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Comparison Of Hospital Costs In California, New York, And Canada
by Jack Zwanziger, Geoffrey M. Anderson, Susan G. Haber, Kenneth E. Thorpe, and Joseph P. Newhouse

Abstract: When the components of health care spending are broken down, hospital spending accounts for the largest portion of the total. This DataWatch compares hospital spending in two U.S. states with spending in two Canadian provinces, to gain better understanding of the recurring differences in hospital spending reported by the two countries. To make the data comparable, the study combines different hospital output measures into a composite measure that is converted into U.S. dollars and applied to data from both countries. In 1987 hospital costs per person were about one-third higher in the United States than in Canada. Results suggest that the higher U.S. costs are due primarily to higher unit costs rather than to differences in output.

The cost of hospital services is by far the largest single component of health care spending in both the United States and Canada. Despite this similarity, the difference in per capita hospital spending is an important factor in explaining the difference in total per capita health care spending between the two countries. Amidst the interest in a Canadian-style alternative to the current U.S. health care system, there has been little detailed comparison of hospital costs and hospital care in the two countries.

In this DataWatch we compare hospital spending per person in Canada and in the United States. Both countries experienced similar nationwide increases in hospital expenditures between 1981 and 1987 (approximately 7.5 percent annually) (Exhibit 1). In 1987 hospital costs per capita were about one-third higher in the United States than in Canada; the difference in these costs accounted for about one-third of the total difference in per capita personal health care spending between the two countries.

Two major factors might account for these differences. More hospital care, measured as days of care or discharges, might be provided in the United States than in Canada, or costs per day or per discharge might be

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higher in the United States than in Canada. In this DataWatch we quantify these two factors. We compare trends in hospital use and in costs per discharge and per day in the two countries.

In previous research Joseph Newhouse and colleagues examined hospital care provided to the elderly in Canada and the United States. These results suggest that the difference in hospital spending in the two countries cannot be explained by greater use of care by American elders. The purpose of this DataWatch is to broaden our previous analyses by examining overall patterns and time trends in hospital use in selected jurisdictions in the United States and Canada.

We chose four jurisdictions for detailed study: New York and California in the United States, and Ontario and British Columbia in Canada. Several factors influenced our selections. First, the proposed comparisons require detailed hospital data. New York and California have data in the needed detail. Furthermore, together they accounted for almost 20 percent of national hospital spending. Ontario and British Columbia provide natural comparisons to these two states, because of their relatively urban populations and their mix of community and tertiary care hospitals. Combined, they account for approximately 40 percent of Canadian hospital spending.

Per capita hospital care costs in Ontario were very similar to those in Canada as a whole (Exhibit 2). Per capita hospital expenditures in New York and California were higher than the national average in 1981, but by 1987 they bracketed the U.S. average per capita spending. Both states had higher per capita costs than those in Ontario, although California had the lowest rate of increase during this period, 5.9 percent per year.

Comparisons of hospital use and costs in the two countries are not straightforward because hospitals provide many services, such as emergency rooms, clinics, and outpatient surgery, that cannot simply be added up.
This multiplicity of outputs makes total output and unit cost comparisons suspect. Comparing the “efficiency” of two hospitals requires that we compare them on an equal basis. For example, adding up all days of care overlooks the fact that some of these days are accounted for by subacute units of inpatient services that require only occasional nurse supervision, while other days are provided in intensive care units and are far more costly.

Here we present a method for combining hospital outputs into a composite output and apply it to hospital data from the two provinces and the two states. With the single composite output as the denominator, we then compare the costs of producing a unit of output.

**Data sources.** Hospital admission rates and average lengths-of-stay were calculated using hospital discharge data from each jurisdiction. For British Columbia we used data from the British Columbia Ministry of Health; for Ontario, the Hospital Medical Records Institute (HMRI); for New York, the Statewide Planning and Research Cooperative System (SPARCS); and for California, hospital discharge data from the Office of Statewide Health Planning and Development (OSHPD).

Our analysis of unit costs excludes all specialty hospitals (because they are so different) and, in California, all Kaiser Permanente hospitals (because the data are not available). Two years of data, 1981 and 1985, were chosen to encompass a variety of reimbursement regimes. Data for California describe its system before and after the implementation of the Medicare prospective payment system (PPS). New York State held a Medicare waiver during the entire period, paying hospitals through an all-payer system. Canadian hospitals were under a global budget during the entire period.

