultimately what emerges is usually the result of an extensive negotiation process.

4. **Approaches to PPS:** There are many possible approaches to the design of acute hospital prospective payment systems. Rates and policies can be developed that are specific to individual hospitals, groups of hospitals, a standard rate for all hospitals, or a blended rate that combines the experience of the individual hospital with group or system-wide averages. There are many methodological and policy issues in any DRG PPS. These are most complex and difficult to
resolve in standard rate systems where all hospitals are paid the same basic amount for each DRG, along with certain formula adjustments.

5. **Overview of Issues for Children’s Hospitals**: There are many issues including the coding and classification systems, costing methods, wage indices, outliers, transfers, relative cost weights, standard payment amounts, update factors and exclusions. There are also costs associated with graduate medical education, treating a disproportionate share of low income patients, and standby capacity for very specialized services.

Children’s hospitals do not fit well or easily within the structures of DRG prospective payment systems. A very large percentage of their inpatient activity is for outlier patients, even with the best available DRG system. A large percentage is for transfer-in patients who have higher costs than other patients within the same DRG categories. And relative weights calculated for their inlier patients are quite different, especially for the more tertiary categories.

*If* it is possible to make a DRG based PPS work for children’s hospitals, it would likely require alternate or adapted approaches. This includes hospital-specific or children’s hospitals specific approaches, along with a number of exclusions and adjustments.

II. **Summary Description of the Two Most Commonly Used DRG Systems**

1. **Medicare Severity Diagnosis Related Groups (MS-DRGs)**: In October 2007, CMS introduced MS-DRGs for Medicare PPS. They are a replacement system for the previous CMS-DRGs implemented in 1983. The MS-DRGs are different in three ways:

   (a) DRGs with low-volume for the Medicare population were consolidated (mostly pediatric categories).
   
   (b) The Medicare list of comorbid-complicating (CC) secondary diagnoses was significantly updated for the first time since 1983.
   
   (c) The comorbidity-complication splits for base DRGs were expanded to include major CCs where statistically indicated for Medicare patients.

These changes represent an advance for Medicare PPS but are limited in terms of DRG methodology and were not intended to address the needs of non-Medicare populations. Pediatric oriented DRGs with low Medicare case volume were eliminated, changes to the list of major CC and non-CC diagnoses were made based upon Medicare patient data patterns and would be different if done on the basis of non-Medicare patients, and the CC methodology is still rather limited. The CC methodology only looks for the presence of a single diagnosis on either the major CC or CC list, and does not consider other factors (see APR-DRGs in Section II 2).
Altogether, while an advance for Medicare PPS, the MS-DRGs are still a limited DRG methodology and are not intended to address the needs of non-Medicare patients. This latter point is clearly acknowledged by CMS.

CMS has stated many times in that Federal Register that the CMS DRGs and now the MS-DRGs are developed from Medicare data and specifically designed for purposes of Medicare inpatient hospital PPS. CMS has stated it does not have the data or expertise to refine its DRGs for newborn, pediatric and maternity cases, and that non-Medicare systems need to choose from other systems or develop their own modifications. CMS has further stated that whether or not it attempted to develop revisions for newborn, pediatric and maternity patients, private insurers and other payors would have to develop their own DRGs or relative weights to address the needs of these patients (Federal Register, May 18, 2004 and August 22, 2007).

2. **All Patient Refined Diagnosis Related Groups:** The APR-DRGs were first introduced in 1990. The APR-DRGs assign each patient to one of 314 base DRGs, and within each base DRG to one of four severity of illness subclasses and one of four risk of mortality subclasses.

**Building Blocks:** The APR-DRGs are built from the same ICD-9-CM information as other DRG systems. It is different in how extensively it works with the diagnosis and procedure codes and combinations of diagnoses and procedures. There are many differences in base DRG definitions, the number of severity levels, the classification of individual diagnoses into severity levels, and the full multi-step logic for its severity subclass assignments.

**Severity Algorithm:** The APR-DRG system assigns each patient to one of four severity subclasses based upon an 18-step algorithm. The first half of the algorithm takes into account the severity of individual secondary diagnoses, the DRG context and age of the patient, and the effect of multiple interacting secondary diagnoses. The second part takes into account differences among principal diagnoses and surgical procedures within DRG, multiple surgical procedures, non-O.R. procedures such as mechanical ventilation, and considerations such as gestational age within newborn birthweight ranges.

**Limitations:** The APR-DRGs have a more extensive and sophisticated logic than other DRG systems. This enables it to better describe a hospital’s case mix and expected costs for groups of patients than other DRG systems. At the same time, there are limitations on how well it can predict costs and the extent to which it can remove systematic biases for certain groups of patients and hospitals, including children’s hospitals (see Section IV).

