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Texas at San Antonio, San Antonio, TX

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Leawood, KS

Mustafa Z. Younis, Professor of Health Economics &
Finance, Jackson State University, School of
Health Sciences, Department of Health Policy &
Management, Jackson, MS
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Once again, this issue of the *Journal of Health Care Finance* is illustrative of the breadth of topics we cover. We are always interested in new article ideas that directly or indirectly relate to health care finance. To submit ideas or articles, please send an email to: HealthFinanceJournal@yahoo.com.

—James J. Unland
The Health Capital Group
244 South Randall Road, Ste 124
Elgin, IL 60123
(800) 423-5157
healthfinancejournal@yahoo.com
The Effects of Certificate of Need Regulation on Hospital Costs

Patrick A. Rivers, Myron D. Fottler, and Jemima A. Frimpong

This study examines the impact of Certificate of Need Regulation (CNR) on hospital costs (HC). Secondary data from multiple sources were used for the analysis. A panel representing 2,168 short-term general, nonfederal US hospitals operating during the period 1999–2003 was analyzed. Results of our analysis indicate that the existence of a CNR program was not related to HC; however, the stringency of the CNR program was positively and significantly related to HC. Implications from these results include the inability of CNR to contain HC as assumed or expected, and the possibility that CNR may actually increase HC, while reducing competition. Keywords: Certificate of Need Regulation (CNR), hospital costs (HC), HC per adjusted admissions, hospital competition.

The Certificate of Need Regulation (CNR) emerged in the early 1960s as a practice to contain health costs (HC) in American hospitals. The overarching rationale was to regulate capital expenditures of health care providers by requiring providers to obtain specific certification showing the need for services and expenditures. As a result of the CNR, prior approval of health care investments over certain dollar limits became mandatory, though the threshold varies from state to state. In an increasingly global competitive world economy, the necessity of containing HC cannot be overemphasized. However, assumptions and practices on how HC are contained merit a critical examination. Through such an examination, health policy makers and administrators in the health care industry are likely to become more informed and adaptive to the ever-changing economic environment of health care.

The CNR reflects one response to the rising cost of medical care and the existence of excess capacity within the US health care system, which are some of the major concerns of health care policy makers. As a result of these concerns, state governments have been compelled to become actively engaged in regulating health care expenditures. Indeed, the CNR has been embraced as an alternative instrument to controlling the increase in hospital capital expenditures and the state Medicaid budgets.1

From a historic perspective, the first CNR law was enacted by New York State in 1964. New York was then followed by Rhode Island and Maryland in 1968 and California and Connecticut in 1969. In 1972, the US Congress modified the Social Security Act (SSA) by enacting a Public Law (Public Law No. 92–603) to resonate with the CNR. The SSA reinforced the orientation of various

Patrick A. Rivers, PhD, MBA, is a Professor and the Director of Health Care Management at the College of Applied Sciences & Arts, Southern Illinois University, Carbondale, Illinois.

Myron D. Fottler, PhD, MBA, is a Professor and Executive Director of Health Administration Programs at The University of Central Florida, Department of Health Professions, College of Health and Public Affairs, in Orlando, FL. He can be reached at fottler@mail.ucf.edu.

Jemima A. Frimpong, PhD, MPH, is an Assistant Professor in the Heilbrunn Department of Population and Family Health, Mailman School of Public Health at Columbia University. She can be reached at jf2584@columbia.edu.

state CNR proposals by prohibiting the use of monies allocated for Medicare, Medicaid, and maternal and child health programs to make “unnecessary capital expenditures” by the health care facilities or health maintenance organizations (HMOs). The CNR laws require that state regulatory agencies approve both the entry of new hospitals and “large” capital expenditures by existing hospitals. By 1979, almost all states had enacted these laws. There is some empirical evidence that hospitals began some capital projects in anticipation of CNR. Once enacted, CNR laws plausibly would have greater effects after they had been in place for a number of years. By 1999, most CNR state laws had been in effect for at least 13 years.

As of 2002, 36 states were active participants of the CNR program or had passed some form of CNR legislation. Although the laws governing the administration of CNR differ from state to state, they generally cover hospitals, nursing homes, ambulatory facilities, and laboratories. As a norm, the state CNR laws require agencies that regulate the health care providers within states to approve the investments over a certain dollar amount made toward the construction of new facilities and additional beds, investments in new services and equipment, and expenditures towards restoration and equipment to sustain existing services.

However, the current normative implementation of the CNR in various states has been criticized by some researchers. For example, Campbell and Fournier maintain that “a clear, economic, and legal standard to distinguish between an action to deny an applicant in order to prevent investments that would raise costs by unnecessary duplication, and actions motivated by the anticompetitive effect of such denial” is absent from most state CNR policies. In addition, the CNR programs necessitate that a legally authorized government agency offer written substantiation that a change for service or project is needed.

The “need,” often based on the requirements of the public for an institution or for a service over a preset period of time, may be difficult to quantify. Furthermore, the review process that certifies “need” also varies from state to state. For example, some states require two while other states require three reviews each by different bodies of the review board. There is also an appeal process for institutions that want to appeal the decisions of the review board. The structure of CNR legislation adopted by a state also depends on the economic situation of the state and the relations between political bodies such as legislators, government regulators, planners, providers, and consumers. Each of these entities undoubtedly holds a distinct purpose and objective in the CNR process.

This article presents the results of an empirical study on the effectiveness of CNR as a hospital cost containment practice in the US hospital industry. The study examines prior research on CNR and HC, investigates CNR and HC in light of more recent data, and addresses the implications of the current study findings on public policy and future research.

Literature Review

Research Streams on CNR

Since the introduction of CNR as a mechanism for cost containment in health care, there have been numerous studies in the health care domain concerning the impact
of CNR efforts. Most studies published in the 1980s and 1990s have analyzed data from the 1970s and 1980s. This literature has examined the relationship within three streams:

1. Between CNR and quality of health care;  
2. Between CNR and access; and  
3. Between CNR and health care system costs.

Although we have seen some progress in understanding the nature of CNR in the field of health care and its impact on health care—related outcomes from the above studies, the results have been quite mixed. For example, results from the first research stream (CNR and quality) suggest that no clear conclusion concerning the impact of CNR on hospital quality is possible since data are old and results mixed. Results from the second stream (CNR and access) suffer from the same limitations. However, while the impact of CNR on quality and access are important topics, the present research focuses on the third research stream (i.e., the impact of CNR on HC) where current studies suggest inconsistent results.

**Research on CNR and HC**

Empirical studies have shown different and mixed impacts of CNR on HC. Data gathered from the early 1980s suggest that CNR programs did little to contain cost. Although most of the past studies on CNR focused on hospital expenditures, CNR has been used by many states to plan and regulate facilities despite the apparent inability of CNR programs to lower costs. Burda states that CNR programs have not been instrumental in controlling the cost of health care and have negatively affected the health care industry by reducing competition. Examination of CNR’s failure to control cost has been based largely on the performance of programs during the early years of their enactments.

