

Policy issues related to prospective payment for pediatric hospitalization

by Susan M. C. Payne and Joseph D. Restuccia

Children's hospitals have been excluded from the Medicare prospective payment system (PPS) because of concerns over the applicability of the DRG case-mix system and PPS payment weights to pediatric hospitalization. Nevertheless, DRG-based payment systems are being adopted by State Medicaid agencies and private third-party payers, and the Health Care

Financing Administration has been mandated to report to Congress on the feasibility of including children's hospitals in the Federal PPS. This article summarizes policy research on this issue and discusses options in the design of prospective payment systems for pediatric hospitalization.

Introduction

When the Medicare prospective payment system (PPS) was introduced in 1983, children's hospitals and long-term, psychiatric, and rehabilitation facilities were excluded from immediate participation in the system. The exclusion of children's hospitals was primarily because of concerns that the diagnosis-related group (DRG) case-mix system and the payment weights used in PPS did not adequately reflect pediatric hospital utilization and that PPS might adversely affect children's hospitals if adopted without modification. The Health Care Financing Administration (HCFA) has been mandated by the Social Security Amendment of 1983 (Public Law 98-21) to report to Congress on whether or not children's hospitals should be incorporated into PPS and if so, how.

Best known as a program for the elderly, Medicare covers relatively few children. The great majority of the children covered under Medicare are covered under the end stage renal disease (ESRD) program.¹ In 1984, Medicare paid for the treatment of 3,490 children age 0-17 years. Most (82 percent) were treated in hospitals included in PPS; only 18 percent were treated in children's hospitals excluded from PPS. Approximately one-sixth of the \$30.3 million that Medicare spent on children went to children's hospitals.² The issue of whether children's hospitals will be incorporated into PPS is thus primarily of concern to the Federal Government for programmatic and policy reasons and not for financial reasons.

The decision by HCFA regarding prospective payment for children will have wide-ranging repercussions, however. Because of the market power of Medicare, which contributes 29 percent of the Nation's hospitals' revenues (Waldo, Levit, and Lazenby, 1986), changes introduced by Medicare tend

to be adopted by other payers. For example, at least 12 States have adopted or plan to adopt DRG-based prospective or retrospective payment systems, many of them using the PPS payment weights and classification system without change (Hellinger, 1986). In addition, many private payers, such as health maintenance organizations (HMO's), Blue Cross, and commercial insurers, have followed HCFA's lead in adopting prospective, fixed-price payment for hospitalization.

Because of the importance of Medicaid as a payer for children's hospitalizations, State Medicaid payment policies could have a significant financial impact on hospitals serving children and may influence their willingness to serve Medicaid recipients. Medicaid is the second largest payer for pediatric hospitalizations. Almost one-quarter (24.4 percent) of patient days of patients under 15 years of age discharged from non-Federal short-stay hospitals in 1984 were paid for by Medicaid (National Center for Health Statistics, 1986). This reliance on Medicaid is higher for children than for any other age group.

The adoption of the PPS model for pediatric hospitalization raises important policy questions for both payers and hospitals as to the appropriateness of the DRG case-mix system for pediatric hospitalization and the adequacy of the PPS payment weights and payment adjustments for reimbursing pediatric inpatient costs. Extensive policy research has now been completed on the applicability of the DRG system to pediatric hospitalization; considerable work remains to be done on payment system design issues. The purpose of this article is to summarize the preliminary findings from the case-mix work, discuss major issues in the design of payment systems, and identify areas for future research. The discussion will help establish a context for policy debate on the general issues of prospective payment for children's hospital care by HCFA, State Medicaid agencies, and private third-party payers, and on the specific issue of whether children's hospitals should be included in the Medicare PPS.

Before reviewing the hospital experience of children, it is useful to comment on the types of patients and hospitals included in the discussion. As

¹Medicare also covers disabled children who are covered in their own account as workers (such as child actors) and the disabled adult children (age 20 and older) of disabled adults who are covered under Medicare.

²Rand Corporation tabulations using HCFA data for calendar year 1984.

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the reader may notice, definitions of "pediatric" patients can vary. Demographic reports often use the age category 0-15 years to define children; 18 years or 21 years is frequently used in reports on Medicaid eligibles or other third-party payment beneficiaries.

By convention, discussions of pediatric hospitalization exclude normal newborns, who are usually included in discussions of obstetrical care. Normal newborns are therefore not included in this discussion. Sick newborns (defined as patients admitted by birth to the hospital and having at least one diagnosis in addition to the newborn diagnosis) are usually either described separately (for example, the National Center for Health Statistics [NCHS] presents only summary data on sick and well newborns, excluding them from its general tables) or included in discussions of neonates (age 28 days or less).

Finally, regardless of the definition used, it is important to remember that, even excluding newborns, pediatric utilization is concentrated in the youngest age groups (Figure 1). In 1984, 26.6 percent of the 4,375,000 pediatric discharges were of sick newborns, 18.7 percent were of infants other than newborn, and 54.7 percent were of patients age 1-15 years. The rate of days of care per 1,000 persons was 1,456.5 for infants, compared with 244.8 and 165.1 for patients age 1.4 years and 5-14 years, respectively (all data from National Center for Health Statistics, 1986).