Beyond the limitations of the APR-DRGs as a classification system, it is important to realize that there are many delivery system and costing issues that are beyond
the realm of any classification system and can only be addressed through the policies and methodologies of the payment system.

III. Pediatric Inpatient Hospitalization and Role of Children’s Hospitals

1. Regionalization: In aggregate there are relatively few children hospitalized, less than one-tenth as many as adults. There are a small number of common pediatric conditions that are treated across a variety of hospitals (e.g., asthma, bronchiolitis, gastroenteritis, appendicitis, orthopedic injuries), but on the whole pediatric services are highly regionalized involving many diverse low volume conditions and referral relationships between community hospitals and pediatric tertiary hospitals.

This makes it challenging for ICD-9-CM diagnosis and procedure codes and a system of Diagnosis Related Groups to have sufficient specificity to fully distinguish pediatric case mix differences across hospitals. This makes it especially difficult to distinguish the case load of hospitals such as children’s hospitals.

2. Highlights of Children’s Hospitals: Children’s hospitals serve as tertiary referral centers and providers of inpatient and outpatient services for large populations of children from extended catchment areas and large numbers of children from low income families.

- Children with congenital and chronic health conditions represent approximately 60% of admissions, 70% of days and 75% of costs at children’s hospitals.
- Trauma represents approximately 10% of admissions at children’s hospitals.
- Children transferred-in from other acute hospitals represent 12% of admissions, 29% of days, and 30% of costs at children’s hospitals.
- Approximately 55% of patients are Medicaid recipients. Most children’s hospitals are classified as disproportionate share hospitals.
- Most children’s hospitals serve as major centers for pediatric graduate medical education.
- Most children’s hospitals serve as major centers for pediatric medical research.

3. Role of Children’s Hospitals in Regionalized Delivery System: Hospital care for children in the USA is highly regionalized, with children’s hospitals providing a
very large percentage of the care for specialized pediatric conditions and a lesser percentage for the more common conditions. Following are a series of projection statistics for the USA.

- Acute freestanding children’s hospitals represent just 1% of hospitals in the USA, but provide approx 21% of all pediatric inpatient days and 30% to 50% of inpatient days for specialized pediatric conditions.

- Acute freestanding children’s hospitals plus non-freestanding children’s hospitals that are part of larger hospitals represent just 3% of hospitals in the USA, but provide approx 43% of all pediatric inpatient days and 60% to 95% of inpatient days of care for specialized pediatric conditions.

- For surgical services, all children’s hospitals together provide the following percentages of pediatric inpatient days in the USA:
  - 94-97%: organ transplants and cardiac surgery
  - 84-85%: spinal surgery, neuro-surgery, and kidney surgery
  - 76-78%: major GI surgery and cranial-facial surgery
  - 45%: orthopedic surgery for trauma
  - 28%: appendectomies

- For congenital and chronic conditions, all children’s hospitals together provide the following percentages of pediatric inpatient days in the USA:
  - 89%: cancer, cystic fibrosis
  - 84%: spina bifida
  - 76%: cerebral palsy
  - 67%: sickle cell anemia
  - 61%: seizure disorders
  - 51%: diabetes
  - 31%: asthma

- For acute conditions, all children’s hospitals together provide the following percentages of pediatric inpatient days in the USA:
  - 70-71%: burns, major infections
  - 63-64%: major respiratory, major trauma (medical)
  - 44%: moderate trauma (medical)
  - 34%: minor trauma (medical)
  - 31%: urinary tract infection
  - 25%: bronchiolitis, pneumonia
  - 24%: gastroenteritis

IV. Issues for Children’s Hospitals in DRG Prospective Payment Systems
Following is a summary of issues for children’s hospitals with each of the components of a DRG based PPS. The reference point for this assessment is a standard rate payment system where all hospitals are paid the same basic amount for each DRG and where the best available DRG system is used, the APR-DRGs.

1. Costing: Average costing methods are used to one degree or another in converting billed charges to an estimate of costs in large hospital discharge data bases. They significantly understate the cost of pediatric patient care in general hospitals. This creates problems in comparing the cost of pediatric inpatient care in general hospitals and children’s hospitals, in developing relative cost weights, and prospective payment systems. This occurs for several reasons.

First, the unit costs for nursing and other labor intensive services such as respiratory therapy are considerably higher for children than adults. The differences are largest for very young children and children with multiple complex problems, especially those with severe neurologic and mental conditions.

To illustrate, nurses staffing levels are higher translating to higher per day nursing costs. Services such as respiratory therapy are more labor intensive because hospital staff often need to perform the therapy with the child every time rather than showing the child how to do it on their own.

Second, a higher proportion of pediatric inpatient services are for nursing and other labor intensive services and a lesser proportion are for ancillary services. This adds to the impact of unit cost differences.