Some authors claim that the performance of many CNR programs has improved over time. Donahue et al. acknowledged the importance of early evaluation of the performance of CNR programs but concluded that the CNR programs generally have little impact on overall cost inflation of hospitals. These authors pointed out that some successes have been experienced in states that have cost control as the primary function of CNR programs. Sloan came to a similar conclusion when he found that CNR laws reduced cost per patient. However, his finding did not conclude that CNR laws have considerable impact.

Lanning, Morrisey, and Ohsfeldt found contrary results associated with the presence of CNR. According to these authors, the presence of a CNR increased hospital spending by 20.6 percent, personal services by 13.6 percent, and other health care expenditures by 9 percent. In other cases, the absence of a CNR program is reported to have a negative effect on HC. For example, using time series data to assess the effects of eliminating CNR, Conover and Sloan found that there is a 5 percent long-term decrease in acute care spending per capita as a result of eliminating mature CNR programs. In addition, these authors found no significant change in total per capita spending. However, they also found that after the elimination of CNR, there was no increase in the acquisition of facilities or costs, and there was a 2 percent reduction in bed supply. Finally, Younis, Rivers, and Fottler
also found a positive relationship between the existence of CNR and HC.

While most studies have failed to clearly delineate the usefulness of CNR regulations in containing hospital and other health care costs, the case for deregulation seems strong to some researchers. Some researchers believe that deregulation is necessitated by the anti-competitive CNR impact of protecting existing providers from competition. Although assessment of CNR programs does not show a significant impact on hospital expenditures, policymakers in many states are not inclined to abolish CNR laws. Their prime concern is that eliminating the CNR program would result in increased health care capital expenditures and operating expenses despite data to the contrary. The motivating factor is that for a CNR program to be effective, it has to put restrictions on both existing hospitals and those looking to enter the industry.

The review of the literature reflects an ambiguity regarding the impact of CNR on HC. Previous research suffers from a lack of recent data, failure to differentiate the various impacts of CNR (i.e., on HC versus other impacts), inadequacies of the measurement of CNR, insufficient research on CNR impact on HC, failure to control for the effects of managed care and other environmental or market variables, and the lack of national data in most of the earlier studies conducted.

While the question of CNR effectiveness remains an area of public policy debate and an area that warrants the attention of health service researchers, it has been at least a decade since research in this area has been done. The purpose of the present study is to present a focused examination of the effectiveness of CNR as a hospital cost containment practice in the US hospital industry.

In addressing the limitations of previous research on CNR and HC, this study takes a different, more sophisticated approach to looking at the relationship between CNR and HC. National data (1999–2003) encompassing all states in the United States were used to assess the impact of CNR on HC. The impact of both existence and stringency of CNR in the states where it exists was included in the analysis. The study also advances our knowledge base of CNR and extends the literature by controlling for a number of environmental, market, and institutional variables, which have not been controlled in previous research. The study hypothesis examines the relationship of both the existence of CNR and the stringency of the regulation on HC:

Hypothesis: The existence of a Certificate-of-Need Regulation and the stringency of CNR will both negatively impact HC, after controlling for environmental, market, and institutional characteristics.

Methodology

Sources, Definitions, and Measures of Variables

This study integrates data from different but related sources and datasets to test the study hypothesis. The datasets used were drawn from the databases of the American Hospital Association Annual Survey (AHA), American Health Planning Association (AHP), Area Resource File (ARF), Centers for Medicare & Medicaid Services (CMS), CMS Case-Mix Index (CMI), and InterStudy Data (ISD). The AHA dataset contains data on an annual survey of non-federal short-term general hospitals in the
United States. The analysis included data on surveys conducted in 1999–2003. The AHA, AHP, ARF, CMS, and CMI datasets provided measures for capital investment, financial factors, and operational characteristics while the ISD dataset provided HMO penetration rate. The measures were used to obtain operational and market characteristics, and only hospitals located in metropolitan statistical areas (MSAs) in 1999–2003 were included in the analysis.

While defining a hospital’s market can be problematic, for this study, a hospital’s market is defined by the MSA for urban hospitals, and by county for non-MSA hospitals since rural hospitals may be in communities too small to be included in an MSA. MSA is defined by the US Bureau of Census to include central cities and their associated suburbs. The use of only those hospitals operating in MSAs is valuable in that the definitions of hospital markets and HMO markets are reasonably clear, and enhance the validity of hospital and HMO penetration measures.

The impact of CNR on HC was investigated with the hospital as the unit of analysis. Data 1999–2003 determined if current findings will refute or substantiate findings from earlier studies that used data from the 1980s. In addition to using more recent hospital data, this study takes into consideration the stabilization of the hospital industry in the implementation of CNR in the United States. Those states that enacted CNR have not seen significant changes in these laws between the early 1990s and 2000. The period selected for this study is also particularly advantageous since there were significant changes in both the number of HMOs and enrollment in HMOs than what would have been captured in studies using 1980s data. Finally, by 1999, the effects of the Medicare’s Prospective Payment System and the Balanced Budget Act of 1997 should have also stabilized, thereby minimizing extraneous sources of variation in the data.

CNR is defined as the primary independent construct with two variables:

1. The existence of CNR law in the state where the hospital is located; and
2. The stringency score for the CNR program of each state used.

The stringency score is measured by the number of CNR-regulated services multiplied by a weight based on reviewability thresholds. For the two CNR variables, (1) CNR laws are defined as 1 if hospital is located in a state that has a CNR law, and 0 otherwise; and (2) for CNR stringency (1 if a state has the most stringent CNR thresholds, and 0 otherwise).

The states having the most stringent CNR are Maine, Connecticut, West Virginia, Georgia, Alaska, Vermont, South Carolina, and Missouri. If CNR programs are effective in containing cost, then it is expected that the regression coefficients for each of the two CNR independent predictor variables will be negative and significant (see the analytical approach in next section).

The study defines the dependent construct with one variable, HC per adjusted admission. Previously, measures of HC have been cost per day or cost per case. In some cases, both of these indicators have been used. In the present study, costs-per-adjusted admission was used to measure HC. Since the expense data on the AHA Annual Survey of Hospitals included both the inpatient and outpatient expenses, the admission was adjusted
to summarize the inpatient and outpatient use into a single utilization measure. The AHA calculated adjusted admissions attributed to outpatient services by multiplying admissions by the ratio of outpatient revenue to inpatient revenue.

The HC measure was calculated in this study as operating expense or costs divided by adjusted admissions. This choice of variable was conceptually consistent with the goals of hospitals in the environment of increasing dominance of fixed payment reimbursement. Fixed payment reimbursement caused hospitals to have as their objective the minimization of the cost per episode of care. Operating expense or cost was calculated as the total facility expense minus non-operating expenses including depreciation, interest, and other non-operating losses.32

All variables used in the study are defined and listed in Figure 1. For all constructs Figure 1 lists the variables, measures, means, and standard deviations of the variables and data sources.