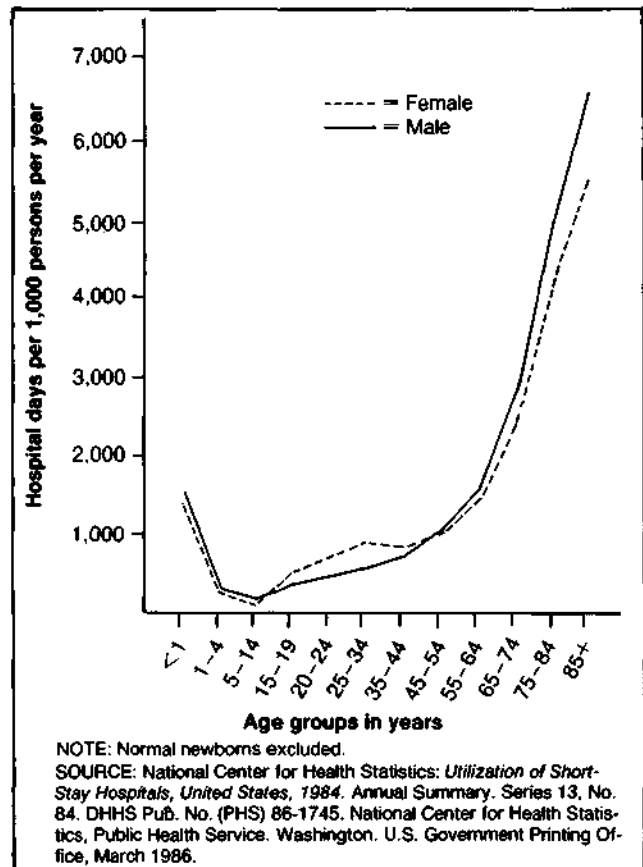
Because of the high costs of neonatal intensive care, when a neonate is hospitalized the costs can be catastrophic. The cost of care in a newborn intensive care unit averages over \$1,000 per day, and the average length of stay is anywhere from 7 days to 3 months, depending on birth weight (Rosenbaum, 1987).

Because of the high admission rates of sick newborns and neonates, their longer average stays, and the extremely high costs of neonatal care, many of the policy debates regarding pediatric hospitalization are driven by concerns with how to pay for neonatal care.

Pediatric hospitalization is provided in diverse settings, including children's hospitals (freestanding hospitals treating only pediatric patients), university teaching hospitals with pediatric residency programs, community hospitals with pediatric residency programs, and other hospitals. Although only children's hospitals have been specifically excluded from PPS, it is important to note that there is a close similarity in the case mix of children's hospitals and university teaching hospitals (National Association of Children's Hospitals and Related Institutions, 1985a) and that 90 percent of children's hospital beds in the United States are in institutions affiliated with medical schools. In this discussion the term "tertiary pediatric hospitals" is used to refer to children's hospitals and university teaching hospitals with pediatric residency programs.

These distinctions are useful because some of the concerns related to prospective payment for pediatric

Figure 1
Hospital days per 1,000 persons per year in short-stay non-Federal hospitals by age and sex: United States civilian, noninstitutionalized population, 1984.



hospitalization apply regardless of hospital type, while other concerns stem from the particular case mix served by tertiary pediatric hospitals, and still other concerns relate to children's hospitals only.

Case-mix system issues

Case-mix systems used for hospital reimbursement must meet several criteria. Groupings of discharges must be created that are homogeneous in resource use (length of stay, charges, or costs); sensitive to differences in the mix of outputs across hospitals and to differences in resource needs across patients; and clinically valid, reliable, cost-effective, and relatively resistant to "gaming" (Hornbrook, 1982a).

DRG's are the best-known patient classification system because of their use in PPS. Because of that, and because of the lack of an obvious, fully developed, validated, alternative pediatric case-mix system (NACHRI, 1985a), DRG's are the only case-mix system discussed here. (Reference is made where appropriate to the Children's DRG (CDRG) system developed by the National Association of Children's Hospitals and Related Institutions (NACHRI) in response to limitations of the DRG system. Final determination of the extent to which CDRG's address

the concerns raised in this discussion await further validation of the system.)

The DRG system has been extensively tested vis a vis the criteria listed above by HCFA and others, primarily as a case-mix system for elderly patients (Hornbrook, 1982b; Pettengill and Vertrees, 1982; Fetter et al., 1977; Fetter et al., 1980; Horn et al., 1985). While those criteria are all relevant, the primary concerns related to the application of DRG's to pediatric as well as adult hospitalization have focused on clinical validity, sensitivity to differences in outputs across hospitals, and sensitivity to differences in resource needs across patients. This discussion therefore concentrates on the issues of validity and sensitivity, addressing the questions of whether the DRG system as currently structured is appropriate for use in pediatric prospective payment systems and, if it is not, how it should be modified.

Sensitivity to differences across patients

Differences by diagnoses

The formation of categories in the DRG system was driven by the characteristics of adult hospitalization, since approximately 90 percent of U.S. discharges are of patients 15 years of age or over (National Center for Health Statistics, 1986). However, children have different diseases than adults (or different clinical presentations of the same disease) and require different types of treatment, which may require modification of the DRG system for use with children.³

This is true on a number of levels. First, there are diseases or conditions that, being congenital, by definition pertain to childhood. Some of these result in death before adulthood and are therefore not seen in adult medicine. Examples of some of these childhood diseases include storage diseases (Hunter's and Hurler's syndromes, familial dysautonomia, Pompe's disease, etc.); cystic fibrosis (those patients who survive into early adulthood are usually cared for in children's hospitals); complex congenital heart disease; and biliary atresia. Congenital anomalies are the fourth most common diagnosis among sick newborns but are rarely listed as the first diagnosis among adult patients (National Center for Health Statistics, 1986). Then there are diseases that are associated with certain developmental stages confined to childhood (e.g., Sudden Infant Death Syndrome, feeding disorders, failure to thrive, certain neoplasms such as Wilm's tumor, neuroblastoma). Other diseases are found in both adult and pediatric populations but the incidence is much greater in the latter (e.g., asthma, leukemia, and meningitis).

Children are also hospitalized for conditions that may not warrant hospitalization for adults. This is

due in part to the heightened vulnerability of younger children, in whom clinical status is more likely to deteriorate rapidly than in older children or adults. In addition, the younger the child, the more difficult it is to make a definitive diagnosis based on objective clinical evidence. Younger children have limited or no ability to communicate verbally and their behavioral repertoire is more limited than that of adults. Pediatric clinicians therefore frequently find themselves confronted with clinical situations in which they must make potentially life and death decisions based on far more imperfect information than is the case for older children or adults. Thus, certain conditions are more likely to necessitate hospitalization for aggressive treatment. For example, fever in a child under 2 months of age is much more likely to result in hospitalization and usually antibiotic therapy than would fever in an older child or an adult. Diarrhea and dehydration will result in admission more frequently for younger children because of their greater surface area in relationship to body size. In some cases, such as suspected child abuse, the greater dependence and heightened vulnerability of younger children (compared with, for example, adolescents) may prompt hospital admission.

