Much concern has been expressed about the Medicare Prospective Payment System's impact on access to care. In this study, we examine the financial impact of diagnosis-related group (DRG) payment for chronic ventilator-dependent Medicare patients. During a one-year period, payment for 98 Medicare patients who received a minimum of three days of continuous ventilator treatment and who spent no time in surgical intensive care at Rush-Presbyterian-St. Luke's Medical Center, was calculated to be $2.2 million below costs, representing an average loss per discharge of $23,129. Patients stayed an average of 26.6 days, of which 14.2 days were spent on a ventilator. We conclude that the results suggest a financial bias against chronic ventilator-dependent patients exists in the DRG system which could present access problems. We recommend three approaches to recognizing the cost of care for such patients in the DRG payment system and encourage those in public policymaking positions to use our results as the basis for a larger scale analysis of the impact of Medicare DRG payment on chronic ventilator-dependent patients.

Since Oct 1, 1983, when the Medicare Program began paying for hospital inpatient care on a prospective Diagnosis Related Group (DRG) basis, there has been much debate surrounding the equity of paying an average amount for an entire group of patients rather than paying for each patient individually. Paying at the average is not inherently a flawed concept, but its equity depends on costly patients being offset by less costly ones. The issue is not whether payment under the DRG system covers the cost of treating each individual patient, but whether the system underpays the care for entire categories of patients. If that is the case, the system is flawed because it creates perverse incentives that seriously bias the access to care for certain kinds of patients.

We believe chronic ventilator-dependent patients are an example of a category of patients for which the Medicare Prospective Payment System (PPS) is especially inequitable. These patients are a defineable category for which a treatment profile can be determined. However, under PPS, these patients are neither defined by a single DRG or set of DRGs, nor by a single Major Diagnostic Category (MDC). In fact, chronic ventilator dependency is not recognized at all by the DRG System. The DRGs group patients primarily on the basis of International Classification of Diseases—Ninth Revision—Clinical Modifications (ICD-9-CM), diagnosis and procedure codes. However, the ICD-9-CM code for ventilator treatment (93.92, other mechanical assistance to respiration) is not a code that affects DRG assignment. Thus, chronic ventilator dependency, which is a condition requiring a treatment equally as definable as a surgical procedure, is not recognized as a cost differentiating factor.

Because there are no specific DRGs for ventilator dependency, these patients are classified into DRGs along with nonventilator-dependent patients. Thus, when DRG payment rates were calculated, the costs of treating ventilator patients were simply averaged in with the costs of treating all the other patients in the particular DRG. This would not present an equity problem if all hospitals' proportions of ventilator-dependent patients were equal to the proportion for the Medicare program as a whole. However, we suspect this is not the case. A study by Draper et al comparing intensive care patients in a university and community hospital indicated that the vast majority of patients in the community hospital's intensive care unit was admitted solely for monitoring purposes. By contrast, the majority of the university hospital's intensive care patients received active treatment. If the results of this study are an indication of intensive care unit usage across the nation, it suggests that ventilator-dependent patients may be concentrated in teaching hospitals, as ventilator treatment is generally provided only in intensive care units.

To test whether the DRG system is biased against specific categories of patients, we chose to analyze chronic ventilator treatment with the hypothesis that
PPS fails to account for the special situation of respiratory failure requiring prolonged ventilator support. Chronic ventilator treatment was selected because it is life-sustaining, the weaning process can be long, if weaning is not possible placement alternatives are limited, and Medicare beneficiaries represent a large percentage of patients requiring such treatment.

METHODS

Sample Selection

Medicare patients discharged from Rush-Presbyterian-St. Luke's Medical Center during the period July 1, 1983 through June 30, 1984, who received three or more days of continuous ventilator treatment and spent no time in surgical intensive care were selected. A minimum of three days of continuous ventilator treatment was used as a criterion to distinguish patients with chronic respiratory failure from those with an acute easily reversible problem. Surgical intensive care patients were excluded in the interest of focusing on patients who received ventilator care because of a chronic respiratory problem or respiratory complication of a medical illness, rather than as an aid in recovery from surgery. The result of these two selection criteria was 95 patients. The study sample of 95 chronic ventilator-dependent patients was divided into four groups. The purpose of this division was to differentiate patients with respiratory failure on the basis of the degree of their illness and intensity of their nursing care requirements. Medical patients at Rush who require ventilator support receive their care in either a general medical intensive care unit (MICU) or a respiratory care unit (RCU). The MICU cares for patients requiring cardiopulmonary intensive care with hemodynamic monitoring and/or general intensive nursing care. The RCU is utilized to manage patients who are hemodynamically stable, but who require a mechanical ventilator and primarily pulmonary nursing care. Patients are transferred between these units depending on their need for invasive hemodynamic monitoring and general intensive nursing care. Table 1 summarizes the characteristics of these patient groups.