The specific market environmental, market, and control variables were identified through a review of previously cited literature regarding CNR regulation and HC,33 as well as the impact of these variables on HC.34 The control variables included the models’ per capita income and percentage of non-White in the market as proxies for socioeconomic status. To examine the effect of market competition on HC, the Herfindahl-Hirschman index (HHI), defined as the sum of squares of the market shares of all facilities in the market, is used. Hospital market share is measured by the hospital’s acute-care patient days divided by total acute-care patient days for the MSA in which the hospital was located for urban hospitals, and total acute-care patient days in the county for rural facilities.35 This study also measured the level of managed care penetration in each market defined as the percent of the population enrolled in HMOs. Market variables also include per capita income and percentage of non-Whites in the market area.

The institutional control and operating variables include percentages of Medicare and Medicaid discharges from the hospital as well as patient acuity [derived from CMS data on Medicaid and Medicare discharges], bed size, system affiliation, staffing intensity, ownership status, occupancy rate, staffing index, teaching status, and Medicare wage index (i.e., cost of hospital labor).

**Empirical Specification and Analytic Approach**

The analytic approach addresses several important issues absent from any earlier single study. First, from the theoretical framing of the CNR program, HC are assumed to differ only in the values of the measured attributes included as explanatory variables and control variables. However, there exists the possibility that hospitals have unmeasured attributes that may affect HC. It is often believed that these hospital-specific variables are correlated with the variables of interest, and thus their exclusion leads to omitted variables bias problems.36 Second, there might be year-specific effects.37 Third, while market variables are assumed as strictly exogenous, that is, uncorrelated with the error term in all time periods, hospital-level variables are not strictly exogenous.38

Fourth, there is the possibility of “feedback effects” which are most easily thought of as a type of endogeneity across time periods. For example, a change in HC in period [t]
**The Effects of Certificate of Need Regulation on Hospital Costs**

### Figure 1. Variables, Measurement, Descriptive Statistics, and Data Source: 1999–2003

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measure</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital Costs</td>
<td>Operating expense or costs divided by adjusted admissions</td>
<td>6,187.515</td>
<td>2554.44</td>
<td>AHA</td>
</tr>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate of Need Regulation (CNR)</td>
<td>1, existence of CNR law; 0 otherwise</td>
<td>0.660</td>
<td>0.474</td>
<td>AHP</td>
</tr>
<tr>
<td>CNR Stringency</td>
<td>1, if a state has most stringent CNR thresholds; 0 otherwise</td>
<td>0.085</td>
<td>0.278</td>
<td>AHP</td>
</tr>
<tr>
<td><strong>Market Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMO Penetration</td>
<td>% HMO enrollment as % of total MSA population</td>
<td>0.309</td>
<td>0.157</td>
<td>ARF</td>
</tr>
<tr>
<td>HMO Competition MSA</td>
<td>Market shares based on distribution of enrollees' market (i.e., 1- value of HMO Herfindahl Index)</td>
<td>0.681</td>
<td>0.206</td>
<td>Interstudy</td>
</tr>
<tr>
<td></td>
<td>Squared sum of (acute-care patient days/total acute-care patient days in the market)</td>
<td>0.819</td>
<td>0.185</td>
<td>ARF/CMS</td>
</tr>
<tr>
<td>Per Capita Income</td>
<td>Log of per capita income in the market</td>
<td>27,775.020</td>
<td>7352.318</td>
<td>ARF</td>
</tr>
<tr>
<td>% Non-White</td>
<td>% Nonwhite population in the market</td>
<td>0.314</td>
<td>0.178</td>
<td>ARF</td>
</tr>
<tr>
<td><strong>Operating Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Profit</td>
<td>1, for profit; 0, otherwise</td>
<td>0.192</td>
<td>0.394</td>
<td>AHA</td>
</tr>
<tr>
<td>Bed Size</td>
<td>Number of staffed beds</td>
<td>229.886</td>
<td>189.659</td>
<td>AHA</td>
</tr>
<tr>
<td>Teaching Status</td>
<td>1, for teaching; 0 otherwise</td>
<td>0.105</td>
<td>0.306</td>
<td>AHA</td>
</tr>
<tr>
<td>Occupancy Rate</td>
<td>Inpatient days/(staffed beds* 365)</td>
<td>0.571</td>
<td>0.171</td>
<td>AHA</td>
</tr>
<tr>
<td>Staffing Intensity</td>
<td>Health care workers full-time equivalents (FTEs) per 1,000 adjusted patient days</td>
<td>13.691</td>
<td>5.567</td>
<td>AHA</td>
</tr>
<tr>
<td>Wage Index</td>
<td>Cost of health care labor (i.e., ratio of adjusted average hourly wage to mean of adjusted average hourly wage)</td>
<td>1.013</td>
<td>0.154</td>
<td>CM</td>
</tr>
<tr>
<td>System Affiliation</td>
<td>1, system affiliated; 0 freestanding</td>
<td>0.723</td>
<td>0.448</td>
<td>AHA</td>
</tr>
<tr>
<td>% Medicare Discharges</td>
<td>Medicare discharges/total discharges</td>
<td>0.412</td>
<td>0.129</td>
<td>CMS</td>
</tr>
<tr>
<td>% Medicaid Discharges</td>
<td>Medicaid discharges/total discharges</td>
<td>0.139</td>
<td>0.101</td>
<td>CMS</td>
</tr>
<tr>
<td>Case-Mix Index</td>
<td>Medicare case-mix index</td>
<td>1.394</td>
<td>0.253</td>
<td>CM</td>
</tr>
</tbody>
</table>

Notes: AHP = American Health Planning Association; ARF = Area Resource File; AHA = American Hospital Association; CMS = Centers for Medicare & Medicaid Services; CM = CMS Case-Mix Index; ISD = InterStudy Data
may feed back to changes in bed size in period \([t+1]\). Such feedback effects violate the typical assumption of strict exogeneity. In this study, feedback effects are allowed by making the weaker assumption that hospital-level regressors are predetermined: the error term is uncorrelated with current and past values of the predetermined regressors but potentially correlated with future values of regressors.

To address the foregoing problems, a fixed effects model is employed to remove the influence of such hospital heterogeneity and year-fixed effects. Although one of the commonly applied methods for fixed-effects models is the within-group transformation in which the ordinary least squares (OLS) estimator is applied to data transformed by taking deviations from time-series means for each cross-sectional unit, the within-group transformation yields inconsistent parameter estimates if the model does not include strictly exogenous variables. 39

Thus, the current study applies first-difference transformation with the instrument variable (IV) estimation. After applying the first-difference transformation to eliminate the fixed effects, the dependent variable is regressed on the first differences of the regressors. As consistent estimates may be obtained by using past values of the strictly exogenous regressors as instruments, a two-year lagged value of the endogenous variable and one-year lagged values of the predetermined regressors are used as the instruments.