Third, there are cost differences for certain equipment, drugs and supplies related to the care needs of infants and young children. There are also cost differences that relate to the care needs of children of all ages such as “orphan drugs” (for rare diseases) and social services. In aggregate, the cost differences are much less than the first two items, but still important.

Costing methods that start from billed charges have a built-in bias to underestimate nursing/room & board services and certain specialized services (e.g., chemo-therapy, blood products), and to overestimate ancillary services costs. This is because hospital charge structures tend to have a lower mark-up of charges over costs for nursing/room & board and certain specialized services, and a higher markup for ancillary services.

One approach to reducing cost distortions deriving from the lower charge markups for nursing/room & board services is to use departmental RCCs (ratios of costs to charges) to convert from billed charges to an estimate of costs. This is an improved method compared to using a hospital-wide RCC, but it can also introduce other cost distortions when there are widely varying markups for services within the same department. If, for example, there is a lesser markup
percentage for chemotherapy drugs than most other drugs, than the costs for chemotherapy will be understated. The same applies to very expensive devices and blood products (e.g., hemophilia factor VIII).

It is also important to realize that departmental RCCs do little to address pediatric versus adult cost differences. This method still uses average departmental values across all age patients, so it doesn’t address unit cost differences or differences in the mix of services. In all, it is difficult to achieve accurate estimates of patient level costs from large hospital databases, especially for pediatric patients. This needs to be taken into account in formulating policies and approaches to PPS.

2. **Wage Index Adjustments**: The higher wage levels for hospitals located at or near the center of large urban areas will be understated if the wage indices are from broad geographic areas such as Metropolitan Statistical Areas (MSAs). In addition, children’s hospitals may incur higher costs to recruit specialized personnel.

These differences are real but difficult to measure and develop adjustment formulas for. One of the main difficulties is that wage related cost differences vary across a gradient, rather than a bright dividing geographic boundary.

3. **DRG Classification and Systematic Risk**: As described in Section II of this document, Medicare Severity DRGs (MS-DRGs) are developed from Medicare patient data and are intended for Medicare PPS. There are not intended to address the needs of non-Medicare patients and CMS has acknowledged this numerous times in the Federal Register. The APR-DRGs are intended for all age patient populations. They have more specific DRG categories and a more sophisticated severity subclass methodology, and are much improved over the MS-DRGs, but still have their limitations. It is not possible through ICD-9-CM diagnosis and procedure codes and DRGs to fully distinguish patient level differences across all hospitals, even with APR-DRGs.

With all DRG classification systems, there are systematic risks for certain subgroups of patients. In the case of children, those with congenital and chronic conditions except the more common such as asthma, severely ill newborns, and transferred-in patients are more resource intensive than other patients in the same category and are financial losers in standard rate payment systems. Children without congenital and chronic conditions tend to be financial winners. This is true across all hospital but its greatest impact on children’s hospitals. This is mitigated by the APR-DRGs but there remains a significant bias.

4. **Outliers**: A very large proportion of children’s hospital patients are long stay/high cost outliers, and a much lesser proportion are short stay/low cost outliers. Children’s hospitals are thus at risk for substantial losses for high outlier patients. Most hospitals are less likely to incur the same risks for high
outliers, and in some instances may receive windfall gains from low outlier patients.

Following are estimates of the overall proportions of admissions, days, and costs that are for outlier patients.

- **Children’s Hospitals:**
  - High outliers: 11% cases, 39% days, 43% costs.
  - Low outliers: 6% cases, 2% days, 2% costs.

- **General Hospital Pediatric Patients, age 0-17 yrs, excluding normal newborns:**
  - High outliers: 4½% cases, 21% days, 24% costs.
  - Low outliers: 14½% cases, 6% days, 4% costs.

- **General Hospital Adult Patients, age >17 yrs:**
  - High outliers: 5% cases, 18% days, 15% costs.
  - Low outliers: 6% cases, 3% days, 3% costs.

Outlier rates are high for children’s hospitals patients across most body systems or Major Diagnostic Categories (MDCs), but there is a range. From MDC to MDC, patients who are outliers range from 8 - 18% of admissions, 25 - 50% of days, and 30 - 55% of costs. Outlier rates are highest for pre-MDC categories for transplants and tracheostomy procedure patients (30 - 45% cases, 55 - 75% days, and 60 - 75% costs) and select APR-DRGs.

These outlier estimates were generated using a constrained statistical distribution approach to defining outliers, intended primarily for comparative analyses. If intended for use in a PPS, it would be important to also have an absolute stop-loss outlier provision (e.g., $25,000 above base payment), and additional patients would be classified as outliers.