The Canadian data set was derived from the Annual Return of Health Care Facilities-Hospitals-Part One. This set contains utilization, cost, and health personnel data for each Canadian hospital for fiscal years beginning 1 April and ending 31 March. Only data from British Columbia and Ontario were used, however, both because the data from these prov-
Inces had been previously validated and because, as noted above, these two provinces contained urban centers and teaching hospitals that were comparable to those in New York and California. For California we used the Hospital Disclosure Data created by the OSHPD, which contain detailed utilization, cost, and health personnel data for each acute care hospital in California. For New York we used two separate data sets: the Institutional Cost Report (ICR) for hospitals, with cost, health personnel, and some utilization data; and SPARCS, providing further information about use.

### Comparing Hospital Outputs And Costs

Both California and New York displayed steady decreases in hospital discharge rates between 1983 and 1987 (Exhibit 3). Discharge rates remained relatively stable over the same period in Ontario and British Columbia. The average length-of-stay decreased by 28 percent in California between 1983 and 1987, but there were much smaller decreases in average length-of-stay in the other three jurisdictions. The combination of decreasing discharge rates and decreasing lengths-of-stay resulted in a 36 percent decrease in days of care provided in California; the other three jurisdictions showed smaller decreases in days of care. In 1987 acute care hospitals in both Canadian jurisdictions provided more discharges and more days of care per capita than those in California. The largest differences in days of care were noted between Ontario and California, with Ontario acute care hospitals providing twice as many days of care and 28 percent more discharges than California hospitals. New York and Ontario were more similar in discharge rates and lengths-of-stay.

On average, Canadian (Ontario and British Columbia combined) hospitals are of comparable scale to their U.S. counterparts (Exhibit 4). The appearance of similarity fades when inpatient care is disaggregated, however. Canadian hospitals provide a far higher proportion of low-cost subacute days of care; U.S. hospitals provide a far higher proportion of high-

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**Exhibit 3**

Measures Of Hospital Utilization For Selected U.S. And Canadian Jurisdictions, Selected Years, 1983-1987

<table>
<thead>
<tr>
<th></th>
<th>Discharges per thousand residents</th>
<th>Average length-of-stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>158.2</td>
<td>154.2</td>
</tr>
<tr>
<td>California</td>
<td>138.2</td>
<td>130.0</td>
</tr>
<tr>
<td>Ontario</td>
<td>159.7</td>
<td>156.8</td>
</tr>
<tr>
<td>British Columbia</td>
<td>165.3</td>
<td>163.3</td>
</tr>
</tbody>
</table>

**Sources:** For New York, SPARCS; for California, OSHPD discharge data; for Ontario, HMRI discharge data; and for British Columbia, British Columbia Ministry of Health.
Exhibit 4
Average Hospital Outputs In Canada, New York, And California, 1981 And 1985

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>6,214</td>
<td>35,177</td>
<td>19.89%</td>
<td>2.71%</td>
<td>77.41%</td>
</tr>
<tr>
<td>New York</td>
<td>10,133</td>
<td>63,664</td>
<td>3.10</td>
<td>8.20</td>
<td>88.70</td>
</tr>
<tr>
<td>California</td>
<td>6,888</td>
<td>44,395</td>
<td>2.10</td>
<td>8.60</td>
<td>89.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>6,545</td>
<td>44,213</td>
<td>22.98</td>
<td>3.01</td>
<td>74.01</td>
</tr>
<tr>
<td>New York</td>
<td>10,079</td>
<td>74,219</td>
<td>6.80</td>
<td>6.20</td>
<td>87sN</td>
</tr>
<tr>
<td>California</td>
<td>6,685</td>
<td>50,206</td>
<td>4.00</td>
<td>10.30</td>
<td>85.69</td>
</tr>
</tbody>
</table>

Sources: For Canada, Annual Return of Health Care Facilities, Part 1; for New York, SPARCS and ICR data for hospitals; and for California, OSHPD Hospital Disclosure Data.

cost intensive care days.

**Estimating average costs.** We used a regression model for total hospital expenses (excluding those associated with medical education and research) to estimate the average cost of four outputs: subacute care days, acute care days, intensive care days, and outpatient visits. Canadian dollar amounts were translated into U.S. dollars using purchasing power parity exchange rates (Exhibit 5). A comparison across jurisdictions of the average cost of a given output reveals some interesting patterns. For all inpatient outputs, with the single exception of the 1985 value for subacute days in California, California is highest and Canada is lowest. Furthermore, the differences increase from 1981 to 1985. The average cost of an outpatient visit, on the other hand, was similar in 1985 across all jurisdictions.

