

# Case-mix reimbursement for nursing home services: Simulation approach

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*Nursing home reimbursement based on case mix is a matter of growing interest. Several States either use or are considering this reimbursement method. In this article, we present a method for evaluating key outcomes of such a change for Connecticut nursing homes. A simulation model is used to replicate payments under the case-mix systems used in Maryland, Ohio, and West Virginia. The findings*

*indicate that, compared with the system presently used in Connecticut, these systems would better relate dollar payments to measure patient need, and for-profit homes would benefit relative to nonprofit homes. The Ohio methodology would impose the most additional costs, the West Virginia system would actually be somewhat less expensive in terms of direct patient care payments.*

## Introduction

One of the most difficult problems in health care reimbursement policy is adjusting payments to patients' care needs, or case mix. In hospital reimbursement, Medicare's answer has been prospective payment per case based on diagnosis-related groups. In nursing home reimbursement, however, the States have taken the lead in adjusting for case mix. The Federal Government is currently considering the use of case-mix reimbursement for skilled nursing facility services provided to Medicare beneficiaries (Jablonski, 1985). Meanwhile, several State governments have already implemented such systems for Medicaid: Illinois (1969), West Virginia (1976), Ohio (1980), and Maryland (1983). In Minnesota, a recently developed method for paying facilities in relation to patient case mix began in fall 1985. In New York, an extensive effort has been made to categorize patients in terms of their relative needs and resource usage, and since January 1, 1986, Medicaid reimbursement to nursing facilities has been based on these categories.

Several advantages can result from case-mix reimbursement systems. Such systems directly relate dollars paid to resident needs and functional disabilities and/or to services deemed necessary to meet these needs. State governments can then be better assured that their payments are in line with patients' clinical needs. Case-mix reimbursement systems can also improve the overall access of

Medicaid patients to needed care, particularly for patients with relatively high needs. Improved access may be especially valuable for States with patients "backed up" in hospitals, unable to obtain necessary care. If designed to provide the correct incentives, these reimbursement systems can also encourage the provision of the appropriate type and quality of care while saving State governments the cost of lengthy hospitalization for high-need patients.

Case-mix reimbursement systems also have potential weaknesses. The systems are administratively complex, and nursing homes may be encouraged to keep patients debilitated in order to maintain high payment levels (Smits, 1984). In addition, such systems are ultimately limited in the extent to which the true needs of individual patients can be measured through standardized assessment forms. State governments considering the adoption of a case-mix system should therefore carefully evaluate both the strengths and weaknesses of these systems before proceeding. In this article, we provide an example of such an evaluation for the State of Connecticut.

The Connecticut State government currently has a prospective, facility-specific, cost-based reimbursement system for Medicaid; private pay rates are also regulated under this system. Connecticut policymakers, however, are considering the development of a case-mix reimbursement system for nursing home care as an alternative. As part of that process, the Connecticut government contracted with the Center for Health Services Research, University of Colorado Health Sciences Center, to conduct a simulation study of the implications for Connecticut of adopting a system similar to those used in three other States: Ohio, West Virginia, and Maryland. The study was carried out for the Connecticut Department of Income Maintenance (which administers the Medicaid program) and the Medicaid Cost Containment Study Commission (a legislative study group). The study is summarized here; a complete discussion can be found in the final report (Adams et al., 1985).

The simulation model used in this analysis was drawn from a larger model under development as part of a study funded by the Health Care Financing

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Administration (HCFA). For the Connecticut study, the portion of the model that simulates the nursing care component of the nursing home reimbursement rate was applied to data from a representative sample of 26 Connecticut nursing homes and 601 patients. To our knowledge, this is the first such attempt to simulate these case-mix systems using a common data instrument and data base.

The results of the simulation process pertain to the Connecticut nursing home industry, but they should also be of considerable interest to policymakers in other States and at the national level. These results indicate that all three systems would relate Medicaid payments more closely to facility case-mix measures than does the current Connecticut system. They also indicate that Ohio's system would be more costly than Connecticut's current system, West Virginia's would be somewhat less expensive, and Maryland's only slightly more expensive.

Another major finding is that each of the three simulated systems would redistribute Medicaid revenues from the nonprofit to the for-profit facilities in Connecticut. The redistribution under each of these three systems that "account" for differences in case mix among facilities would apparently be attributable to differences in services provided and/or costs incurred. Even under a case-mix system that would provide more revenue to virtually all nursing homes (Ohio's system), the for-profit homes would gain more additional revenue than the nonprofit homes would, compared with the current cost-based rate structure of Connecticut nursing homes.

The remainder of this article is divided into three sections. First, the methodology and data used in the analysis are described. Brief descriptions of case-mix systems and of the simulation model are included in this section. The results of the analyses are presented in the second section. In the final section, the implications of the findings for Connecticut as well as other States are discussed.

## **Methodology and data**

### **Case-mix reimbursement systems**

Case mix generally refers to a measure of patients' condition and care needs; it thus largely defines a nursing home's "product" and can significantly affect costs, particularly nursing staff costs. Case mix may or may not be recognized by a payment system, and it can be addressed in various ways. These issues are of major importance in determining nursing home behavior and, ultimately, system outcomes in terms of cost, quality, and case mix.

As noted above, case-mix information has been incorporated into reimbursement systems in several States. Usually this involves a frequent (monthly or quarterly) detailed evaluation of each Medicaid patient's service needs, called a patient assessment. The Illinois point system was an early effort of this type. Patients were given points on the basis of service

needs, and the value of a point was determined using regression analysis (Walsh, 1979). Similar approaches were developed for West Virginia, Ohio, and Maryland, although, as indicated in the following discussion, each State's system is unique.