Group 1 is patients who did not require invasive hemodynamic monitoring or general intensive care, and therefore, received all of their ventilator management in the RCU. Patients in group 2 required general intensive care and/or hemodynamic monitoring. These patients received ventilator management in the MICU, but because they could not be weaned from the ventilator once their general condition stabilized, ventilator management was continued in the RCU. Group 3 patients also required general intensive nursing care and/or hemodynamic monitoring. These patients however, received all of their ventilator management in the MICU prior to or following stays on a general medical unit, and either were weaned from the ventilator in the MICU, or died while on the ventilator there. Group 4 patients were admitted directly to the MICU and died there while on a ventilator. They received no treatment on a general medical unit.

Cost Calculation

Patient costs were calculated using a case-mix system which merges clinical and demographic data from the medical record abstract with detailed billing information. Individual patient charge items from the billing file are converted to cost by applying a cost-to-charge ratio for each patient care unit and ancillary service department. This is the same methodology the Medicare cost report uses for ancillary service costing purposes. However, instead of the approximately 20 ratios the Medicare cost report uses, our study used 138 ratios. The result is a more precise estimation of cost of care.

Since the data are from fiscal 1984, calculated costs were updated by 5 percent and Rush's actual overall cost per case increased from fiscal 1984 to fiscal 1985. The average increase in cost per case for all hospitals in the country from 1984 to 1985 was 9.4 percent. Fiscal 1985 was selected to compare cost and payment because that was Rush's first year under the PPS.

Payment Calculation

Payment under the PPS is currently in a transition stage whereby each year a declining proportion of a hospital's payment rate is based on its own historical cost and a regional rate, while an increasing proportion is based on a national rate. Once the PPS is fully phased-in in 1988, payment will be based on the national rate adjusted for area wage differences. Thus, to avoid making the analysis reflective of only a single transition year payment in this study is reflective of the fully phased-in national rate.

Payment was calculated using the labor-related and nonlabor-related national rates from the Sept 3, 1985 Federal Register, the most recently published final rules at the time this article was written. The labor-related component of the national rate was adjusted by the wage index for Chicago, also from the Sept 3, 1985 Federal Register.

Patients were classified into DRGs using the revised version of the DRG "group" utilized by the Medicare Prospective Payment System beginning May 1, 1985. The DRG payment rates were determined by multiplying the DRG relative weights effective on May 1, 1986, by the wage adjusted national rate.

Under the prospective payment system, four other types of payment can be made in addition to the DRG rates as follow:

(1) The DRG rates paid to teaching hospitals are adjusted by what is called an indirect medical education factor which is based on the hospital's ratio of interns and residents to beds. For every 0.1 increase in this ratio, payment is increased by a percentage.

There are many proposals to reduce the indirect medical education adjustment factor from its original level of 11.99 percent. These proposals range from factors of 8.7 to 5.9 percent. For purposes of this study, the factor used in adjusting payment is 8.1 percent. This is a straight line on a curvilinear basis. This reflects the provision contained in the Consolidated Omnibus Budget Reconciliation Act (COBRA) of 1985 signed into law on April 7, 1986, and effective May 1, 1986.

(2) Another kind of payment made to teaching hospitals is for direct medical education expenses. These expenses are predominately composed of resident salaries and benefits. There have been several proposals to change the amount of Medicare payment for these expenses. For purposes of this study, the provisions contained in the 1985 COBRA relating to payment for direct medical education are assumed.