The differences in diagnoses between children and adults and the possibility of different lengths of stay or distributions of costs by diagnosis among children compared with adults suggest that groupings different than those formed for the DRG system may be necessary to form clinically valid pediatric categories that are homogeneous in diagnoses and resource use.

Differences by age

In developing DRG's, a primary objective was to keep the number of categories "manageable." As a result, the number of age categories within each of the 23 major diagnostic categories (MDC's) is limited. In addition, for the sake of consistency it was decided that all age breakdowns within the DRG's in a single MDC should be made at the same ages. The only age divisions within pediatric-specific DRG's are made for neonates and for children under 18 years of age.

There is evidence that the age categories used in formulating the existing DRG's may be too crude or too rigid to reflect the utilization and cost experience of pediatric patients, as resource use in pediatric hospitalization is so sensitive to age. For example, the average length of stay (ALOS) of infants (children under 1 year of age) was 6.5 days in 1984, 44 percent higher than the ALOS of all patients under 15 years of age. The ALOS of infants hospitalized for perinatal morbidity was 12.2 days in 1984, longer than for any other diagnosis except mental disorders (National Center for Health Statistics, 1986). It is not unusual for such infants to be hospitalized for a month or more (Kovar, 1978). The ALOS for neonates with cystic fibrosis in children's hospitals is twice as long as that for patients with the same diagnosis who are older (NACHRI, 1984).

³Andrew Racine, M.D., Howard Bauchner, M.D., and Michael Weitzman, M.D., contributed the clinical information used in this section.

The sensitivity of length of stay and charges to age was substantiated by Long, Dreaschlin, and Fisher (1986), who found that subdividing the age category 0-18 years into 5 subcategories (under 1 month, 1 month to under 1 year, 1-5 years, 6-12 years, and 13 years of age or over) increased the variances explained in length of stay and charges by 5 percent or more in 35 of 61 selected DRG's.

The grossness of the age categories within the 51 pediatric DRG's and the homogeneity of the age categories within MDC's may penalize pediatric hospitals if they suppress differences in resource use between children and adults or among children of different ages within the same DRG. Finer age breakdowns may be needed to reflect resource use among pediatric patients.

Classifying neonates

Neonates are the most elusive group of pediatric patients in the DRG system since they can be classified based either on their age or the presence of neonatal diagnosis into the DRG's specifically devoted to neonates (e.g., DRG 385: neonates, died or transferred; DRG 387: newborn or neonate with prematurity or with major problem) or into any one of a number of other DRG's based on their principal diagnoses (e.g., DRG 422: viral illness; DRG 184: gastrointestinal disorder, age 0-17 years).

Evidence for this comes from a study by NACHRI with funding from HCFA, the Pew Foundation, and NACHRI. Data from 1982 were obtained from the Commission on Professional and Hospital Activities for approximately 500,000 pediatric discharges and 250,000 adult discharges. The sample was stratified by hospital type (children's hospitals; university teaching hospitals with pediatric residency programs; other hospitals with pediatric residency programs; and rural hospitals without pediatric residency programs). All payers were included. Ninety-five DRG's comprising 80 percent of the sample were examined in detail. Resource use was approximated by using length of stay and charges (NACHRI, 1985a).

In the study data set, 81.4 percent of the 69,913 neonates had been grouped into neonatal DRG's based on their age and/or a neonatal principal diagnosis. The remaining 18.4 percent of the neonates had been assigned to other MDC's, based on their principal diagnoses alone. Given the longer stays among neonates overall, merging them into nonneonatal DRG's with older patients can mask the high cost of their care. This suggests that, as was found in the NACHRI study, more homogeneous groupings may result from classifying neonates first by age and then by principal diagnosis and procedures.

Finally, there is evidence for the need to use a new variable—birth weight—in the classification of neonates. Neonatal charges and length of stay are strongly related to birth weight. For example, a 1981

study of neonatal intensive care unit (NICU) costs indicated that the average total costs were \$19,213, \$15,204, and \$9,516 for the birth-weight categories 501-1,000 grams, 1,001-1,500 grams, and 1,501-2,000 grams, respectively (Phibbs, Williams, and Phibbs, 1981). Birth weight was the single most powerful factor in explaining neonatal charges in the NACHRI study (NACHRI, 1986a).

Classifying disabled chronically ill children

Approximately 5 percent of U.S. children have disabling chronic illnesses. Approximately one-half of those (1.1 million children) are severely limited or unable to carry on a major activity. Disabled children are more than twice as likely to be hospitalized and to stay on average twice as long as other children (Newacheck, 1987).

There is evidence that children who are repeatedly hospitalized for the same illness contribute disproportionately to the high-cost patients in children's hospitals. Zook, Savickis, and Moore (1980) found that 37.6 percent of the patients in the children's hospital they studied during a year were repeatedly hospitalized for the same disease (RHSD). Over 10 years, 50.5 percent of the patients in this hospital fell into the RHSD category. Among the 20 percent of the patients who had the highest costs during the year, 69.5 percent were in the RHSD category; 43.8 percent of the higher-cost patients had congenital defects (Zook and Moore, 1980).

Depending on the diagnosis, these children may either require progressively more intensive and expensive care or, if their condition is ameliorated by growth, development, or treatment, progressively less expensive care (Quilty, 1985).