More specifically, the regression model is given below:

\[
y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \lambda_i + \eta_t + u_{it}; \quad i = 1, 2, \ldots, N; \quad t = 1, 2, \ldots, T,
\]

where \(i\) is used to index the hospital and \(t\) is used to index the year (\(N = 2,168\) and \(T = 5\) in our case). \(y_{it}\) equals log of hospital \(i\)'s costs per adjusted admission at year \(t\), \(\alpha\) is constant, \(X_1\) it equals CNR, \(X_2\) it equals CNR stringency, \(X_3\) it equals environmental/market variables, \(X_4\) it equals operating variables, \(\lambda_i\) is unobservable hospital-specific effect which is constant across time, \(\eta_t\) is a time-specific effect which varies across time, and \(u_{it}\) equals unexplained residual variation. \(\alpha, \beta_1, \beta_2, \beta_3, \text{ and } \beta_4\) are coefficients needed to be estimated, and they are estimated by applying the IV estimation to the following first-differenced equation:

\[
\Delta y_{it} = \beta_1 \Delta X_{1it} + \beta_2 \Delta X_{2it} + \beta_3 \Delta X_{3it} + \beta_4 \Delta X_{4it} + \Delta \eta_t + \Delta u_{it}; \quad i = 1, 2, \ldots, N; \quad t = 1, 2, \ldots, T,
\]

where \(\Delta\) denotes the difference operator.

Results

Preliminary Tests

First, the study checked correlations among the study variables. While most had low correlations, some correlations coefficients were higher than others. However, dropping one or more of the independent variables in an effort to reduce multicollinearity could lead to omitted variable bias. 40 Since the study variables are properly chosen based on theory and previous literature, all the variables were included in the subsequent analyses.

Also important is the question of serial correlation. Serial correlation was tested without strictly exogenous regressors. First, the simple OLS regression of the dependent variable on the independent variables
was run; and the OLS residual value was obtained. Second, the residual was regressed on the lagged residual and all of the independent variables. Finally, a heteroskedasticity-robust version of the test was used to check the significance of the coefficient for the lagged residual. Since no significant results were obtained, there is no evidence that the data have serial correlation problems.

Descriptive Findings

Figure 1 displays the mean values and standard deviations for all variables included in the analysis of the 2,168 (36 percent of total number of hospitals) nonfederal short-term care general hospitals in the sample. Nineteen percent were for-profit organizations, the average number of staffed beds were 229, the occupancy rate was 57 percent, and 10 percent were teaching hospitals. HMO penetration in the market averaged 30.9 percent in 1999–2003 and on average; the hospitals were located in more competitive markets. In 1999–2003, 41 percent of hospital discharges showed Medicare as payer and 13.9 percent showed Medicaid as payer. The mean of costs per adjusted admission was $6,187.52.

Regression Results

A regression model was used to determine the impact of CNR on costs per adjusted admission in hospitals. The model contained all the hospitals in MSAs in the sample. The existence of CNR laws and CNR stringency were used as independent variables.

The dependent variable used in the regression is the natural logarithm (LOG) of HC per adjusted admission. The LOG is used to provide normal distributions of the dependent variable in order to meet the normality assumption of regression.41 We analyzed the data to test the hypothesis of the relationship between CNR construct variables and HC performance variables (as indicated above). The results of the analysis of CNR on health system performance (i.e., HC per adjusted admission) are discussed below. The estimates of the coefficients and standard errors from OLS results of the model regressions are presented in Figure 2.

From the analysis, the adjusted R² for the model is 0.48. CNR stringency is significantly and positively associated with costs per adjusted admission at the .05 level. There was no significant relationship between CNR laws and HC. The estimated coefficient for the CNR law variable is 0.009. The positive signs indicate that all else being equal, HC per adjusted admission increase if the hospital is located in a state that has CNR law. Our findings concur with a number of studies conducted with data from 1970s and 1980s, which concluded that the CNR did not decrease HC in the 1970s.42 Our findings are also in agreement with two other studies which showed that CNR is associated with only a modest increases in HC in the 1980s.43 Even though previous results separately examined the 1970s and 1980s, these results for 1999–2003 data are consistent with those earlier studies.

The results also showed that there are several other variables that have a significant impact on HC. Higher costs were found to be associated with hospitals with major teaching functions, larger size, higher occupancy rates, higher staff intensity, higher percentage wage intensity, higher percentage of Medicare and Medicaid discharges, higher case-mix, and location in high income...
areas and/or areas with a higher percentage of non-Whites. HC were lower for hospitals located in more competitive hospital markets as defined by the market share variable and HMO penetration.

Discussion

The purpose of this study was to investigate the impact of CNR on health care organizational performance, as measured by HC. The main findings of this study can be summed up as follows: Based on the hypothesis investigated:

1. Contrary to expectation, the existence of CNR law has no statistically significant impact on HC per adjusted admissions for all hospitals; and
2. Contrary to expectation, CNR stringency has a positive statistically significant relationship with HC per adjusted admissions for all hospitals.

Previous health services research on the impact of CNR on HC has tended to either use data that pre-dates the implementation of the prospective payment system (PPS) in 1984 or predates the rise of
managed care during the 1990s. This has made the generalizability of these previous results to the current health care environment questionable. The present study went beyond previous research in a number of ways. The CNR effects on HC were examined after establishing more sophisticated controls for possible intervening environmental, market, and institutional variables. In the current study, cost per adjusted admission was used as a measure for HC. HC were calculated in this study as operating expense or costs divided by adjusted admission.

Our results, as well as those of several previous studies, indicate that CNR programs do not only fail to contain HC, but may actually increase costs as well. Our results, together with those of previous research, heighten the debate whether CNR will ever be an effective HC containment approach, and counter arguments that CNR programs could be more effective after they have been in place for a period of time.

Numerous studies, as referenced in this research, have made evident the inefficacy of the CNR program in containing HC. Studies conducted in the 1980s showed that CNR programs were not successful in controlling hospital expenditures. The findings of our study are consistent with several studies conducted during the 1980s as well as some studies published in the 1990s.

Our findings, together with results from previous studies, raise the question of the impact of the abolishment of CNR on HC. To determine the impact of the abolishment of CNR programs, Mendelson and Arnold reported that there was no increase in cost in 12 states that abolished CNR programs. Considering this finding, it is important to note that each state has different regulations and operates in different markets that are unique to the particular state. A similar statistical analysis of all 50 states by Conover and Sloan reported that removing CNR did not have any overall effect on per capita health care spending.

Examining the impact of CNR, we controlled for all things being equal and the estimated coefficient showed a positive sign, which illustrates that HC per adjusted admission increase if the hospital is located in a state that has a CNR law. Our findings are substantiated by previous studies. Lanning, Morrisey, and Ohlsfeldt also measured the effects of CNR on hospital expenditures and also found it to be positive and significant. The most significant increase was for hospital expenditure where CNR appeared to increase per capita hospital expenditure by 20.6 percent. They also found that CNR raised hospital prices and they attributed this finding to the restraining of competition by CNR laws. Similar to our findings, Sloan and Steinwald found no evidence of CNR impact on for-profit hospitals. After CNR repeal, for-profit hospitals did not significantly increase their costs or market presence.

**Limitations**

There are a number of limitations inherent in this study. Similar to studies that defined hospital and HMO markets in the research process, this study by definition excluded some hospitals. Hospitals that operate outside of an MSA were not included in this study. Organizational strategy is another limiting factor; by using a geographic definition of the market, this study tends to
overestimate the competitiveness of markets if segmentation is part of the market strategy. That is, hospitals and HMOs may be located in the same MSA, yet due to market segmentation, they may appear not to compete with others in that MSA since they cater to different populations (e.g., young families versus older adults, white collar versus blue collar).