Patient assessments are used in different ways in these three systems. In each system, however, patients are assessed in terms of their need for each of a specific set of services and the level, degree, or extent to which each service is required. In West Virginia, 15 service categories are used to prospectively set ceilings on per diem nursing services reimbursement. The Ohio State government drew on West Virginia's categories and added six rehabilitative services. These are used to retrospectively set ceilings on per diem reimbursement for the cost of nursing services. In Maryland, 4 patient classifications (based on dependency in 5 activities of daily living, or ADL's) and 10 specific services are used in a formula to determine patient-specific per diem reimbursement rates for the nursing services rate component. Although the services used differ among the States, they tend to be referred to as "standards" in each State. Therefore, that terminology is adopted in this discussion as well. The services (i.e., standards) used in each of the three States are presented in Table 1.

In case-mix reimbursement systems, the nursing time required for specific services is estimated by the State government on the basis of time-motion studies and expert opinion. Combining these standard service times with standardized nursing personnel wage rates, also calculated by the State government, yields estimated service costs for each of the services a patient might require. The aggregation of these service costs for a facility's Medicaid patient population can be used either to set reimbursement rates for the cost component of nursing services or to set facility-specific ceilings on per diem reimbursements that are directly tied to the facility's case mix.

The New York and Minnesota State governments have taken a different approach. Information similar to that shown in Table 1 is used to group patients into categories that need different amounts of resources in their care. These categories are called resource utilization groups (RUG's). The RUG method was originally developed by Fries and Cooney (1985). RUG-based systems tend to be based more on patient characteristics than on specific services. For example, dependency in an ADL, such as eating, is considered to represent a patient characteristic that is more costly than a lack of dependency. This dependency can be treated in many different ways using different services. The RUG's approach does not define specific ways or services in its reimbursement method. In contrast, the three State systems simulated here are more likely to relate such a dependency to the need for a specific type and level of service and thereby estimate facility rates. The RUG's approach was too recent a development to be included when the simulation model discussed in this article was first designed.

**Table 1**  
**Standards for case-mix reimbursement in Maryland, Ohio, and West Virginia**

Maryland	Ohio	West Virginia
—	Behavioral/mental status	Behavioral/mental status
Bathing <sup>1</sup>	Personal hygiene <sup>2</sup>	Personal hygiene <sup>2</sup>
Dressing <sup>1</sup>	—	—
Eating <sup>1</sup>	Eating	Eating
Mobility <sup>1</sup>	Mobility	Mobility
Incontinence <sup>1</sup>	Incontinence/catheters	Incontinence
—	—	Catheters
Turning and positioning <sup>3</sup>	—	—
Tube feeding <sup>3</sup>	—	—
Decubitus care <sup>3</sup>	Dressings and nonroutine skin care	Dressings
—	Medications	Medications
Single injections	Injections	Injections
Multiple injections	—	—
—	Appliances	Appliances
Restraints	—	—
—	Enemas or douches	Enemas or douches
Suctioning/tracheostomy	Suctioning/tracheostomy	Suctioning/tracheostomy
Oxygen/aerosol	Oxygen/aerosol therapy	Oxygen/intermittent positive pressure breathing
Ostomy care	Colostomy, ileostomy, or ureterostomy	Colostomy, ileostomy, or ureterostomy
Intravenous/subcutaneous	Intravenous and subcutaneous fluids	Intravenous/subcutaneous
—	Habilitation <sup>4</sup>	—
—	Specialized services <sup>5</sup>	—
—	Physical therapy <sup>5</sup>	—
—	Occupational therapy <sup>5</sup>	—
—	Speech/audiology <sup>5</sup>	—
—	Psychological <sup>5</sup>	—

<sup>1</sup>Activities of daily living used to categorize patients into light, moderate, or heavy care classifications.  
<sup>2</sup>Includes bathing, dressing, hair care, nail care, shaving, and dental care.  
<sup>3</sup>Special services used to categorize patients into a heavy special care classification.  
<sup>4</sup>Determines the need for physical and/or psychosocial rehabilitation therapies.  
<sup>5</sup>Specific physical and psychosocial therapies.

By way of comparison, in the current Connecticut nursing home reimbursement methodology for operating (noncapital) costs, a prospective rate for each facility is set based on that facility's historical costs. (A fair rental approach is used for the capital component of the rate.) Ceilings are applied, but they are fairly generous. Private pay rates are also regulated. Therefore, the differential between Medicaid and private pay rates is likely to be less in Connecticut than in most other States.

## Simulation model

The simulation model was designed to replicate reimbursement for the component directly affected by case mix, the nursing care component, for Maryland, Ohio, and West Virginia. To do this, a detailed understanding of the standards (or services) and the method used for payment in each State was needed. The methodological details include types of personnel, time estimates, frequency of service, and wage rate determination. This analysis of the details of each State methodology was carried out as part of the larger HCFA study (Foley et al., 1984) and refined here. In this section, we discuss several major descriptors of the three case-mix systems. These include service categories (Table 1), personnel classes, and time allocations to services, as well as other major characteristics (e.g., determination of wage level for each personnel class). Also, the assumptions that were necessary to tailor the simulation model to the specific aspects of the Connecticut system are briefly discussed.