As mentioned above, principal diagnosis is a key variable in categorizing discharges into DRG's. With some handicapping conditions or chronic diseases, however, the principal diagnosis (i.e., the immediate reason for admission, such as tonsillitis or hernia) may not be as important a determinant of costs as the underlying condition (such as cystic fibrosis), which may necessitate longer hospitalization and more intense care than for patients without the underlying conditions. For example, in the NACHRI study mentioned above it was found that lengths of stay and costs were more homogeneous if all patients with diagnoses of cystic fibrosis (whether they were principal, secondary, or tertiary diagnoses) were grouped together into a single category than if they were put into different categories based on their principal diagnoses (NACHRI, 1985b).

If the true costs of caring for chronically ill children are reflected equitably, the phenomenon of multiple discharges and changing costs over time is not a problem. If, however, those costs are not reflected equitably through a system based on averages, then either new categories must be developed or payment weights must be adapted.

Transferred versus nontransferred patients

The regionalization of services (such as perinatal services, cardiac surgery, end stage renal disease treatment, cancer treatment, and multiple congenital malformation treatment) has been promoted nationally as a means of attaining economies of scale and assuring quality of care at the appropriate level (National Foundation—March of Dimes, 1976).

Effective regionalization requires appropriate transfers of severely ill children “up” (from general to tertiary-level facilities) and of less severely ill children “down” (from tertiary to general hospitals). Ideally, high-risk patients should be referred to the tertiary care level while low-risk patients should be referred to less intensive and less costly facilities.

Because variations in resource use by transfer status are so closely tied to the type of hospital involved in the transfer, a fuller discussion on this issue is postponed to the next section, which takes up variations in resource use among different types of hospitals.

Sensitivity to differences across hospitals

Differences in scope of services

The data bases used to develop and validate DRG's may have underrepresented the scope of services available in tertiary-level pediatric hospitals.

The data base used by Fetter, Thompson, and colleagues to develop DRG's (Fetter et al., 1977; Fetter et al., 1980) was drawn from general acute care hospitals. No children's hospitals were included in the data base and there were therefore fewer tertiary-level pediatric patients included than there would have been if children's hospitals had been included. Furthermore, the Michigan and Maryland cost data base used to set relative DRG payment weights for the Medicare PPS included only one children's hospital. Thus, any distortions introduced during the development of DRG's by the omission of children's hospitals' data would probably not have been revealed during the validation phase. One implication of this is that the costs of the various specialized services in tertiary pediatric hospitals may not have been adequately reflected in the development and validation of DRG's or PPS payment weights.

Various specialized pediatric services more likely to be present in tertiary hospitals make caring for patients there more expensive than in other hospitals. There are, for example, feeding teams that specialize in therapy for infants who have difficulty feeding; play therapists; specialists in developmental pediatrics who evaluate children with developmental delays; clinical psychologists who specialize in educational testing; tutors for children staying for long periods; and often toxicologists to deal with poisonings. All of these services are especially labor intensive and

therefore expensive, and their presence can increase average costs substantially.

Differences in level of severity of illness

The DRG system as currently structured addresses differences in severity of illness among patients by separating patients with and without complications or comorbidities into separate DRG's. In addition, PPS incorporates an additional payment for extremely long-stay or costly patients (discussed below under “Outliers”). If those provisions are not sufficiently sensitive to systematic differences in case mix or resource use between tertiary and community hospitals, however, hospitals with more costly and complex caseloads may be adversely affected.

Evidence that within-DRG costs are higher in tertiary pediatric hospitals comes from the NACHRI study mentioned previously. For 35 of the 95 DRG's studied, patients in children's hospitals and university teaching hospitals had longer and/or more expensive stays in comparison with the other hospital types. For the remaining 50 DRG's, either no distinct patterns were discerned, or there were too few cases to allow meaningful comparisons to be made.

This difference across hospital types is especially striking among neonates. On the average, discharges in DRG 385 from children's, university teaching, and other teaching hospitals were 10.2, 7.2, and 6.9 times more expensive, respectively, than in nonteaching hospitals (Table 1). Only DRG 388 (prematurity without major problems) exhibits relatively similar charges across the four types of hospitals.

In a study performed on 61 DRG's drawing on the same data base used for the NACHRI study, severity levels measured by use of SysteMetrics' Disease Staging were compared among hospital types (Long, Dreaschlin, and Fisher, 1986). Overall, no difference in severity of illness among the hospital groups was found. However, when comparing the proportion of patients in more severe disease stages (categories 3-5) by DRG, children's hospitals and university teaching hospitals had over twice the proportion of severely ill patients as did the other hospital types—a significant difference. These findings indicate that, like university teaching hospitals, children's hospitals are the major providers of tertiary-level care. Like other tertiary hospitals though, children's hospitals also provide a certain amount of secondary-level care, especially to children residing in their geographic catchment areas. This may account for the fact that, overall, the analyses conducted so far do not indicate a significant difference in severity of illness among different types of hospitals.

Whether or not these within-DRG differences across types of hospitals warrant changes in the DRG system or PPS depend on a number of factors, including whether the outlier and indirect teaching payment policies adequately reimburse tertiary-level hospitals for the costs of treating more severely ill patients. This is discussed in more detail in the section below on outliers.

Table 1
Percent of discharges, average length of stay, and average charge for neonates in major diagnostic category 15, by type of hospital

Diagnosis-related group (DRG)	Number of discharges	Hospital type				All hospital types
		Children's	University teaching	Other teaching	Non-teaching	
Total	57,815	20.8	18.9	13.9	46.4	(100.0)
Percent of discharges						
DRG ²						
385	9,322	41.0	17.3	7.9	33.8	(100.0)
386	4,824	39.5	24.2	11.0	25.3	(100.0)
387	4,145	23.2	28.9	16.5	31.4	(100.0)
388	6,061	30.1	14.7	11.9	43.3	(100.0)
389	14,573	16.8	18.4	15.9	48.9	(100.0)
390	18,890	5.6	17.9	16.3	60.2	(100.0)
Average length of stay in days						
385	—	12.2	11.0	8.4	2.7	—
386	—	31.3	32.0	28.9	18.5	—
387	—	20.1	21.5	17.4	13.5	—
388	—	4.6	9.5	9.2	8.2	—
389	—	9.0	8.1	6.0	5.0	—
390	—	5.0	4.4	3.9	3.6	—
Average charge per discharge in dollars						
385	—	16,321	11,485	11,035	1,596	—
386	—	25,235	21,048	17,710	12,677	—
387	—	13,057	11,060	7,789	4,500	—
388	—	1,055	2,351	2,336	1,259	—
389	—	7,217	5,034	2,690	1,722	—
390	—	3,084	1,370	832	615	—

¹N = total number.