There are some issues that may be of concern but were not addressed in the design of this study. HMO enrollment data do not delineate which portions of the enrollees are located within the MSA. Also, the study data do not capture how the HMOs reimburse. The data do include the total number of enrollees and the service area (usually by county) of the HMO, requiring that the enrollment for HMOs with service areas overlapping MSA and non-MSA counties be estimated.

Second, like all cross sectional studies, this study demonstrates only association and leaves open the question of causality. Third, by defining a market at the MSA level, only a fraction of hospitals were included in the analysis. Hospitals located outside of defined MSAs would not be captured by the measure. This biases the sample toward urban areas and larger size hospitals. Fourth, of the hospitals studied, the mean case-mix index is 1.34. This figure contrasts poorly with the nation as a whole with a mean of 1.00. This difference could also bias the results of this study. Not withstanding the foregoing limitations, this study provides further insight into CNR and spurs further research that will seek to address these shortcomings.

From the current study and the findings of several earlier studies, it appears that CNR may stifle competition and increase HC. These findings when combined suggest CNR laws constrain competition more than the lowering of hospital expenditures. Similar to Conover and Sloan, these study results refute the argument that the ending of CNR laws will increase HC or costs of other health care services. The goals for cost containment, in addition to increasing access and quality sought by most CNR laws do not achieve that end result, and may be counterproductive. A recent study by Short, Aloia, and Ho examined how Certificate of Need (CON) influences cardiac mortality rates and reported that states that dropped CON had relatively lower rates for Coronary artery bypass graft (CABG) surgery, with no association between CNR and higher quality of care.

State goals for enhancing consumer access and quality could be better achieved through other programs such as provider or insurer report cards. The results indicate that CNR stringency has a positive statistical relationship to urban HC within the period 1999–2003. Since the purpose of CNR legislation is to contain or reduce such HC, we conclude that CNR policies did not achieve their stated objectives during the study period. As a consequence of the inability of CNR laws to contain HC, many states in the United States are attempting to refine their CNR to better address the nature and causes of HC inflation. Future research should evaluate these initiatives in order to determine which approaches are most effective in achieving state objectives, with particular attention to rural hospitals that experience a higher percentage of Medicare and Medicaid discharges, higher case-mix, and higher percentage of non-Whites.
REFERENCES


4. Supra, n.2.


7. Supra, n.2.


16. Supra, n.1.


36. Id.


44. Id.


49. Supra, n.3.

52. Supra, n.47.
The Utilization of Hospitalists Associated with Compensation: Insourcing Instead of Outsourcing Health Care

Doohee Lee and Andrew Sikula, Sr.

Objectives: The utilization of hospitalists is reversing an industrial and health care business model where outsourcing work has been the trend for the past several decades. This empirical analysis seeks to understand a link between hospitalist utilization and physician compensation affected by quality of care.

Methods: We analyzed the secondary data from the 2004–2005 CTS Physician Survey (n = 6,628). A multivariate regression analysis was performed to estimate a link between compensation and the hospitalist model.

Results: Of respondents, 66 percent reported the use of hospitalists one year prior to the survey. After controlling for other covariates, hospitalist users were those physicians concerned with patient satisfaction and quality of care associated with compensation, but were less concerned about compensation affecting personal financial performance. Consistent with prior research, we found that hospitalist users were affiliated with managed care and capitation.

Discussion: Future research is needed to understand factors improving physician compensation affected by productivity and financial performance of practice.

Keywords: insourcing health care, hospitalist, hospital medicine, compensation, quality care, managed care, capitation.

We are now seeing a new trend within health care where outsourcing is beginning to be replaced by insourcing. For decades, medical communities have attempted to lower costs by reducing the length of hospital stays. Outpatient clinics first, emergency care facilities later, and then day surgery centers recently have been part of this outsourcing of health care movement. Hospices now routinely handle health care outsourcing for near-death patients. However, there are signs that outsourcing health care services has run its course and trends may be reversing. Many health care organizations now find it desirable and economical to have a physician as part of staff to reduce work time away from the office or place of employment.

The development of hospitalists, managed care, and capitation have made insourcing health care more plausible and perhaps even mandatory. A hospitalist, coined by Wachter and Goldman, is a physician who specializes in seeing and treating other physicians’ hospitalized patients in order to minimize the number of hospital visits by the patients’ regular physicians. Such insourcing appears efficient and effective as evidenced by the literature. Managed care is a system of providing health care (usually by an HMO or a PPO) that is designed to control costs through managed programs in which the physician accepts constraints on the amount charged.

Doohee Lee, PhD, is an Associate Professor in the Graduate School of Management, the Elizabeth McDowell Lewis College of Business, Marshall University, Charleston, West Virginia.

Andrew Sikula, Sr., PhD, is Associate Dean of the Elizabeth McDowell Lewis College of Business at Marshall University. He is also Director of the Marshall University Graduate School of Management.
for medical care and the patient is limited in the choice of a physician. Reducing choice and variation are health care insourcing cost reduction tactics and strategy. Capitation also encourages health care insourcing since it is a fixed per capita payment made periodically to a medical service provider (such as a physician) by a managed care group (such as an HMO) in return for medical care provided to enrolled individuals.

There are other indicators and measures of increased health care insourcing and less physical treatment outsourcing going on in the economy and within society. Increasingly, terminally ill patients are being cared for at home by family members and friends for their last surviving months and weeks. Hospice personnel may visit home care providers and recipients, but patients staying full-time at hospices today is normally now a practice reserved for just the last few days of life.

What affects there will be on hospitalist utilization and the health care insourcing movement because of the impending US federal health care system are indeterminable at this time. A prediction is that the more a government option and one payer system results, the greater the expansions of hospitalists usage and health care insourcing mandates. What is certain is that there will be a dollar trail. “Follow the money” is always a predictor of past, present, and future behavior. Health care must make both physical sense and fiscal cents. As indicated later in this article, physician compensation is related to hospitalist utilization and the implementation of both insourcing and outsourcing medical diagnoses, disease treatment, and health care delivery alternatives.

According to a recent survey, there are about 23,000 hospitalists currently practicing in US hospital settings as active physicians to provide inpatient care. This same report indicates over half of US hospitals now have hospital medicine programs. The hospitalist model has been widely touted to reduce health care costs and to improve quality of care. Specifically, these benefits include resource saving, reduced length of stay (LOS), patient satisfaction, and medical training and education. A recent study by Pham et al. revealed two primary motivators for hospitalist growth:

1. Reduction of LOS and per admission costs; and
2. Reimbursement pressures on primary care physicians (PCPs) so that they can avoid traveling time and focus on outpatient services.