**Comparing adjusted outputs and unit costs.** We then used these dollar values to combine inpatient days and outpatient visits into composite outputs: “adjusted” days and “adjusted” discharges (adjusted for outpatient output). Unit cost—the cost of an adjusted day or an adjusted discharge—is total expenses divided by the corresponding adjusted output quantity. As expected, given both the intensity of their output mix and

Exhibit 5
Average Costs For Subacute Care, Acute Care, And Intensive Care Days And Outpatient Visits In Selected Jurisdictions, In U.S. Dollars, 1981 And 1985

<table>
<thead>
<tr>
<th></th>
<th>1981</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>California</td>
<td>New York</td>
</tr>
<tr>
<td></td>
<td>California</td>
<td>New York</td>
</tr>
<tr>
<td>Subacute care days</td>
<td>$171</td>
<td>$110</td>
</tr>
<tr>
<td>Acute care days</td>
<td>438</td>
<td>266</td>
</tr>
<tr>
<td>Intensive care days</td>
<td>1,193</td>
<td>490</td>
</tr>
<tr>
<td>Outpatient visits</td>
<td>7</td>
<td>47</td>
</tr>
</tbody>
</table>

Sources: For Canada, Annual Return of Health Care Facilities, Part 1; for New York, SPARCS and ICR data for hospitals; and for California, OSHPD Hospital Disclosure Data.

* Canadian currency converted to U.S. dollars using purchasing power parity. Includes both British Columbia and Ontario.
their average costs, Canadian hospitals have the lowest costs per adjusted
day, followed by New York, with California far higher (Exhibit 6). The size
of the difference in these unit costs, with California’s expense per adjusted
day almost three times that of Canada, suggests enormous variation in the
intensity of resource use. Canada also has the lowest rate of increase in cost
per adjusted day, with New York’s increasing at the fastest pace—almost
twice Canada’s rate.

In many ways, the cost of an adjusted day is not a good measure of
efficiency, since hospitals can, within limits, decide to trade off days against
the intensity of therapeutic and diagnostic services in treating a patient.
The more fundamental measure is the cost of treating a disease episode,
corresponding roughly to the cost of an adjusted discharge. Despite Can-
da’s longer average stays, the average cost of an adjusted discharge is still
lowest in Canada and highest in California, but the differences are far
smaller. Not only is the average cost per adjusted discharge lowest for
Canadian hospitals, but again, so is the rate of increase in this measure.

**Effect of changing intensive care and outpatient care.** Since the
proportion of intensive care days provided in the two U.S. jurisdictions is
far higher than in Canada, we estimated the effects on costs of a change in
practice patterns to determine what proportion of the total cost differences
can be explained by practice patterns. The impact of differences on use of
intensive care units was estimated by increasing (decreasing) the number of
intensive care units and decreasing (increasing) the number of acute care
days so as to leave the average length-of-stay unchanged. Total expenses
and the number of adjusted discharges were recalculated using this pattern
of use. We also estimated the effects of the smaller differences in outpatient
use by changing the number of outpatient visits in our cost models.

Adoption of the other jurisdictions’ intensive care utilization patterns
substantially changes cost per adjusted discharge (Exhibit 7). The largest
change in 1981 would have occurred if Canadian hospitals had used as
many intensive care days as New York hospitals used. The 9.3 percent

<table>
<thead>
<tr>
<th>Exhibit 6</th>
<th>Average Expense Per Adjusted Hospital Day And Per Adjusted Hospital Discharge In California, New York, And Canada, 1981 And 1985</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Expense per day</strong></td>
</tr>
<tr>
<td>California</td>
<td>$537</td>
</tr>
<tr>
<td>New York</td>
<td>298</td>
</tr>
<tr>
<td>Canada</td>
<td>200</td>
</tr>
</tbody>
</table>

Sources: For Canada, Annual Return of Health Care Facilities, Part 1; for New York, SPARCS and ICR data
data for hospitals; and for California, OSHPD Hospital Disclosure Data.
Notes: Weighted by average adjusted days. Values for Canada combine British Columbia and Ontario.
Exhibit 7
Percentage Change In Average Expense Per Adjusted Discharge Resulting From Adoption Of Alternative Intensive Care Utilization Patterns, In Canada, New York, And California, 1981 And 1985