²DRG = diagnosis-related group.

NOTES: DRG 391 (normal newborns) was excluded from the NACHRI study.

DRG 385 = Neonates, died or transferred.

DRG 386 = Extreme immaturity, neonate.

DRG 387 = Prematurity with major problems.

DRG 388 = Prematurity without major problems.

DRG 389 = Full-term neonate with major problems.

DRG 390 = Neonates with other significant problems.

SOURCE: (National Association of Children's Hospitals and Related Institutions, 1985b.)

Transfers up and down the system

The primary focus of concern regarding transferred patients is DRG 385 (neonates, died or transferred), which includes neonates transferred from one acute care hospital to another.

Apparently at least two distinct groups of transferred patients have been combined into the DRG (neonates who died may constitute a third distinct group). Neonates born in community hospitals who are immediately transferred up to tertiary facilities have considerably shorter stays and lower charges than infants kept in such tertiary facilities for several days, weeks, or months who are then transferred down to the community hospitals for further treatment or stabilization. In addition, children transferred out of tertiary facilities may have any one of a number of different diagnoses, complications, and/or comorbidities with a wide range of average lengths of stay and charges.

Whether or not transfer status should be incorporated into a case-mix system depends on the numbers of transferred cases and whether the costs

between discharges up and down the system are significantly different. Differences in resources used by neonates treated in different hospital types are reflected in Table 2. The ALOS and the charges for patients in DRG 385 for children's hospitals are 4.5 and 10.2 times greater, respectively, than are the ALOS and charges in nonteaching hospitals, which indicates the wide variation in resource use by patients in this DRG across hospital types. The ratios between both the ALOS and the charges of children's hospitals and nonteaching hospitals are much higher for this DRG than for any of the other neonatal DRG's (DRG's 386-390), which suggests that the transfer issue, and not differences in severity of illness, is responsible for the wide variations by hospital type in resource use among neonates in DRG 385.

Although the percentage of patients in DRG 385 is relatively small for all four hospital types (ranging from 1.6 percent to 2.9 percent of the patient population in each type of hospital), the percentage of patient days attributed to these neonates is disproportionately high for the teaching hospital types, ranging from 3.4 percent to 4.3 percent of the

Table 2**Average length of stay for patients discharged from short-stay hospitals, by geographic region and age: United States, 1984¹**

Age in years	Region				
	All regions	North-east	North central	South	West
All ages	6.6	7.8	6.9	6.1	5.7
Under 15 years	4.5	4.5	4.9	4.2	4.4
15-44 years	4.9	5.3	5.4	4.6	4.3
45-64 years	7.2	8.1	7.4	6.8	6.4
65 years or over	8.9	11.3	8.7	8.4	7.4

¹ Discharges from non-Federal hospitals. Excludes newborns.

SOURCE: (National Center for Health Statistics, 1986).

patient days. Average charges for neonates in DRG 385 are relatively high, especially in the teaching hospitals (Table 1).

Payment system issues

Finance and reimbursement

Almost one-third (31.1 percent) of the expenditures for children's hospitalization comes from public sources, the most important of which is the Medicaid program. Medicaid was the principal source of payment for 24.4 percent of the days of care of patients under 15 years of age discharged from non-Federal short-stay hospitals in 1984 (National Center for Health Statistics, 1986). This reliance on Medicaid is higher among children than any other age group. It was second only to private insurance, which covered 56.3 percent of pediatric patient days.

It is important to recognize that, in spite of the importance of Medicaid coverage in reimbursement for children's hospitalization, less than one-third of the 21 percent of U.S. children who live in families with incomes below the official poverty level were covered by Medicaid in the early 1980's, down from two-thirds of poor children in the early 1970's (Newacheck, 1987; Butler et al., 1985). Coverage varies radically from State to State, ranging from a high of 143 percent of the population below the poverty level in Massachusetts to a low of 25 percent in Texas (*Federal Register*, 1985). Among the poor, children are more likely to lack insurance coverage than adults. Thirty-four percent of poor and near-poor children are always uninsured, compared with 19 percent of those 18-64 years of age and none of those over 65 (Wilensky and Berk, 1982).

In addition, although inpatient hospitalization is one of the services that must be included in each State Medicaid program, the number of days of inpatient hospitalization reimbursed is limited in 18 States (Sawyer et al., 1983).

The limitation of Medicaid coverage has several implications: Medicaid data give only a partial picture of hospital use by poor children, because eligibility is

so limited; there is no one source of data on hospital use by poor children, because those not covered by Medicaid are grouped into mixed categories (e.g., self-pay, other government programs); the length-of-stay data for Medicaid children probably underestimate their medical needs because of limitations on days of coverage; and limitations in Medicaid coverage and the reliance of children on Medicaid increase the financial jeopardy of hospitals caring for children.