As noted, the differences in service categories among the States are highlighted in Table 1. For example, the Maryland system does not include a separate category (or standard) for behavioral/mental status but does classify patients into light, moderate, or heavy care categories based on dependency in the five ADL's listed (bathing, dressing, eating, mobility, and continence). In addition, certain services, including turning and positioning, tube feeding, and decubitus ulcer care, are used to categorize patients into a heavy special care classification. Only the Ohio system explicitly identifies and reimburses for a series of rehabilitation services. Other differences in the three systems pertain to the level of care a particular patient is assigned within any one standard and, consequently, the type of personnel assigned to provide that level of care in each system. These differences can be illustrated by viewing what happens to a hypothetical patient under each system for a particular standard.

Consider the standard for oxygen therapy. A hypothetical patient needed and received oxygen therapy more than 15 days during the past month. This patient would be categorized in the third, or highest, level of care for this standard in West Virginia. In Ohio, the patient would be classified in the third out of four categories (the fourth being more than 15 aerosol treatments). In Maryland, the nursing home would receive a constant per diem reimbursement for the actual number of days the service was provided.

To obtain the data necessary to capture these differences in the simulation model, a fairly complex patient-level data collection instrument was designed and pilot tested as part of the larger study. All the necessary patient-level data were obtained through this

instrument. Additionally, a series of variable transformations was created to classify each patient according to the standards, levels, and other items applicable to each of the three simulated systems.

The next step in the simulation process was to link the patient classifications to payment rates. Each State system relates categories of patient care to specific personnel types and time needed for each service. To continue with the example of the patient needing oxygen therapy, in the West Virginia payment system, a licensed practical nurse (LPN) is the assumed provider, and the time needed to provide the service is estimated as 16 minutes. In the Ohio system, an LPN is also assumed, and a total time of 17 minutes is estimated for service provision. Finally, in the Maryland method of payment, the standard of oxygen/aerosol therapy reimburses for both a registered nurse (RN) and an LPN to provide the service. The relative weights are 48 percent for the RN and 52 percent for the LPN. The total assumed time per day is .1042 hour, or approximately 6 minutes.

To translate these estimates of time needed for each service level into dollar amounts, hourly wage rates for the appropriate personnel types are multiplied by the time estimates. If the same wage levels are used for each State in the example, the per diem reimbursement for this particular service would be \$2.82 in Ohio and \$1.16 in Maryland, and it would range from \$2.65 to \$2.94 in West Virginia, depending on the size of the facility. As noted, the Maryland rate is adjusted for the patient's categorization as light care, moderate care, heavy care, or heavy special care.

The oxygen therapy example illustrates the considerable variation among the three States in the way that measures of patient need are translated into actual dollar payments. This example is for only one service and reflects some simplifying assumptions (wage rates). It should not be construed, therefore, as reflective of actual differences in total payment rates and/or relative generosity of any of the three systems. The example does show the complexity of these systems and the detail involved in trying to replicate, or simulate, the payment rates that would prevail in each system.

Several other characteristics that differentiate these systems were pertinent to the simulation model and were included to the extent feasible. State characteristics and simulation methods highlighted here are method of deriving wage rates, treatment of fringe benefits, use of ceiling payment rates, and other general differences.

The derivation of wage rates for actual payments varies across the three State systems. The systems vary in the number of personnel classes used as well as the level of wages. For example, in West Virginia the average wage of three specific skill levels is used, but in Ohio, payments are based on 115 percent of the statewide average salaries for eight categories of personnel. The simulation model replicated each State's personnel categories. However, only the Maryland method was used for deriving wage levels

from Connecticut data. The 75th percentile of wages in each personnel category was found for three geographic areas believed to reflect differences in the costs of living in Connecticut. By using only one method of deriving wage levels, the simulations highlight other differences in the structure of these three reimbursement systems.

The systems also differ as to whether fringe benefits paid to personnel are included in the calculation of the nursing care reimbursement rate. In West Virginia, fringe benefits are not included. In Ohio, they are included through an indirect adjustment (weighting) of the time allocation for certain services. In Maryland, fringe benefits are calculated and included directly in the payment rate. For these data, as with Maryland wages, a percentage "markup" for fringe benefits was calculated separately for the three Connecticut geographic areas. Each State system's approach to fringe benefits is replicated in the simulated rates.

The Ohio and West Virginia systems are similar in that the payment rate calculated from patient-level needs serves as a ceiling rather than an actual payment. Whenever the actual costs incurred for nursing services are less than the calculated rate, facilities are reimbursed their actual costs. Simulations (not shown here) were run for Ohio and West Virginia, reflecting this approach (Adams et al., 1985). The simulations reported here treat the ceilings as the actual rates. In Maryland, on the other hand, calculated rates are those actually paid out, and the simulations reflect this.

The three reimbursement systems differ in still other ways. Some differences were built directly into the simulation model, but others were judged not appropriate for modeling. In a few instances, data were not available to allow identical replication of a State payment system.

A feature of the Maryland system is an example of a system characteristic that could not be totally captured in the simulation process. In Maryland, if a patient's level of dependency improves (i.e., the patient moves from a heavier care ADL dependency level to a lighter care level such as from heavy special care to heavy care), the facility is still reimbursed at the heavier dependency level for 2 months. Because the measure of Connecticut patient status pertained to one point in time, the simulation model estimated only the lower payment level for these particular patients (i.e., without such bonuses). Although this procedure will underestimate the Medicaid payments under the Maryland system, it is expected that only a small proportion of the patient population and/or dollar reimbursements would be affected by bonus payments at any one point in time.