(3) A third kind of payment is made for capital-related expenses. Although Congress is considering proposals to pay for capital on prospective basis by means of an add-on to the DRG rate, Medicare is currently paying its share of the hospital's actual capital-related costs. For purposes of this study we have assumed Medicare's current method of paying for capital. While in practice payment for these expenses is made on a lump-sum rather than a per-case basis, the total amount has been spread across all cases.

(4) Outlier payments are made for those patients who stay beyond a DRG-specific length-of-stay threshold or who incur atypically high costs for the particular DRG. As noted earlier, for this study, payment is calculated based entirely on a national average rate.

Table 1—Breakdown of Chronic Ventilator-Dependent Patients

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>Required Invasive</th>
<th>Location of Ventilator Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monitoring &amp;/or</td>
<td>MICU &amp; RCU</td>
</tr>
<tr>
<td></td>
<td>General Intensive Care</td>
<td>MICU</td>
</tr>
<tr>
<td>1</td>
<td>No</td>
<td>RCU</td>
</tr>
<tr>
<td>2</td>
<td>Yes</td>
<td>MICU</td>
</tr>
<tr>
<td>3</td>
<td>Yes</td>
<td>RCU</td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>MICU</td>
</tr>
</tbody>
</table>

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DRG Payment for Long-term Ventilator Patients (Douglass et al)
results
The financial impact of the DRG prospective payment on chronic ventilator-dependent patients is summarized in Table 2. The average projected DRG payment per case for the 95 Medicare patients is $8,421. With outlier payments included, the average payment per case is $15,357. Total payment for the 95 patients is $1,458,909, compared with a total cost of $3,656,137, representing a loss of $2,197,228 or $23,129 per case. Payment amounts to 40 percent of costs for these patients.

Table 3 shows the average length of stay and average number of days of ventilator and post ventilator support for the four patient groups. For all but group 3, over 50 percent of their time in the hospital was spent on a ventilator. Also shown in Table 3 are two indicators of the degree of severity of these patients’ conditions — disease stage and survival rate. Disease staging is a method developed by Systemetrics/McGraw-Hill which measures severity of illness or proximity to death on a scale from 1.0 to 4.0, with 1.0 being illnesses with single organ involvement and 4.0 being death. The disease staging data are consistent with our a priori grouping of the patients based on our need for intensive nursing care and/or hemodynamic monitoring. The overall average disease stage for all 95 patients in the study is 3.5, indicating that these patients as a group had illnesses which involved multiple organ systems.

Table 4 shows the distribution of cases by Major Diagnostic Category. Four of the 23 MDCs account for 81 percent of chronic ventilator patients. For patient groups 1 and 2, the largest concentration is in the respiratory MDC, while for groups 3 and 4, the largest concentration is in the circulatory MDC. Again, this is consistent with our a priori grouping of the ventilator patients on the basis of their need for hemodynamic monitoring.

Per Diem Requirements
To isolate the cost associated with ventilator treatment, we defined the basic services for supporting a patient on a ventilator. Although recognizing that patients on a ventilator are rarely stable, the basic services are defined in terms of what is necessary for managing a stable patient.

In addition to the use of the ventilator, the basic requirements include respiratory therapy comprised of bronchial treatments, which include ultrasonic nebulizer and intermittent positive pressure breathing (IPPB) treatments; medication nebulizer; and chest physical therapy. During the weaning process, continuous aerosol is required and once weaning occurs, supplemental oxygen is used. Laboratory studies unique to this group of patients and necessary for optimal management include chest x-rays films and arterial blood gas (ABG) determinations.

Table 5 presents the number and cost per ventilator day of these services that patients in our study received from their first day of ventilator treatment until their discharge or death. In other words, costs and units are divided by the number of days on a ventilator so that all patients have ventilator units of 1.0. The data are presented in this way to capture respiratory care services directly associated with patients’ ventilator support as a function of their days on a ventilator.

Over the period of ventilator and postventilator support, the 95 patients as a whole averaged 2.3 arterial blood gas determinations per ventilator day.