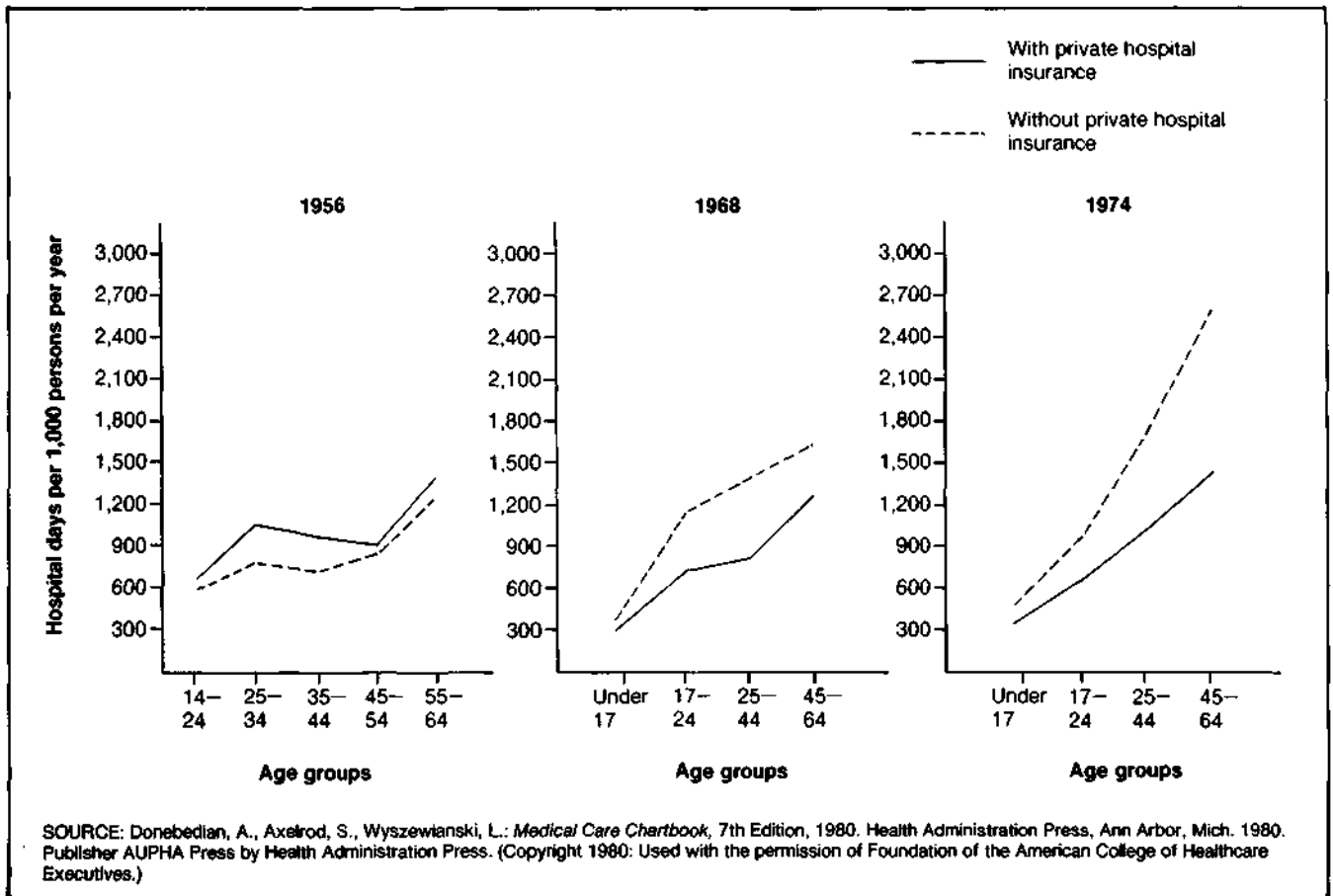
Need to promote efficient utilization

In the case of adult hospitalization, much of the incentive to initiate prospective payment came from the need to reduce the perceived "fat" in the medical care system caused by the retrospective cost-based system. Evidence from a number of sources indicates that there may not be as pressing a need for reducing medically unnecessary use vis a vis pediatric hospitalization:

- Regional differences in ALOS for children are much less pronounced than are the differences for adults, which suggests that children's hospital utilization may be much more closely related to medical need and less influenced by other factors, such as regional differences in practice patterns, than is adult hospitalization (Table 2).
- Pediatric patient days are less likely than adult patient days to be covered by private insurance and more likely to be covered by public programs, self-pay, bad debt, or charity, which are more limited sources of revenue for the hospital. Over one-third (35.2 percent) of patient days of those under 15 years of age were covered by Medicaid and self-pay compared with 12.6 percent of patient days of all patients in 1984 (National Center for Health Statistics, 1986).
- Hospitalization rates for children are less closely related to the extent of private insurance coverage than are rates for adults. This tendency has persisted since at least 1956 (see Figure 2). Results of the Rand Health Insurance Study indicate that expenditures on children's hospital care were much less influenced by the amount of coinsurance the individual or family was required to pay than were expenditures for adults (Leibowitz et al., 1985). The Health Insurance Study results imply that children's hospitalization is less price-elastic than that of adults.
- Further evidence to support this point is the finding that, at least in the Eastern Massachusetts area, the level of inappropriate (medically unjustified) hospitalization is much lower for noninfant children than for adults (Restuccia, Gertman, and Dayno, 1984).

The apparently strong social commitment to provide hospital services to children regardless of the ability of the family to pay for the services places an additional financial burden on hospitals treating children compared with those primarily treating adults.

Figure 2
Hospital days per 1,000 persons per year, by age group and hospital insurance status:
United States, 1956, 1968, and 1974



It does not appear that the need for prospective payment systems in order to control overutilization is as pressing for pediatric as for adult hospitalization (although recent evidence indicates a cost saving in State Medicaid programs initiating DRG-based prospective payment [Hellinger, 1986]). As a corollary, since there is less slack for a PPS to squeeze out of the pediatric hospital system, there is much less margin for error in the design of a pediatric PPS. Financial incentives must be designed to reduce overutilization without jeopardizing necessary utilization or fair and equitable payment to institutions providing such care.