Differences among the systems led to the development of an important characteristic of the present simulation model. A unique benchmark was developed for each of the three State systems that is specific to the features that differentiate it from the other systems. For instance, the benchmark for the Ohio simulations takes into account the current

amount spent on physical and speech therapists in Connecticut, whereas the benchmark for the other two systems does not. Use of benchmarks allows us to always compare current payments with simulated rates for the same set of services (i.e., that set of services used in the State system being simulated).

## Connecticut samples and procedures

The simulation model was applied to data from a representative sample of 26 Connecticut nursing homes and their patients. These nursing homes were drawn as a 10-percent sample from a population list of 257 Connecticut facility units. This sample size was determined as necessary for statistical reliability in a fairly standard case-mix measure, the Katz ADL score (Katz et al., 1963; Adams et al., 1984). Using the facility-level mean and standard deviation for the Katz score from earlier studies, the sample size was based on an accepted error of about 10 percent of the mean and a 99-percent confidence level.

Several types of facilities were excluded: those that did not participate in Medicaid, homes for the aged, facilities that had been in operation for less than 1 year or had recently changed ownership, and those in which more than 40 percent of patients had a primary psychiatric diagnosis. These were viewed as "outliers," or not representative of the nursing home population as a whole. Facility units with less than 30 or more than 200 beds were also excluded from the sample. This eliminated patient populations too costly for data collection and/or with an insufficient number of Medicaid patients for analysis.

The resulting population from which the sample was drawn consisted of 257 separate units in rest homes with nursing supervision (RHNS) and chronic and convalescent nursing homes (CCNH). RHNS units correspond to intermediate care units, and CCNH units correspond to combined skilled and intermediate care units. Some Connecticut facilities are "duplicate" in that they have both types of units, with separate cost/rate reports and, consequently, Medicaid rates. Although units with more than 200 beds were excluded, facilities with two types of units could have a total facility bed count of more than 200. No unit of more than 200 beds was actually generated by our random sampling procedure; hence, no exclusion for large size was actually made.

The population of nursing home units was stratified by urban-rural and profit-nonprofit status to improve precision in the sample means. Based on the relative percentages in each cell in the population, the following numbers of each type were sampled: 17 urban profit, 5 urban nonprofit, 3 rural profit, and 1 rural nonprofit. Clearly, the fact that only one rural nonprofit facility was included means that the results for this category of nursing home must be considered as only illustrative.

Patient sampling and patient-level data collection were carried out by nursing personnel from the Connecticut Department of Income Maintenance. A 25-percent random sample of all patients (Medicaid

and non-Medicaid) was chosen in each unit, resulting in a total sample of 601 patients from the 26 facilities visited.

The data collected through this process, as well as financial data obtained directly from the Connecticut Department of Income Maintenance and the accounting firm of Ernst & Whinney, provided indepth information on patient-level characteristics and service needs as well as facility characteristics, such as current Medicaid rates, bed size, percent Medicaid patients, and current operating expenditures. These data were then used to simulate alternative rates "as if" Connecticut nursing homes were reimbursed under the existing systems in Maryland, Ohio, and West Virginia.

## Results of analyses

### Financial outcomes

In this section, we provide the results of simulating the nursing component of the Medicaid rate for each of the three payment mechanisms and comparing them with current Connecticut payment rates. As noted, the current rates used in the comparison are specific to each State system's benchmark. It should also be noted that the simulations reported here are based on data from all patients in the sample, not just Medicaid patients, because Connecticut now pays on the average costs of all patients. However, additional simulations were run on Medicaid patients only, and the results are discussed later in this section. The tables highlight average changes in revenues and patterns by urban, rural, profit, and nonprofit status. Total projected costs to the State government of Connecticut (including Federal matching funds) for nursing care services under each alternative system are also presented.

### Maryland system

The financial impacts at the facility level of shifting to the Maryland, Ohio, or West Virginia reimbursement system are summarized in Table 2. If the Maryland system had been used for 1984-85 payments to the sample of facilities in Connecticut, a minor net savings of \$.55 per patient day, on average, would have occurred. The average dollar payment per diem under this system would have been \$23.02, ranging from approximately \$13 to almost \$33 per patient day. This range shown in Table 2 is smaller than the range for current Connecticut rates using the Maryland benchmark assumptions—from \$10 to almost \$48 per patient day. The range of current rates, as well as the appropriateness of these rates for patient needs, were major issues raised by Connecticut policymakers.

The smaller range of payments under the Maryland system reflects shifts in revenues that would occur among facilities. As the data in Table 2 show, nonprofit facilities would experience major reductions in average reimbursements per patient day, but the

for-profit facilities would gain. The biggest shifts in revenue would occur for rural facilities.

These shifts can be seen in terms of the correlation of the simulated payment rates with the facilities' current operating expenses. The correlation for the Maryland simulation, .32, is a substantial change from the current correlation, .78. Clearly, considerable changes in rates would occur among Connecticut nursing homes if the Maryland system, as modeled here, were adopted.