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>+4.4% +8.4%</td>
<td>+9.3% +10.0%</td>
<td></td>
</tr>
<tr>
<td>New York</td>
<td>-5.3% -7.2%</td>
<td>-2.9% -1.2%</td>
<td>-1.2% -1.2%</td>
</tr>
<tr>
<td>California</td>
<td>-9.5% -9.6%</td>
<td>-9.6% -9.6%</td>
<td>+8.0 +1.8%</td>
</tr>
</tbody>
</table>

Sources: For Canada, Annual Return of Health care Facilities, Part 1; for New York, SPARCS and ICR data for hospitals; and for California, OSHPD Hospital Disclosure Data.
Note: Values for Canada combine British Columbia and Ontario.

increase represents over 40 percent of the difference between unit costs in the two jurisdictions. By 1985 such shifts in practice patterns explain a smaller proportion of the differences in unit costs. Because outpatient volumes were closer than those for intensive care across jurisdictions, and because incremental costs were generally quite similar, trading for the outpatient use patterns of the other two jurisdictions had smaller effects on unit costs. In total, output differences accounted for as much as 60 percent of cost differences in 1981 (New York versus Canada). By 1985, however, the combined effect of these differences in outputs tended to explain a smaller proportion of the differences in units. Although the proportion of cost differences caused purely by differences in outputs was nontrivial, a large and increasing proportion remains unexplained.

What Have We Learned?

The results of this study indicate that the higher costs of U.S. hospital care are not the result of the provision of a greater quantity of inpatient acute care hospital days or discharges. In 1987 residents of New York had about the same level of acute care hospital discharges and days of care as residents of Ontario but had 50 percent higher per capita hospital expenditures. In the same year residents of California had 28 percent fewer discharges and half the hospital days of residents of Ontario but 20 percent higher per capita hospital expenditures.

Our analysis reveals that important differences in use over time can have some impact on costs. Between 1983 and 1987 there was a major shift in hospital use in California. Discharge rates decreased by 12 percent, and average lengths-of-stay decreased by 28 percent, resulting in a 36 percent decrease in days of care per thousand residents. In fact, during this period three-quarters of the increase in per capita spending in California was due...
to increases in hospital input prices. Expenditures may continue to grow in the face of decreased inpatient use because costs per discharge increase or because of a dramatic increase in outpatient services as substitutes for inpatient services. Both of these possibilities deserve further investigation.

Hospital costs in Canada are lower than in California or New York. The difference in costs partially reflects differences in outputs, with Canadian hospitals providing a less costly mix of outputs than their U.S. counterparts (Canadian hospitals provide more subacute care days and fewer intensive care days). This study shows that output differences account for a significant but decreasing proportion of the difference in costs. Even after our study controls for such output differences, Canadian hospitals have lower unit costs largely because they produce each output at a lower cost. The cost of an average intensive care day in California in 1985 was more than twice that of a corresponding day in a Canadian hospital. Further, whether costs are compared per day or per discharge, the rate of increase in unit costs is lower in Canadian hospitals than in hospitals in either U.S. jurisdiction.

These differences suggest that hospitals use quite different approaches to “produce” a stay. Canadian hospitals appear to combine lower treatment intensity with longer inpatient stays. The average incremental costs of an outpatient visit were essentially identical in 1985, suggesting a far greater degree of similarity in the outpatient area, especially as contrasted to the large differences in the inpatient area.

These results provide only one fragment of an assessment of hospital performance in the three jurisdictions. Interpreting cost differences requires further analysis to compare the number and types of patients. Moving the marginal patient from inpatient to outpatient care will tend to increase the average cost in both categories, although total costs will fall. The fact that fewer patients were discharged from our sample of general acute care hospitals in California in 1985 suggests an increase in the mean case-mix and/or severity for hospitalized patients there. This process would account at least partially for the observed rapid rate of increase in cost per discharge. In addition, focusing only on hospital costs provides only a partial assessment. For example, the much shorter lengths-of-stay in California (and to a lesser degree in New York) may mean that the United States makes greater use of posthospital care (such as convalescent facilities and home health care).