Options in payment system design

States adopting case-mix-based prospective payment systems must address several policy issues: the case-mix system to be used (DRG's or an alternate system); the basis for calculating and adjusting payment weights and prices; how to pay for atypical cases (e.g., outliers and transfers); and whether to exclude certain types of discharges (e.g., for alcohol or substance abuse or psychiatric care) or certain types of hospitals or types of costs (e.g., teaching costs, costs of treating low-income children) (Vertrees and Bartlett, 1985).

A comprehensive discussion of the options available to and adopted by State Medicaid PPS's is beyond the scope of this paper.⁴ Instead, we focus on empirical findings and policy considerations related to three issues: payment weights, outliers, and transfers.

Payment weights

At the Federal level, payment weights for pediatric DRG's were determined for use in the Medicare PPS using data from Maryland and Michigan. Controversy over the weights has focused on the concern that (1) possible underrepresentation of tertiary-level hospital data from those two States may have resulted in average charges per category that are much lower than the true average cost of treatment for all pediatric patients; and (2) that flaws in the case-mix system (such as the problems described above with DRG 385), if uncorrected, may result in weights that will financially penalize hospitals treating large numbers of severely ill neonates. In this situation, averaging the charges of community hospitals with those of university teaching hospitals and children's

⁴See Vertrees and Bartlett (1985) for a full discussion of several options.

hospitals may jeopardize the financial viability of the tertiary-level institutions.

From the perspective of payers there is a potential that, over the entire range of hospitals' case mix, the use of the HCFA PPS weights may *overpay* children's hospitals for patients in those categories in which the weights were based primarily on elderly patients (e.g., the several DRG's in which age is not specified or the age boundary is "under 70 years of age").

Evidence for this comes from a NACHRI study of 12 randomly selected children's hospitals, using data on 84,000 discharges. Simulations on the potential impact of various payment options indicate that, if paid under existing PPS payment weights, with adjustments for urban-rural wage differentials, indirect teaching costs, and outliers, children's hospitals would have received 103.7 percent of their costs (excluding capital costs and direct teaching costs) for Medicare patients only, 115.5 percent of their costs for Medicaid patients only, and 127.9 percent of their costs for all patients (NACHRI, 1986b). (Without the outlier and indirect teaching payment, however, they would only receive 64 percent of their costs for all patients, indicating the heavy reliance of children's hospitals on those adjustments.)

At the State level, in establishing payment weights and length-of-stay guidelines, Medicaid programs must decide whether to calculate values for all hospitalized children or for Medicaid children only.

In most States, the number of Medicaid inpatient discharges is not large enough to create stable payment weights. Basing weights on all children would allow States to draw on a larger sample than if only Medicaid discharges were used. If Medicaid charges are sufficiently different from those of non-Medicaid charges, however, such an approach might result in either incentives to hospitals not to treat Medicaid children (if they are more expensive, on the average) or incentives to overhospitalize (if they are less expensive). The decision between these two options, therefore, depends on whether Medicaid children use a systematically different level of resources than their non-Medicaid counterparts. For example, Medicaid children may have less expensive stays in some categories if they are hospitalized when non-Medicaid children with the same clinical conditions would be closely monitored by a personal physician and treated on an outpatient basis. Alternatively, they may have more expensive stays because of greater severity of illness at the time of hospitalization or because of delayed discharge due to adverse physical, environmental, and/or family situations.

Preliminary evidence suggests that this indeed may be the case. A recent study of children hospitalized in metropolitan Boston institutions found that Medicaid recipients had longer average lengths of stay than their non-Medicaid counterparts in 70 percent of DRG's for which reliable estimates could be obtained (Payne et al., 1986). In many cases, the differences were of 3 or more days.

Further evidence of differential Medicaid use comes from a study conducted by the State of Ohio Division of Maternal and Child Health, in which handicapped children eligible for Medicaid consistently had higher hospital costs than did non-Medicaid eligible handicapped children in the same DRG. This was true even though the latter group of children was eligible for coverage under the State's Crippled Children's program and thus came from medically indigent families—the working poor and unemployed who are slightly above Medicaid eligibility standards (Quilty, 1985).

If other States reproduce the findings from the Boston and Ohio studies, setting reimbursement weights based on all children could underestimate the true costs of caring for Medicaid children in some or many DRG's. These rates could penalize hospitals serving disproportionate shares of Medicaid and low-income children and could jeopardize the access of these children to hospital services. Alternatively, if rates are set in such a way to overestimate the utilization of Medicaid children, States will lose an opportunity to control costs and to encourage efficient use of Medicaid funds.

Outliers

The Medicare PPS outlier policy is designed to protect hospitals from the financial risk of treating severely ill, high-cost cases. Outlier patients are defined as those patients with either unusually long stays (stays greater than 17 days or 1.94 standard deviations above the geometric mean length of stay) or unusually expensive stays (charges more than 2.0 times the average cost for the DRG or charges greater than \$13,500). Payments for length of stay patients who qualify as outliers consist of the standard inlier payment plus 60 percent of the average per diem cost for each patient day beyond the outlier trim point day.

The adequacy of an outlier payment policy in performing this task depends on a number of factors, including relative variability in resource use (for example, using 1.94 standard deviations above the mean length of stay will yield relatively high trim points if the standard deviation of the length of stay is relatively great) and the adequacy of the marginal cost payment to cover end-of-stay costs.

Children's stays may be more variable in length than adults' for two reasons. The first is the extremely long stays of severely ill neonates (discussed above). The second is that a large proportion of children's stays are quite short. For example, in Boston-area hospitals in fiscal year 1984, 45 percent of the stays of patients 5-17 years of age were 2 days or less (Payne et al., 1986). The large proportions of very long and very short stays may result in greater variance in length of stay among children having a given condition compared with adults. An example of the greater variability in length of stay of pediatric patients comes from data on 1,512 Professional Activities Study (PAS) hospitals in 1980. The

coefficient of variation of length of stay for patients 0-19 years of age (excluding normal newborns) was 1.323, which was 18.5 percent above the coefficient of variation for all patients (1.116). Children had more variable stays than the other age groups (coefficients for which ranged from .942 to 1.141) (Commission on Professional and Hospital Activities, 1981). This is surprising, as the general population is much more diverse in age and case mix and hence would be expected to have a larger coefficient than children. This greater variability may result in larger standard deviations for pediatric lengths of stay in pediatric-specific payment systems and hence may result in higher trim points than in payment systems using data based on adult utilization. A higher trim point relative to the mean will result in fewer cases being classed as outlier patients, which could financially jeopardize hospitals treating those patients.