**Table 2**

**Simulation results: Average change in Medicaid revenues per patient day, average payment per patient day, and correlation with operating expense, by type of reimbursement system and type of facility: Connecticut, 1984-85**

Type of facility	Maryland system	Ohio system	West Virginia system
Average change in revenues per patient day			
<b>All sample facilities</b>			
Mean	-\$0.55	\$6.12	-\$3.65
Minimum	-21.51	-7.60	-19.61
Maximum	7.13	14.05	0.29
<b>Urban</b>			
Profit	0.57	6.42	-2.39
Nonprofit	-5.73	5.12	-7.33
<b>Rural</b>			
Profit	4.66	10.61	-0.45
Nonprofit	-9.16	-7.60	-16.09
Average payment per patient day			
<b>All sample facilities</b>			
Mean	\$23.02	\$29.13	\$16.40
Minimum	13.20	13.47	7.87
Maximum	32.63	40.98	21.57
Correlation of simulated payment with operating expense per day			
<b>All sample facilities</b>	.32	.49	.35

### Ohio system

A similar summary description of changes that would occur if Connecticut had used the Ohio reimbursement system and paid the calculated ceiling rates, irrespective of actual costs, is shown in Table 2. This system, on average, would be more expensive than the current system. The higher cost may partially reflect the fact that necessary rehabilitative services are reimbursed under the Ohio system. Of course, other structural differences may also lead to higher rates.

The Ohio system calculates ceilings for facility reimbursement. If a facility's costs are below this ceiling, it is paid on the basis of costs. Data on ceiling rates are not shown in Table 2. However, a simulation was run using this approach. Using these sample data, it was found that the Connecticut State government would actually save money, approximately \$.60 per patient day, because the costs of only three facilities exceeded the simulated rate. In the long run, facilities are likely to increase expenditures up to the ceiling payment, so the ceiling rates are presented here.

As shown in Table 2, the per diem reimbursement using the ceilings as calculated rates would increase by an average of \$6.12 for the sample of facilities. The simulated range of rates under the Ohio system would be greater than under the Maryland system but still not as wide as the difference of \$38 per patient day in Connecticut's current minimum and maximum rates using the Ohio benchmark assumptions. The correlation of the Ohio simulated nursing rates with operating expenses per patient day is quite a bit higher than for the Maryland rates, .49 versus .32. This indicates that the adoption of the Ohio system would not be as great a shock to facilities in terms of changes in payment rates relative to current patterns of expenditure.

The Ohio system, as simulated, would distribute more funds to all facilities in the sample except rural nonprofit facilities. Again, more funds would be redistributed to for-profit homes than to nonprofit facilities. In the simulation, the average gains of \$6 to almost \$11 for the for-profit homes are greater than the gains to the urban nonprofit facilities of approximately \$5 and the loss to the rural nonprofit homes of more than \$7. The Ohio system would cost the Connecticut State government more on average. However, this type of redistribution among categories of facilities might be politically more acceptable to providers than the redistributions that result under the other simulated systems because most nursing homes would receive higher payments under the simulated Ohio system. (As noted earlier, the results for the rural nonprofit category must be regarded as illustrative because only one such facility was in the sample.)

### West Virginia system

The changes in rates simulated for the West Virginia system are also presented in Table 2. With this system, again assuming that calculated rates are paid rather than used as ceilings, there is an average savings in reimbursements for nursing care services of almost \$4 per patient day. The maximum savings per facility are \$20 a day, and no nursing home gains more than \$.29 in reimbursement per patient day. Thus, compared with the present Connecticut system, the West Virginia system may improve the relationship of payment to patient needs while actually saving money in overall reimbursements for nursing care services.

However, the inability to completely replicate the West Virginia system may be part of the reason it appears less expensive. In West Virginia, direct care nursing hours rather than total nursing hours are used to estimate hourly wage rates. This calculation could not be made in the current simulation because of lack of Connecticut data on direct care nursing hours. Thus, the appropriate wage rates for the West Virginia simulation may be higher than those actually used. It is not clear whether the dollar value derived using the West Virginia method would be greater than the 75th percentile of Connecticut personnel wages

that was actually used in these simulations. Another relevant factor is the assumption in West Virginia that certain services can be provided by lower cost personnel than are assumed in the other systems (e.g., aides versus LPN's). This factor was built into the simulation model. The potential cost-quality tradeoffs involved deserve further study.

### Payment rates and case mix

If the foregoing simulations provide insight into the financial consequences of implementing a case-mix system, a pertinent question concerns the policy benefits involved. What improvements, if any, would accompany the financial consequences? To assess this, we first consider how well the current system is working in terms of meeting the relative needs of each facility's patients.

The findings of this study suggest a somewhat stronger correlation between the current Connecticut payment rates and case mix than was found in earlier studies (State of Connecticut, 1984). For the sample of facilities used in this study, both the total State rate and the estimated nursing care component of that rate exhibited a positive and significant relationship with the following case-mix measures: the Katz ADL score (Katz et al., 1963; Shaughnessy, Schlenker, and Yslas, 1983), a resource utilization group (RUG) facility-level index, an indicator of the prevalence of long-term care problems, and an indicator of the prevalence of intense problems (Shaughnessy, Schlenker, and Yslas, 1983).

The Katz score sums the number of ADL's in which the resident has some dependencies. The RUG index is derived by weighting the frequencies of patients in each of the nine RUG categories with the mean time classification as calculated for the original RUG derivation (Fries and Cooney, 1985; Cooney and Fries, 1985). The prevalence of 21 problems characteristic of the long-term care populace was identified through the patient-level data collection instrument developed for this study. These are ulceration of skin, constipation, bowel incontinence, ostomy, urinary incontinence, catheter, mobility impairment, recovery from surgery, heart disease, hypertension, shortness of breath, diabetes, intravenous therapy, end-stage disease, tracheostomy, urinary tract infection, depression, impaired mental status, inadequate social support, behavioral problems, and sensory deficit. The number of such problems per patient was measured at the facility level.