Large cost differences remain after controlling for differences in hospital outputs. Further analysis of the origin of these differences involves disaggregating total costs and comparing them component by component. One explanation for higher U.S. costs is that they are due primarily to the greater costs of delivering health care in a multiple-payer environment. Susan Haber and colleagues, however, show that none of this difference is attributable to differences in factor prices. Other possibilities include...
differences in staffing ratios or more intensive use of capital equipment. It is unlikely that any one of these factors explains the entire difference in cost, but further analysis will show their relative contributions. Disaggregating total cost into its components suggests one line for future research. A full comparison of the two health systems must include costs, of course, but also must assess the quality of care each provides.

Studies of the two systems may prove even more valuable when the two systems are viewed as one large-scale natural experiment. A variety of forces have led two similar systems into divergent courses, and the observed cost differences are simply aggregate reflections of different patterns of patient care. One immediate implication to be drawn from this study is that the observed variation in intensive care use can serve as a convenient means to analyze the extent to which the use of these units improves patient care outcomes. Other interesting comparisons include medical education (Canada has a far lower proportion of specialists) and physician practice patterns (Canadian physicians tend to practice in a far less aggressive style). Rather than proving the superiority of one entire system over another, a more modest, and possibly more productive, view is that international comparisons provide an opportunity to evaluate different patient care strategies.

The authors acknowledge the support of Agency for Health care Policy and Research (AHCPR) Grant no. HS06414. Neither the AHCPR nor the Department of Health and Human Services necessarily endorses the findings contained herein.

NOTES


5. Hospitals have divided the services they provide into two broad categories: inpatient and outpatient. The American Hospital Association (AHA) combines the two into a
single “adjusted” day measure, by using the ratio of the average charge per inpatient day and per outpatient visit to convert visits into day equivalents. The AHA approach could not be used when comparing hospitals in Canada and the United States for at least two reasons. First, charge data are not collected in Canada since hospitals are reimbursed on a global rather than per patient basis. Second, an inpatient day is too aggregate a measure of hospital output, since it is composed of a diverse mix of subacute, acute, and intensive care days. The proportion of each type of day in a hospital’s total output will have a powerful effect on its average cost per day.

6. Data from Ontario and British Columbia were pooled because of the relatively small number of hospitals in British Columbia.

7. Medical education, as measured by the intern-to-bed ratio, was included as a “quasi-output” because of its indirect effect on hospital costs. A more theoretically based model, such as the “trans-log,” could have been used in the analysis, but the increased complexity and difficulty of interpretation outweighed the likely benefit (a marginal improvement in estimating the composite output). The New York data presented two unique difficulties. New York has a substantial number of very large hospitals whose cost structures were substantially above average. Furthermore, there were substantial regional differences in both the cost structures and the composition of hospital outputs. Both of these factors could lead to biased coefficient estimates. To allow for these effects, two interaction variables were included in the regressions. J.A. Rogowski and J.P. Newhouse, “Estimating the Indirect Cost of Teaching,” Journal of Health Economics 11 (1992): 153-171.

8. We multiplied the regression coefficients, as estimates of each jurisdiction average incremental cost for each type of output, by each hospital’s actual outputs to calculate a measure of the hospital’s composite output. The average incremental cost per day (AICD) is equal to the total “incremental” cost resulting from the actual mix of subacute, acute, and intensive care days produced (average cost times the output it produced) divided by total inpatient days (the sum of the three outputs). Similarly, the cost of the “average discharge” is the total “incremental” cost divided by the total number of discharges. For example, the cost of an average day in California in 1981 was calculated as follows: AICD equals [$171 times number of subacute days] plus [$438 times number of acute care days] plus [$1,193 times number of intensive care days] divided by total days. To develop an aggregate measure of the volume that combines outpatient and inpatient services (adjusted days or discharges), outpatient services were converted to the equivalent of inpatient days as follows. The total incremental cost of outpatient services is the product of the total number of visits and the corresponding average incremental cost. This cost is divided by the average cost per day or per discharge to calculate the equivalent number of days or discharges. Adding this output equivalent to the relevant total produces “adjusted” days or discharges. Continuing the previous example, the number of adjusted days in a California hospital in 1981 is calculated as follows: Adjusted days equal total inpatient days plus [7.2 times number of outpatient visits] divided by AICD. Unit cost, the cost of an adjusted day or an adjusted discharge, is total expenses divided by the corresponding adjusted output quantity.