As with adults, pediatric patients treated in tertiary hospitals (either children's hospitals or university teaching hospitals) are more likely to have complications and comorbidities than those treated in other hospitals (NACHRI, 1985a). This is evidence that tertiary hospitals treat a more severely ill patient population than average and that they may face greater financial risk if the outlier payment is not sufficient to cover the true costs of treating such patients.

Finally, the impact of extremely short stays needs to be considered in the establishment of outlier policies. For example, if short stays are not uniformly distributed across different types of hospitals, hospitals with a high proportion of short stays could realize windfall profits. If in fact certain types of hospitals have differentially more short stays, payers should explore the need to establish an outlier policy for short stays (e.g., discharges with lengths of stay below a given lower trim point) to avoid possible overpayments.

Transfers

The first issue related to transfers is how the costs of transporting patients are allocated among hospitals. Transport costs are imposed on tertiary pediatric centers because of the clinical needs of the patients. These costs are not imposed on the referring hospitals. When asked by an outlying hospital to accept a critically ill child (whether a neonate or an older child), it is the tertiary center that provides the transport team (the doctor and nurse who are specially trained to stabilize and transport critically ill children). Since these transports are often carried out on an emergency basis, they cannot be scheduled. Standby capacity for transports must be available,

which increases the costs to the tertiary center. A reimbursement system in which the costs of transporting the patient are not reflected in the payment weights could unduly penalize the receiving tertiary hospital. This could be true even if the costs of the transports are added to the charges of the patients in the tertiary hospitals, because in PPS as currently formulated those charges would be averaged into a pool, including lower charges from community hospitals, in order to establish the DRG reimbursement rate, and the tertiary hospital would not recover its full costs.

Second, the payment system should be able to reimburse separately for transfers up the system from community hospitals to tertiary hospitals and transfers down from tertiary to community hospitals. Because of technical and political difficulties of classifying hospitals, the most practical approach is probably not to incorporate the hospital type into the payment formula but instead to incorporate the length of the hospital stay prior to transfer, as was recommended by NACHRI, based on its analysis of problems with DRG 385 (NACHRI, 1985b).

Third, the payment system must either encourage or at least not discourage transfer patterns in a regional system. In order to accomplish this, the payment weights for transferred patients must be as close to the true costs of caring for patients (including costs of transporting transferred patients) as possible. Setting the average payment below true costs would provide an incentive for community hospitals to transfer children they could safely treat and could financially penalize tertiary hospitals. Setting the rate above true cost would provide an incentive for community hospitals to retain patients they might otherwise transfer.

Conclusions

A prospective, DRG-based payment system appears to be feasible for pediatric hospitalization, if it incorporates these considerations:

- The need for finer subdivisions of certain DRG's, particularly those including neonates, by age, diagnosis, or procedure/treatment to increase the sensitivity of the system to variations in resource consumption.
- The recognition that tertiary-level pediatric hospitals are generally part of regional networks of hospitals with extensive transfers to and from other hospitals. Differences in costs for transfers up and down the system and the need to preserve and promote regionalized care must be taken into account when designing the payment system for pediatric hospitals.

- The outlier policy of the adult PPS is aimed at protecting hospitals from the financial risk of treating high-cost cases. Although current policies succeed to some extent, limitations in the methods used to measure illness severity may have placed tertiary-level institutions at continued risk. In addition, to the extent that some pediatric hospitals have proportionately more short-term outliers, those institutions may receive large windfall gains. Modifying outlier policy offers one potential solution to the nonrandom distribution of high- and low-cost children across types of hospitals. This implies a need to recognize what may be a greater variability in length of stay through establishing low as well as high trim points. If that variability increases the outlier trim points substantially, then a more generous policy of reimbursing for high-cost outlier care must be established (either by paying more than 60 percent of the average per diem cost or setting the trim points lower than 1.94 standard deviations above the geometric mean length of stay, for example at 1.50 standard deviations).
- To the extent that Medicaid patients have different costs or lengths of stay than other patients, calculation of separate payment weights for poor children may be warranted to preserve access to care of Medicaid children.
- Finally, hospital payment for disabled chronically ill children may need to be treated separately than that for children experiencing single, acute episodes of illness. This may require either formulation of DRG's exclusively for such children, perhaps based on their underlying condition rather than the principal diagnosis or, failing that, retaining cost-based reimbursement.

The most immediate issues requiring further research are:

- The need for further validation of the CDRG system on other data bases and with other types of hospitals to compare the performance of CDRG's and DRG's.
- The need for further research and option development related specifically to Medicare and Medicaid children.
- The need to simulate the impact of the various options on different types of hospitals to determine whether or not children's hospitals should receive different treatment under PPS or State Medicaid programs than other types of hospitals (especially university teaching hospitals).

The issue of how to pay for pediatric hospitalization originated with the specific question of whether children's hospitals should be excluded from the PPS. That question is still unanswered. Since HCFA was first mandated to address this issue, because of the leading role Medicare plays in hospital reimbursement and the pressing need of States to control Medicaid costs, the implications and potential scope of the issue have moved far beyond Medicare. Although considerable research has been devoted to case-mix systems for pediatric hospitalization, the

research has not addressed several key questions related to payment system design. These questions must be answered before decisions can be made on the exclusion of children's hospitals from PPS and on the design of prospective payment for pediatric hospitalization in general. How HCFA resolves the question of paying for pediatric hospitalization will be important for State Medicaid programs as well as for the other payers (notably private insurers) who follow Medicare's lead.

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