Of the problems identified, the more severe levels of 13 were considered to indicate intense problems and served to identify patients requiring high levels of care. They are ulceration of skin, bowel incontinence, urinary incontinence, mobility impairment, recovery from surgery, heart disease, shortness of breath, diabetes, end-stage disease, impaired mental status, depression, behavioral problems, and sensory deficit. For example, three levels of skin ulceration are identified: tissue destruction that does not enter the

skin, tissue destruction that enters the skin but not muscle, and tissue destruction that extends into the muscle. The third level of ulceration of the skin is considered an intense problem.

Using both Medicaid and non-Medicaid patients to derive the case-mix measures for each sample facility, the simple Pearson correlations of the total State rate ranged from .36 with prevalence of problems to .44 with prevalence of intense problems.

An estimated current nursing rate was calculated by adding therapies and supplies to basic nursing care expenditures. It was felt that this estimate best accounted for all reimbursements made by the Connecticut State government for nursing care services as defined by any of the three case-mix systems.

The estimated nursing rate component exhibited an even stronger relationship to the case-mix measures than the total State rate did. These simple correlations for the sample of 26 facilities ranged from .59 to .69 according to the case-mix measure used. Both the simple Pearson correlations and the Spearman, or rank order, correlations are provided in Table 3 for the current Connecticut rates as well as for rates under the three simulated systems. The highest correlation of Connecticut nursing rates with case mix, .69, occurs for both the Katz score and the RUG facility-level index. The nursing rate is more strongly related to case mix than the overall State rate is. The strong relationship is based on the fact that costs actually incurred by facilities for nursing care services (which, in turn, become the basis for future payment rates) are inherently related to the needs of patients. However, administrative and capital costs, which are included in the total State rate, do not necessarily bear a strong relationship to patient needs.

Results indicate that the current Connecticut system generates payments related to the facilities' patient case mix. The question is whether this relationship is strong enough and/or cost efficient. A partial answer can be found by correlating the simulated rates for the Maryland, Ohio, and West Virginia systems with Connecticut facilities' case mix. Recall that only the nursing care rate components were calculated for these systems, so comparisons should be made only on that basis. The summary of correlations is presented in Table 3 using rates calculated on the basis of all patients sampled in each facility. (The correlation levels and patterns of relationships are similar when based on Medicaid patients only.) Several major conclusions can be drawn from this set of correlations.

- The correlations are higher for all three case-mix systems than for the current Connecticut system.
- Each system's rates are slightly weaker in their relationship to the prevalence of intense problems than to other measures of case mix.
- West Virginia rates exhibit the highest correlations with three of the four case-mix measures (all except intense problems), although the correlations are not much higher than those for the other two simulated systems.

**Table 3**

**Correlation of simulated and actual nursing rates for Medicaid reimbursement with selected case-mix measures, by type of case-mix measure and type of reimbursement system: Connecticut, 1984-85**

Type of reimbursement system	Case-mix measure <sup>1</sup>							
	Katz activities of daily living score		Facility resource utilization group index		Prevalence of problems		Prevalence of intense problems	
	Rank		Rank		Rank		Rank	
	Simple order	Simple order	Simple order	Simple order	Simple order	Simple order	Simple order	Simple order
Connecticut	.69	.56	.69	.56	.60	.55	.59	.52
Maryland	.91	.75	.90	.75	.87	.64	.84	.74
Ohio	.89	.71	.91	.78	.86	.73	.86	.73
West Virginia	.96	.83	.95	.82	.89	.76	.86	.73

<sup>1</sup> See the text for a detailed discussion of case-mix measures.

Based on the simulations, then, it appears that improvements could be made in the overall strength of the relationship of Medicaid payments to facility case mix if any of the three case-mix systems were used. Overall, the correlations are slightly higher for the West Virginia system than for the Ohio and Maryland systems, but these differences are minor compared with those between the current system and any of the case-mix systems. However, one must question whether the gains in better relating payments to case mix outweigh the costs, both direct and indirect, that would be incurred in moving to such a system. Another question is whether there are ways of measuring the effect of these alternative systems (other than simple correlations) that would make any one system the clearly desirable alternative. For example, does one system handle intense problems better than other systems do?

Additional analysis of this issue indicated that treatment of facilities with a high proportion of heavy care patients differs among the three case-mix systems. To determine the proportion of heavy care patients, the high-care levels of 6 of the 21 problems identified through the data instrument were classified as severe. These problems were considered to be characteristic of residents recently discharged from the hospital who needed costly resources and/or resources not currently available in nursing homes. The problems were ulceration of the skin, recovery from surgery, heart disease, shortness of breath, diabetes, and end-stage disease. The variable was measured as the percentage of patients with one or more such problems in each facility unit.

For each simulated system, the five facilities with the highest simulated rates were reviewed in terms of this heavy care variable. In five sample facilities, 20 percent or more of the patients had severe problems. The Ohio and West Virginia systems placed only one of these facilities in the highest payment rate group. The Maryland system, on the other hand, placed three

such facilities in this group. Such long-term care problems are likely to become more prevalent in nursing homes over time. Therefore, the case-mix standards used by the case-mix systems should be evaluated, and possible modifications to improve the access of these heaviest care patients should be considered.

### State-level costs

The simulations for individual facilities provided estimates of the general direction of change that could be expected under each system. One system (Maryland) appeared to generate costs close to current Connecticut costs, another (Ohio) would be more expensive, and the third (West Virginia) would be less expensive. These conclusions, however, were drawn from a sample of facilities. Estimates were needed of total costs to the State government. Such total cost estimates were derived by extrapolation. The simulated rates for the nonprofit, profit, urban, and rural facilities in the sample were assumed to be the same as rates for the total population of facilities of each type; that is, the number of each type of facility in the overall population of 257 facilities was used to extrapolate the sample results.