Table 2—Financial Impact of DRG Prospective Payment for Chronic Ventilator-Dependent Patients

<table>
<thead>
<tr>
<th>Number of Medicare discharges</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average DRG payment per discharge</td>
<td>$8,421</td>
</tr>
<tr>
<td>Total DRG payment</td>
<td>$799,991</td>
</tr>
<tr>
<td>Outlier payment</td>
<td>$658,918</td>
</tr>
<tr>
<td>Total Payment</td>
<td>$1,458,909</td>
</tr>
<tr>
<td>Total cost</td>
<td>$3,656,137</td>
</tr>
<tr>
<td>Total loss</td>
<td>($2,197,228)</td>
</tr>
</tbody>
</table>

outlier payment is calculated only on the federal portion of the rate, it is at its maximum once the system is fully phased-in to a national rate.

Table 3—Severity of Condition by Patient Group

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>No. of Patients</th>
<th>Average LOS</th>
<th>Average LOS on Ventilator</th>
<th>Average Postventilator LOS</th>
<th>Discharged Alive</th>
<th>Average Disease Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>27.8</td>
<td>15.0</td>
<td>7.7</td>
<td>57%</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>41.1</td>
<td>25.4</td>
<td>12.9</td>
<td>44%</td>
<td>3.5</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>21.6</td>
<td>8.4</td>
<td>6.7</td>
<td>31%</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>8.0</td>
<td>8.0</td>
<td>0</td>
<td>0%</td>
<td>4.0</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>26.6</td>
<td>14.2</td>
<td>7.6</td>
<td>35%</td>
<td>3.5</td>
</tr>
</tbody>
</table>
This is greater than the average number of ABGs done each day while the patients were on ventilators because it includes those done during the period after weaning occurred. Medication nebulizer treatments include treatments given in conjunction with the ventilator support as well as postextubation. Included in bronchial treatments are ultrasonic nebulization therapy given during both the time of ventilator and postventilator support, and IPPB treatments given after weaning. The continuous aerosol service shown in Table 5 is supplemental oxygen which was given through an endotracheal tube while the patients were being weaned, while the oxygen services shown is oxygen which was delivered by face mask or nasal cannula after the patients were weaned.

The sum of the individual service costs in Table 5 represents the total cost of services defined as solely related to respiratory support. These are costs which are not accounted for in the DRG payment rates. Even though each day on a ventilator adds $439 to the cost of care, the same amount is paid for ventilator as well as non-ventilator patients in a DRG. Nor are these costs accounted for by outlier payments which are supposed intended to account for patients who have atypically long stays or high costs. Even though outlier payments account for 45 percent of total payment, as Table 2 shows, the system still substantially underpays the care of chronic ventilator dependent patients. This suggests that these patients do not simply represent deviations from the DRG norm, but rather are a different kind of patient altogether.

**Discussion and Recommendations**

The data presented in this study suggest that there is a systematic financial bias in the DRG Prospective Payment System against chronic ventilator-dependent patients. To prevent potential access problems, the cost of providing care to such patients must be recognized by the payment system. Three approaches to recognizing the cost of care for chronic ventilator-dependent patients in the DRG payment system are possible.

**Make Ventilator Treatment a Determining Factor in DRG Assignment.** There are obvious problems with this approach, however. First, it would require a "with ventilator" category for numerous DRGs in much the same way there are DRGs for patients with and without complications/comorbidities. The 95 patients in our study sample represent 43 different DRGs. The addition of with chronic ventilator treatment groups to so many DRGs might make for an unmanageable number of DRGs. Furthermore, because the current ICD-9-CM system has only one code for mechanical ventilation, it is not currently possible to distinguish patients who are on a ventilator only temporarily following surgery from those who are chronically dependent. This problem is neither unique to chronic ventilator dependent patients, nor is it insoluble. In its recent report of recommendations for fiscal year 1987 to the Secretary of Health and Human Services, the Prospective Payment Assessment Commission (ProPAC) recommended that a mechanism for maintaining and updating the IC-9-CM codes in a timely and effective manner be established. On an issue similar to the chronic ventilator dependent one, ProPAC recommended that new ICD-9-CM procedure codes be created to distinguish between cases involving the implantation of dual-chamber cardiac pacemakers, and those involving other single-chamber pacemakers. In this way the two DRGs involving cardiac pacemaker implantation could each be restructured into two DRGs, one for cases involving dual-chamber pacemakers, and one for cases involving other single-chamber pacemakers.