Outlier thresholds for these analyses were defined as the lesser of 2 standard deviations above the geometric mean or a multiple of approx 3 times the geometric mean, with the multiple starting over 3 and gradually tapering for the higher cost categories to prevent outlier thresholds from growing too large on an absolute dollar or LOS basis. The calculations were performed with a large national database of 1,684 general hospitals and 56 children’s hospitals, and with an approximate weighting of two-thirds for general hospital cases to one-third for children’s hospitals. The weighting was designed to allow general hospital cases to have the largest influence, but also to allow children’s hospitals cases to have a significant influence. The resulting outlier thresholds were used for analyses of inlier and outlier patients and relative cost weights across different hospital sample frames.
The financial impact for children's hospitals in a DRG PPS of having so many patients who are outliers to the system (approx 11% cases, 39% days, and 43% costs) would depend upon outlier policies, but is potentially very, very large. If traditional outlier policies are applied, then children's hospitals would be paid the basic amount for inlier patients derived from an all age patient database, then nothing for all the costs the inlier payment amount to the outlier threshold, then 80% of the costs beyond the outlier threshold. Following are the overall results of a simulation of this payment approach:

- 43%: Outlier patient costs as % of total CH costs.
- 10%: Basic payment amount for outlier patients.
- 13%: Outlier payment amount for outlier patients.
- 20%: Outlier patient loss as % of total CH costs.

Clearly, this kind of approach is not viable. Traditional outlier policies were developed with the idea that outlier patients would be a small proportion of a hospital's totally inpatient activity and that other payment or adjustment factors would compensate. When outlier patients represent somewhere in the range of 40% of a hospital’s inpatient activity, then very different approaches to outlier policy are needed. More fundamentally, the overall approach and premise to payment policy needs to be carefully thought through.

5. **Relative Costs Weights**: Relative cost weights for inlier patients vary significantly depending on the hospital sample frame. This is true even after significant numbers of patients are removed as high outliers and low outliers. For children’s hospitals the differences in relative cost weights are most pronounced for:

- Neonates
- Transplants
- Tracheostomy procedure patients
- Malignancy patients
- Major infections
- Respiratory failure
- Rehabilitation
- Mental Illness
- Categories with varying mixes of principal diagnose and O.R. procedures
- Severity subclass 3 (major) patients across most of the APR-DRG system
- Severity subclass 4 (extreme) patients across most of the APR-DRG system

Given the extent of these differences, a single system-wide set of relative cost weights would not accurately reflect the case mix of children’s hospitals, especially for the more tertiary categories and higher severity subclasses.
6. **Transfer-in Patients**: These patients represent a significant portion of children’s hospital activity (approx 12% admissions, 29% days, and 30% costs), and have higher costs than other patients in the same categories. The same may also be true for patients referred from distant catchment areas even if not transferred directly from another hospital.

7. **Transfer-Up versus Transfer-Back Patients**: Transfer-up patients are those who are triaged and transferred to another hospital. They are very different and less expensive than patients who receive more definitive diagnostic and treatment services and are then transferred back for step-down care.

   It is difficult to distinguish these patients because they all have the same discharge destination, “transferred to another hospital”. It is even more difficult to accurately apportion per diem costs. This is especially important for neonatal services where the entire stay may be split among two or three hospitals.

8. **Standard Payment Amount or Multiplier**: To the extent it is not possible to resolve all of the above methodologic and policy issues, which is likely the case; one of the possible solution strategies is to establish a separate standard payment amount or hospital-specific rates for children’s hospitals, along with other adjustments and exclusions.

9. **Annual Update Factor/Rebasing**: However the system is designed, there needs to be an annual update factor or rebasing for inflation, technology and other considerations.

10. **Graduate Medical Education Costs**: These are substantial costs that need to be funded through some mechanism, if not part of the basic payment system.

11. **Indirect Costs of Graduate Medical Education, Disproportionate Share of Low Income Patients, and Standby Capacity**: These are significant costs factors that are not well reflected in standard rate PPS systems. Many of these cost factors for children’s hospitals may be similar to other major teaching and referral centers, but there are important differences as well.

   There are likely additional costs related to the large number of small subspecialty GME training programs conducted at children’s hospitals, making it difficult to achieve economies of scale. Similarly, there are probably significant standby capacity costs for the large number of low volume pediatric conditions and transfer-in patients.

12. **Competitive Market Forces and Standard Rate PPS**: The combination of market forces and standard rate PPS can lead to a situation where a children’s hospital is forced to accept low payment rates to maintain market share for the more common pediatric conditions, while at the same time incurring large losses for
their most distinguished tertiary services, witness the experience with transfer-in and outlier patients. This is not financially viable.

13. **Overall Assessment:** The patients and services of children’s hospitals do not fit well or easily within the structures of DRG based prospective payment systems. *If it is possible to make a DRG based PPS work for children’s hospitals, it would likely require alternate or adapted approaches including hospital-specific or children’s hospitals-specific approaches, along with a number of exclusions and exceptions.*