These estimates of State-level costs were then compared with current costs for nursing care services for the total facility population. As in all the simulations, the benchmarks of current costs were based on the different services included in each simulated system. Therefore, we were able to compare State-level costs under each system with costs currently being paid for the set of nursing care services relevant to that system. The benchmark estimates of current State spending for nursing care services provided to Medicaid patients (Table 4) ranged from almost \$109 million under the West Virginia benchmark assumptions to nearly \$130 million for services covered by the Maryland system. Remember that the major difference between these two systems is the exclusion of fringe benefits and direct nursing supplies in West Virginia and their inclusion in Maryland.

**Table 4**

**Estimated State Medicaid payments for nursing services, current versus alternative reimbursement systems: Connecticut, 1984-85**

Type of reimbursement system	Current payment <sup>1</sup>	Payment under simulated system	Simulated differences <sup>1</sup>	Percent change
West Virginia	\$108,942,524	\$95,263,674	-\$13,678,850	-12.6
Maryland	129,742,752	133,927,217	4,184,465	3.2
Ohio	127,149,186	167,945,720	40,796,534	32.1

<sup>1</sup> Using benchmark assumptions for each reimbursement system.

NOTE: Sample simulation results were extrapolated to the total population of 257 Connecticut nursing facilities.

The estimation of total dollar reimbursements for the three systems is based on the rates in the simulations presented in Table 2. The estimates indicate that the West Virginia system could be operated for a total nursing care cost of about \$95 million, for a total net savings of almost \$14 million. These figures represent approximately a 13-percent reduction in total reimbursement for the set of nursing services covered by the West Virginia case-mix system. Thus, the West Virginia system appears to be a potentially cost-efficient method for better relating payment levels to case mix in Connecticut.

From the foregoing simulations, it was estimated that, on average, the Maryland system would also reduce reimbursements to the nursing homes in the sample. However, these estimates were descriptive of changes in reimbursement per patient day. Estimates of total reimbursements show that the Maryland system would result in slightly higher total payments than the Connecticut system currently makes. Current total dollar payments, using the Maryland benchmark assumptions, are nearly \$130 million. The simulated total payments equal about \$134 million, constituting an increase of about \$4 million, only 3 percent higher than total current payments.

The reason for the differences in average versus total dollar changes under the Maryland system is that certain types of Connecticut facilities had higher averages of Medicaid patient days than others had. The rural profit facilities in the sample averaged around 28,000 Medicaid patient days, as opposed to about 20,000 days for urban nonprofit facilities and about 23,000 days for urban for-profit homes. Therefore, the simulated rates for the cells with relatively higher Medicaid patient days receive more "weight" in estimates of total State dollar reimbursements. In addition, rural profit facilities gained more revenues in the simulated Maryland system than other types of facilities did.

The Ohio system, as expected from the simulations for the sample, would result in additional costs to the State government. These additional reimbursements are estimated at approximately 32 percent of the total dollars now reimbursed—about \$168 million versus a current total of about \$127 million for this set of services. It should be noted that much of this increase is probably attributable to the additional rehabilitative services incorporated in the Ohio system and higher levels of reimbursement for these services.

Finally, it should be noted that Connecticut would generate additional Federal revenues if the costlier case-mix systems were set in place. This additional Federal funding must be taken into account when considering the cost of case-mix reimbursement. There is much uncertainty as to the type of Federal financial participation that will exist in the future, but the current Federal share for Medicaid expenditures is 50 percent for Connecticut. Therefore, the increase in the State government's own revenues that would be necessary to fund an Ohio-type system could be only about one-half of the increase described here.

## Policy implications

### Connecticut

The simulation results have direct policy implications primarily for Connecticut. The overall conclusion for policy is that an improved relationship of payments to case mix could be achieved at little cost in terms of direct payments to nursing homes. However, a redistribution of funds would occur under case-mix reimbursement. This redistribution of funds is the dominant, and perhaps most politically problematic, pattern of change indicated for Connecticut facilities. The shifts have implications not only for average and total State government payments. Ultimately, they may affect the ability and/or willingness of facilities to provide patient access to a given constellation of services and quality of care. The specific patterns of revenue shifts estimated by the simulations should be viewed as peculiar to the current cost structure of Connecticut facilities. The fact that nonprofit facilities in the Connecticut sample incurred significantly higher operating costs (approximately 38 percent for urban and 35 percent for rural) than their for-profit counterparts helps explain the results regarding redistribution.

The higher costs of nonprofit nursing homes are often attributed to case mix. Some studies have found that nonprofit facilities have more intense case mix than for-profit facilities have. (See Shaughnessy, Schlenker, and Yslas, 1983, for Colorado findings.) In this study, a similar, although not conclusive, pattern was found for the sample of Connecticut facilities (Adams et al., 1985). However, case-mix systems should adjust payment levels for case mix—if not perfectly, at least to a considerable degree. Thus, the redistribution away from nonprofit facilities suggested by the simulation results must be partially caused by other factors. For example, it appears that nonproprietary homes in Connecticut provide a different, perhaps broader, set of services than proprietary homes and provide services in a different manner. Therefore, they incur higher costs. It is unknown from the current analysis or other studies whether the higher costs are attributable to differences in efficiency or quality. The overriding conclusion, however, is that incentives for both nonprofit and for-profit homes would be altered by the adoption of a case-mix system of the type examined in the simulations.