**Provide an Exemption from the DRG Prospective Payment System for Hospitals with Dedicated Respiratory Care Units in the Same Way Exemptions are now Provided for Distinct Parts Psychiatric and Rehabilitation Units.** Services provided to Medicare patients in exempt units are paid on a reasonable cost basis. Just as criteria were established for psychiatric and rehabilitation exempt units, criteria could also be developed for a respiratory care exempt unit.

**Provide a DRG Payment Adjustment for Chronic Ventilator-Dependent Patients.** This could work in two ways. The adjustment could be in the form of a per diem add-on payment to the DRG rate for each day of chronic ventilator treatment (we defined this as three
or more days). Such a payment adjustment would have to rely on the presence of a frequency count of days of continuous ventilator treatment on the UB-82 bill, with supporting documentation in the medical record. The payment adjustment would be the number of days of ventilator treatment indicated on the bill times the per diem cost adjustment. Our data indicate that the average per diem cost of care solely related to ventilator maintenance is $439 for each day on a ventilator. This is exclusive of the cost of the room and non-respiratory ancillary services, since these are paid for by the DRG rate. For the sample of patients in this study whose average time on a ventilator is 14.2 days, the average ventilator add-on payment would be $6,234 per case.

An alternative would be to pay the adjustment as a percentage add-on to the DRG rate. The $6,234 average per case cost for ventilator treatment determined above, calculated as a percentage of the total average cost per case, $38,456, is 16.2 percent. Thus, DRG payment rates for chronic ventilator dependent patients would be increased by 16.2 percent.

These payment adjustment approaches are not without precedent. There are several examples where similar adjustments have been employed or suggested. ProPAC has recommended that Medicare pay an amount in addition to the DRG rate for a magnetic resonance imaging (MRI) scan performed on a Medicare beneficiary in a hospital under the prospective payment system. The DRG rates are now adjusted to account for the cost of dialysis for End Stage Renal Disease (ESRD) patients, but only in hospitals that have a high proportion of ESRD patients. The two payment adjustment approaches described above could be similarly applied for chronic ventilator patients. The payment adjustment for each day the patient is on a ventilator is the same approach now used in paying for DRG day outliers. If the payment adjustment is equal to the cost of efficiently rendered ventilator support, the decision of when to discontinue ventilator support is unaffected by financial considerations.

Of the two DRG rate adjustment approaches described above, the percentage adjustment provides a strong financial incentive to keep the patient on a ventilator for a day beyond the chronic threshold definition. However, this kind of manipulation for purely financial purposes could be prevented by the development and use of criteria for when weaning from a ventilator should begin. This would be similar to the criteria and documentation system that is now required for Medicare coverage of home oxygen services.

CONCLUSIONS

In the prior section, we defined for payment adjustment purposes the basic services required to support a patient on a ventilator. This concept of defining basic service requirements should also be applied by hospitals as a means of evaluating ventilator patient needs and services to ensure that care is being provided in the most cost-effective manner.

As the cost data presented in the previous section indicate, even when provided outside the ICU, ventilator treatment in a hospital setting is very expensive. Greater efforts must be made in finding alternative settings for ventilator treatment. Payment policies must be revamped to encourage the use of non-inpatient settings. Although some state Medicaid agencies provide special negotiated nursing home payment rates for ventilator-dependent patients, in general, Medicare and Medicaid nursing home and home care payments are insufficient to promote care for ventilator-dependent patients in these settings on a large-scale basis. However, there are issues beyond just the financial ones that must also be considered. These range from lack of effective hospital discharge planning for these patients, to the enormous strain that home ventilator care places on families.

It is important to note that many of the chronic ventilator-dependent patients do not recover. For the patients in our sample, as Table 3 indicates, the mortality rate is 65 percent. This raises difficult issues related to treating terminal patients with dignity, as well as the resource allocation questions associated with prolonging the lives of patients who are not able to be weaned from a ventilator.

Potential inequities exist in the DRG system, some of which have been documented. Some of these inequities can be remedied by adjustments to the payment system. Others require a combination of payment system solutions and changes in the way medical care is rendered. We have concluded from this study that both are necessary to address the problems that chronic ventilator treatment present. We urge the Prospective Payment Assessment Commission and other interested groups to use the results of this study as the basis for a large scale analysis of the impact of Medicare DRG payment on chronic ventilator-dependent patients.

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