Notwithstanding the benefits and interests of hospitalists, little attention has focused on whether physician compensation is associated with the utilization of hospitalists. Understanding the association between physician compensation and the hospitalist model is an important research question for at least one reason: The hospitalist model is relatively new and hospitals and practicing hospitalists must find ways to be competitive in the market in order to continue expanding hospital medicine and further market their unique quality services of inpatient care. A recent survey of physicians shows the largest increases in compensation (7.32 percent) among hospitalists in the year 2007, suggesting that demand for hospitalists exceeds supply in the current marketplace. The compensation increase does not seem to be related to service quantity or productivity of hospitalists. Several recent studies report financial difficulties among hospitals utilizing hospitalists. A study by Hoff et al. also
revealed most hospitalists (75 percent) in their study having received no compensation linked to financial incentives. It is unclear whether the increase in compensation is related to the hospitalist model.

There are other factors that may affect the utilization of hospitalists. Quality of care may be associated with the use of hospitalists. Also, under the current managed care market system, capitation or the prospective payment system is a primary reimbursement method for medical providers and has been popular for the past two decades. Managed care may be linked to the hospitalist model as Coffman and Rundall concluded indicating that hospitalists under managed care perform better and generate positive outcomes.

Understanding the development of how physician compensation is associated with the use of hospitalists has largely gone unexplained under the current managed health care delivery system. Therefore, the present empirical research seeks to explore, using a nationally representative data of 6,628 practicing physicians, determinants of the use of hospitalists in relation to physician compensation.

The goal of this analysis is twofold:

1. To estimate the prevalence rate of hospitalist utilization among physicians at the national level; and
2. To understand a link between hospitalist utilization and physician compensation.

Methods

Data


A total of 6,628 physicians in the United States participated in this telephone survey, using computer-assisted telephone interviewing technology. The study reports a response rate of 52.4 percent, and all participating physicians received $25 for their time. A list of physicians was provided by the American Medical Association (AMA) and the American Osteopathic Association (AOA), and the survey was conducted between June 2004 and July 2005.

The study participants included American physicians providing direct patient care for at least 20 hours a week. Certain physicians excluded from the survey include federal employees, specialists who do not provide direct patient care, foreign medical graduates with temporary licenses, residents, interns, fellows, and physicians whose names could not be disclosed to outsiders. The stratified random sampling technique was used to study survey participants. More detailed information on the data collection and methodology are described elsewhere.

Measurement

Dependent Variable

Hospitalist utilization has been increasing in the past decade and understanding what is determining the use of hospitalists remains important. This study uses the extent to which hospitalists were utilized in practice as the dependent variable. The survey specifically asks participants, “What percentage of your patients who were hospitalized last year...
had a hospitalist involved in their inpatient care?” The response was in the range of zero to 100 percent.

**Covariate Variables**

Untangling the association between compensation and hospitalist utilization is an important research question unexplored in previous studies. Respondents were asked whether physician compensation is affected by:

1. Own productivity;
2. Satisfaction surveys completed by the physician’s own patients;
3. Specific measures of quality care;
4. Practice profiling; and
5. Overall financial performance of one’s practice.

The response was categorical (no = 0, yes = 1).

The survey measured practice revenue by asking each respondent about the percent of patient care practice revenue coming from:

1. Medicare;
2. Medicaid;
3. Capitation (prepaid basis); and
4. All managed care.

The response was in the range of zero to 100 percent.

Annual income was assessed by the question: “During 2003, what was your own net income from the practice of medicine to the nearest $1,000, after expenses but before taxes?” The response was in the range of 1–7:

1 = $0–$49,999;
2 = $50,000–$99,999;
3 = $100,000–$149,999;
4 = $150,000–$199,999;
5 = $200,000–$249,999;
6 = $250,000–$299,999; and
7 = > $300,000.

Control variables in the analysis included:

- Age:
  1 = 1940 or earlier;
  2 = 1941–1945;
  3 = 1946–1950;
  4 = 1951–1955;
  5 = 1956–1960;
  6 = 1961–1965;
  7 = 1966–1970; and
  8 = 1971 or later;
- Gender (male = 1, female = 2); and
- Race (other = 1, white = 2).

Given most hospitalists come from internal medicine, it is important to control specialty to detect interdependent relationships among variables:

1 = Internal medicine;
2 = Family/general practice;
3 = Pediatrics;
4 = Medical specialties;
5 = Surgical specialties;
6 = Psychiatry; and
7 = OB/GYN.

Specialties thereby were controlled in the analysis.

**Analysis**

The statistical software package STATA 10.1 was used for all data analyses. Descriptive analyses were performed to generate mean values and standard deviations.
for all variables included in the analysis. A multivariate linear regression analysis was conducted to identify determining factors of hospitalist utilization. Several possible confounding factors (age, gender, race, and specialty) were included and controlled in the regression analysis. Using variance inflation factors (VIFs) statement command available in STATA, we tested for multicollinearity. No variable had a tolerance value lower than 0.1., suggesting that all variables analyzed in the regression model are stable. All of the data analyses were fully adjusted, using the weight variables given in the data, in order to represent a national sample.

Results

Most respondents were male (72.07 percent) and white (77.25 percent). About 34 percent of the sample reported that they did not utilize hospitalists one year prior to the survey (not shown in figures). Figure 1 presents descriptive statistics of the sample. Figure 2 highlights results of a multivariate linear regression analysis, indicating determinants of the utilization of hospitalists in relation to compensation. Compensation affected by productivity and practice profiling was not significantly linked to the use of hospitalists after controlling for other variables (patient care revenues, annual income, gender, race, and specialty).

Compensation affected by patient satisfaction survey ($\beta = 5.74$, $p < .001$) and quality of care ($\beta = 6.90$, $p < .001$) were positively associated with hospitalist utilization, whereas compensation affected by financial performance was negatively associated with the usage of hospitalists ($\beta = -2.92$, $p < .020$). Patient care revenues from capitation ($\beta = .118$, $p < .001$) and managed care ($\beta = .062$, $p < .006$) were positively linked to hospitalist usage. Finally, no other variables controlled in the study were found significant, except for medical specialty, which was negatively associated with the use of hospitalists ($\beta = -3.83$, $p < .001$), suggesting that internal medicine specialists are more likely to approve the hospitalist model.

Discussion

To our knowledge, this analysis is the first empirical effort, using a nationally representative survey data of 6,628 physicians, to identify determining factors of the utilization of hospitalists in relation to compensation. We found an association between compensation and the use of hospitalists. Hospitalist users were concerned about compensation affected by patient satisfaction and quality of care. Surprisingly, no prior study has tried particularly to understand the effect of quality care on hospitalist compensation. Our study finding may be comparable to prior research\textsuperscript{15} that organizations may benefit from utilizing hospitalists to improve quality of care, which can be directly associated with how physicians get reimbursed.

Some studies validate the importance of quality care and satisfaction linked to the utilization of hospitalists. In a recent study, Lopez \textit{et al.}\textsuperscript{16} found hospitals with hospitalists better performing on quality indicators for acute myocardial infarction (AMI), pneumonia, disease treatments and diagnoses, counseling, and prevention. Comparing process and outcomes in relation to the inpatient care of 182 pediatric patients, Wells \textit{et al.}\textsuperscript{17} found that patients were more satisfied with care rendered by hospitalists. Halpert and colleagues\textsuperscript{18} also reported the similar finding of higher satisfaction among PCPs.
and improved quality of care provided to patients.