A major benefit expected from adoption of a case-mix system is greater access to care for Medicaid patients, especially those with more intense service needs, who are therefore more costly to serve. Access is often difficult for Medicaid recipients because of the typically lower payments nursing homes receive for Medicaid compared with non-Medicaid residents (Cotterill, 1983; Scanlon, 1980). However, these conclusions concerning access for Medicaid residents were made about States in which the government did

not regulate the private pay rate. The regulation of private rates in Connecticut therefore complicates the access issue somewhat.

One question for Connecticut is whether the provision of greater private patient days that undoubtedly results from the regulation of private pay rates comes at the expense of the Medicaid patient's access to care. However, because Medicaid per diem reimbursement is fairly high in Connecticut, Medicaid recipients with average care needs may not experience serious access problems. Rather, access is likely to be difficult for those potential residents with the highest care needs, both Medicaid and non-Medicaid.

Although severe access problems may not exist at this time in Connecticut, a move to case-mix reimbursement would affect access across facility types. Facilities currently incurring the highest costs, and therefore the highest Medicaid reimbursements, do not appear to be those with the most intense case mix. As their reimbursements are altered under a case-mix system, their incentives to provide access to public and/or private patients would also be altered. For example, higher cost facilities with high amenities and light patient care needs might find the market for their services significantly altered. This appears to be particularly true for nonprofit homes.

The revenue changes would affect decisions of facility administrators on how services will be produced and, ultimately, the quality of services. Although an immediate concern with a drop in revenues is that quality of services would decline, earlier research (Koetting, 1980; Schlenker and Shaughnessy, 1984) suggests that cost changes need not translate directly into quality changes. Conversely, the redistribution of revenues could increase the ability of facilities to provide necessary care of adequate quality for relatively higher case-mix needs, but it might not mean that the quality of care would increase significantly in other ways. An earlier study indicated that the range of nursing home services, particularly physical therapy, was positively related to costs (Lee and Birnbaum, 1983). The nonprofit facilities in Connecticut currently are more likely to provide these services than are the for-profit facilities. However, reductions in public revenues to nonprofit nursing homes, in the absence of additional private revenues, are likely to cause them to restrict this aspect of service provision.

## Other States

Although the results of the simulation are specific to Connecticut, several conclusions about other States' policies can be drawn. These pertain to financial consequences as well as the implications for access and quality. In addition, this type of simulation model can be applied to virtually any current State system to better delineate the expected outcomes of policy change.

The ability to generalize to other States about the financial outcomes is somewhat limited. Yet, to the extent that other States using cost-based

reimbursement exhibit similar patterns of profit versus nonprofit cost relationships that are independent of case-mix differences, similar patterns of redistribution would probably be observed. Several studies have confirmed that nonprofit homes consistently have higher costs than for-profit homes have (Bishop, 1980; Lee, Birnbaum, and Bishop, 1983). At least one study concluded that a significant part of the difference was probably attributable to lower efficiency for nonprofit nursing homes, but that such lower efficiency was partially dependent on the nature of the reimbursement method used (Frech and Ginsburg, 1981). Nonprofit facilities were more likely to have higher costs than for-profit homes under cost-based reimbursement than under a flat rate system. Thus, the Connecticut results presented here may be most applicable to cost-based reimbursement systems.

Two other aspects of the Connecticut system are important in considering the implications of these findings for other States. First, reimbursement levels in Connecticut are relatively generous (Cohen and Holahan, 1983). The level of a State's current payments relative to payments under the three simulated systems could be quite different in States with less generous payments. Second, private pay rates are regulated in Connecticut. The impact of case-mix reimbursement on financial outcomes as well as access would probably be different in States that do not regulate private pay rates.

For States in which payment levels are lower than those in Connecticut, all three systems might be more expensive (unless wage rates are also correspondingly lower). We would expect, however, that the relative costs of the three systems would be maintained as long as the case-mix patterns in other States are not dramatically different from those in Connecticut. All three case-mix systems may impose additional costs in States with lower payment levels, but the Ohio system would probably result in greater additional expenses than the Maryland or West Virginia systems would.

As discussed before, the regulation of private pay rates probably affects the access of both Medicaid and non-Medicaid patients. In addition, if regulation keeps private pay rates lower than they would otherwise be, it would take longer for a person to "spend down" and become eligible for Medicaid. This should reduce the number of persons becoming eligible for Medicaid through the spend-down process in any given time period, which, in turn, may affect the State government's total Medicaid expenditures. Thus, private pay regulation in Connecticut is important to that State government's consideration of a possible shift to case-mix reimbursement, and it also affects the generalizability of the Connecticut results to other States. Each State government considering a change to case-mix reimbursement should, therefore, conduct its own analysis of the advantages and disadvantages of such a change.

Finally, with respect to issues of access to care, many Medicaid beneficiaries may experience more problems in other States than in Connecticut. The

Connecticut State government pays relatively well for nursing services and restricts the differential in payment rates between public and private-pay patients. Because Connecticut does not now have severe access problems, the conclusion that shifting to a case-mix reimbursement system primarily improves access for the highest need patients may be unique to Connecticut. Other State governments could possibly achieve certain types of access improvements by regulating private pay rates (thereby reducing the differential between Medicaid and non-Medicaid rates). This policy, however, has not traditionally had widespread political support. Thus, in the majority of States, which do not regulate private pay rates, shifting to case-mix reimbursement might improve access significantly for the average patient, not just the patient needing relatively heavier care.

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