In our study, hospitalist users were less likely to be concerned about compensation affected by overall financial performance of their practice, which is in line with economic theory of supply and demand in the current marketplace where labor demand for hospitalists exceeds supply. As an example, hospitalist salary has increased by 13 percent during the past two years (2007–2008).

The 2007 Society of Hospital Medicine (SHM) survey reports that hospitalist salaries increased significantly in recent years while productivity remained the same. Researchers of SHM suggested the shortage of hospitalists as a possible explanation of rising hospitalist compensation. However, a review of the literature reflects discrepancy in understanding whether the hospitalist model is linked to a favorable personal financial performance. Several studies report that many hospitals utilizing hospitalists experience financial difficulties. Landrigan et al. found efficiency of the hospitalist model (e.g., cost reduction, reduced LOS), but efficiency gains failed to generate revenues for the hospitalist programs and most hospitalist

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Mean Scores (SD)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of hospitalists</td>
<td>6,107</td>
<td>29.95 (37.71)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Compensation affected by productivity</td>
<td>5,046</td>
<td>.70 (.45)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Compensation affected by satisfaction</td>
<td>5,030</td>
<td>.24 (.43)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Compensation affected by quality care</td>
<td>5,034</td>
<td>.20 (.40)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Compensation affected by practice profiling</td>
<td>5,009</td>
<td>.13 (.34)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Compensation affected by financial performance</td>
<td>5,030</td>
<td>.68 (.46)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Patient care revenue from Medicare</td>
<td>6,628</td>
<td>31.62 (22.55)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Patient care revenue from Medicaid</td>
<td>6,628</td>
<td>16.67 (18.26)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Patient care revenue from capitation</td>
<td>6,628</td>
<td>13.46 (23.78)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Annual income*</td>
<td>6,622</td>
<td>4.18 (1.79)</td>
<td>1</td>
<td>7</td>
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<tr>
<td>Patient care revenue from all managed care</td>
<td>6,628</td>
<td>40.56 (28.08)</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Age**</td>
<td>6,628</td>
<td>4.45 (1.92)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Gender</td>
<td>6,628</td>
<td>1.25 (.43)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>6,535</td>
<td>1.78 (.41)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Specialty</td>
<td>6,628</td>
<td>3.75 (1.68)</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

* A 7-point scale: (1) < $49,999; (2) $50,000–99,999; (3) $100,000–149,999; (4) $150,000–199,999; (5) $200,000–249,999; (6) $250,000–299,999; and (7) > $300,000.
** An 8-point scale: (1) 1940 or earlier; (2) 1941–1945; (3) 1946–1950; (4) 1951–1955; (5) 1956–1960; (6) 1961–1965; (7) 1966–1970; and (8) 1971 or later.
programs in their review faced financial difficulties. A recent study by Tieder et al.\textsuperscript{21} also reports a similar finding that pediatric hospitalist programs in a community hospital experienced a substantial financial deficit. Based on a systematic review of financial performance among pediatric hospitalists, another national survey\textsuperscript{22} reported that only 12 percent of hospitalists were compensated through a model of 100 percent productivity incentives.

Contrary to the aforementioned studies negating the hospitalist model in financial performance, a number of different studies support significant reductions in resource use (\textit{e.g.}, hospital costs and LOS). In an extensive review of the literature, Wachter and Goldman\textsuperscript{23} reported the finding of cost reductions by utilizing hospitalists.

One core finding is that the role of managed care is significant in predicting hospitalist system patient care revenue. This may be due to at least two reasons. The very first hospitalist program started in the high HMO penetration market\textsuperscript{24} and thereby naturally developed with the managed care system. In addition to hospitalist historical evolvement with managed care, several studies support the linkage of managed care affiliation with the usage of hospitalists. Harrison and Ogniewski\textsuperscript{25} reported that organizations utilizing hospitalists are

### Table: Results of a Multivariate Regression Analysis on the Utilization of Hospitalists

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE</th>
<th>t</th>
<th>P</th>
<th>95% CI</th>
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<tr>
<td>Intercept</td>
<td>38.35</td>
<td>4.51</td>
<td>8.50</td>
<td>&lt;.001</td>
<td>(29.50, 47.20)</td>
</tr>
<tr>
<td>Compensation affected by productivity</td>
<td>-1.822</td>
<td>1.27</td>
<td>-1.43</td>
<td>.152</td>
<td>(-4.31, 0.67)</td>
</tr>
<tr>
<td>Compensation affected by satisfaction</td>
<td>5.74</td>
<td>1.65</td>
<td>3.48</td>
<td>&lt;.001</td>
<td>(2.50, 8.97)</td>
</tr>
<tr>
<td>Compensation affected by quality care</td>
<td>6.90</td>
<td>1.90</td>
<td>3.62</td>
<td>&lt;.001</td>
<td>(3.16, 10.63)</td>
</tr>
<tr>
<td>Compensation affected by practice profiling</td>
<td>2.84</td>
<td>1.96</td>
<td>1.44</td>
<td>.149</td>
<td>(-1.01, 6.69)</td>
</tr>
<tr>
<td>Compensation affected by financial performance</td>
<td>-2.92</td>
<td>1.26</td>
<td>-2.32</td>
<td>.020</td>
<td>(-5.40, -0.45)</td>
</tr>
<tr>
<td>Patient care revenue from Medicare</td>
<td>-0.006</td>
<td>0.026</td>
<td>-0.23</td>
<td>.817</td>
<td>(-0.05, 0.04)</td>
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<tr>
<td>Patient care revenue from Medicaid</td>
<td>.006</td>
<td>0.031</td>
<td>0.20</td>
<td>.844</td>
<td>(-0.05, 0.06)</td>
</tr>
<tr>
<td>Patient care revenue from capitation</td>
<td>.118</td>
<td>0.025</td>
<td>4.68</td>
<td>&lt;.001</td>
<td>(0.06, 0.16)</td>
</tr>
<tr>
<td>Annual income</td>
<td>.271</td>
<td>.34</td>
<td>.78</td>
<td>.434</td>
<td>(-0.40, 0.95)</td>
</tr>
<tr>
<td>Patient care revenue from all managed care</td>
<td>.062</td>
<td>0.022</td>
<td>2.77</td>
<td>.006</td>
<td>(0.01, 0.10)</td>
</tr>
<tr>
<td>Gender</td>
<td>2.452</td>
<td>1.35</td>
<td>1.80</td>
<td>.071</td>
<td>(-0.21, 5.11)</td>
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<tr>
<td>Age</td>
<td>.069</td>
<td>.31</td>
<td>.22</td>
<td>.823</td>
<td>(-0.53, 0.67)</td>
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<td>(-4.54, -3.13)</td>
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<td>4,457</td>
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</tr>
</tbody>
</table>
located in communities with higher HMO penetration. Molinari and Short\textsuperscript{26} revealed hospitalists being efficient in managing HMO patients. In a retrospective cohort study to understand efficiency in a managed care setting, Srivastava and colleagues\textsuperscript{27} report hospitalists being efficient and reducing costs in an HMO (\textit{e.g.,} reduced LOS from two days to one day, which resulted in an average cost-per-case reduction of $105.51 for asthma patients).

Capitation-based patient revenue was also significant in predicting the utilization of hospitalists, which can be explained by the fact that capitation is a primary reimbursement method for physician services under the managed care delivery system. In our study, nearly half (48 percent) of respondents reported that their patient care revenue came from capitation or a fixed payment system, which is in line with Coffman and Rundall.\textsuperscript{28} In their careful review of the literature, Coffman and Rundall concluded that hospitals under capitation would benefit from using hospitalists because hospitals maximize revenue by reducing LOS. However, this finding is not in line with Lindenauer \textit{et al.}\textsuperscript{29} whose study revealed that salary was the most common method of reimbursement and only 3.6 percent of the surveyed hospitalist were reimbursed based on capitation. The difference may be explained by several factors including the rationale of the study, study design, and sample size. Particularly, practicing hospitalists were studied by Lindenauer and colleagues,\textsuperscript{30} whereas hospitalist-using physicians were assessed in our study.

This study has several limitations. Our study is subject to response bias particularly as we measured respondent perceptions which by nature are biased. Our findings may not represent those physicians who are excluded from the survey. These physicians include federal employees, specialists who do not provide direct patient care, foreign medical graduates with temporary licenses, residents, interns and fellows, and physicians whose names could not be disclosed to outsiders. Our findings also may not represent all hospitalists in practice as we assessed only physicians who utilize hospitalists instead of practicing hospitalists. Thus, caution is needed when projecting our findings to practicing hospitalists. Finally, this study is cross-sectional and hence it did not investigate the causal relationship between physician compensation and hospitalist use. A longitudinal study may more correctly estimate the causation between the two.

In conclusion, this analysis extends the hospitalist literature by investigating the association between physician compensation and the hospitalist model. We found that hospitalist users were concerned with compensation in relation to quality care and satisfaction, but they were less likely to be concerned with compensation linked to financial performance and productivity. This may pose a threat to many hospitals with hospitalists as the Center for Medicare & Medicaid Services (CMS) looks for evidence-based practices and emphasizes the importance of pay-for-performance (P4P).\textsuperscript{31} A future study may benefit from exploring alternatives of improving financial performance and productivity in the context of hospitalist compensation. Our study also documents that managed care and personal physician capitation are associated with the utilization of hospitalists. These aforementioned findings are important keys to understanding the determinants and utilization of hospitalists and their relationships to individual physician compensation.
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15. Supra, n.10.
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Hospital Productivity and Information Technology

Steven R. Eastaugh

Information technology and linear programming help to control hospital costs without harming service quality or staff morale. This study presents production function results from a study of hospital output during the period from 2005 to 2008. The results suggest that productivity varies widely among the 58 hospitals as a function of staffing patterns, methods of organization, and the degree of reliance on information support systems. Information technology (IT) can enhance the marginal value product of nurses and staff, so that they concentrate their workday around patient care activities. Financial incentives also help to enhance productivity. Incentive pay for nurses based on productivity gains is associated with improved productivity. One should get the greatest output for the least input effort, better balancing all factors of service delivery to achieve the most with the smallest resource effort. Key words: productivity, information technology (IT), nurse scheduling, productivity measures, incentive pay.

Ask delegation and the allocation of staff within the hospital have become major financial issues. The traditional productivity assessment emphasizes tasks, activities, and technical efficiency. A more global vision of productivity asks: What support systems can improve productivity? Support systems that enhance productivity include: automated scheduling systems utilizing linear programming and electronic health records (EHRs). President Obama has pledged $50 billion over five years to help fund the transition to “standards-based” electronic health information systems. President Obama has pledged $50 billion over five years to help fund the transition to “standards-based” electronic health information systems. Scheduling systems and EHRs can transform our health care system by making it safer, more efficient, and more cost-effective. Information technology (IT) support has the potential to improve quality, enhance staff morale, and reduce costs. The Institute of Medicine reports that EHRs can reduce more than half the 1.5 million Americans injured every year by prescribing errors. In July 2008, the Congress passed a law providing Medicare bonuses to physicians who use electronic prescribing, and for penalties beginning in 2012 to those who do not. The Department of Health and Human Services estimated that that will save Medicare $156 million over five years.

According to Peter Drucker, productivity is the first test of management’s competence. A hospital manager should get the greatest output for the least input effort, better balancing all factors of care delivery to achieve the most with an optimal level of quality. A number of exogenous factors can affect productivity. For example, nurse staff flexibility is enhanced during tight low-wage inflation periods. When nurse wage inflation is under control, nurses are less likely to protest productivity improvement programs. Implementing efficient nurse scheduling systems and work-unit reorganizations,

Steven R. Eastaugh is Professor of Finance and Health Economics, Department of Health Services Management and Policy, George Washington University, Washington, DC.

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especially when reinforced by an incentive-pay plan, can reduce costs significantly. Productive managers must be change agents, not overcommitted to the existing ways of doing things. The hidebound, tradition-based hospital that does not adopt IT support systems will not survive. Scheduling is key in productivity enhancement. Three critical actors—the patient, the employee, and the physician—must be scheduled for improved productivity. Better scheduling of all three groups can reduce unnecessary activity flow, reduce unit costs, improve patient satisfaction, and reduce waiting time for both providers and patients.

Scheduling systems for physicians can reduce costs through reducing downtime (wasted time). When an operating room (OR) mishandles case scheduling, cost overruns result from either underutilization or overtime wages. The University of Michigan Medical Center has been a pioneer in OR scheduling. Operating room scheduling efficiency is improved by scheduling on the basis of patient DRG, severity level, and surgeon (speed based on past experience). Scheduling policies were made uniform across all departments, and a service-specific scheduler was assigned in each area (one person for cardiac surgery, one for ophthalmology, and one for general surgery). The specialist in scheduling knows how to collect information, stagger schedule time blocks, minimize misscheduled cases, call surgeons if necessary, and collectively make optimal use of the 33 OR suites. (They experienced only 10 percent downtime.)

Productivity improvement involves more than utilizing linear programming to set schedules. The department manager and the scheduler emphasize identifying problem areas, team building, implementing successful remedies, and holding and extending performance gains. The job of quality control never ends because improvement criteria require effort to maintain the new high levels of performance and productivity. By avoiding mistakes and useless units of activity, gains in productivity occur as quality improves.

Hospital staffing ratios should be set in proportion to forecast workloads. In scheduling nurses, for example, if the workload on day shifts is three times as high as that on night shifts, it would be illogical to provide the same number of nurses over all three shifts. Similarly, even when workload is unscheduled, as in the emergency room, patterns of utilization are predictable. A sample survey over a few months demonstrates the days and shifts that have the highest workload, and staffing should be proportionate to the predicted demand. Additional adjustment for seasonal changes and case-mix severity can be made. 5

A basic requirement of a scheduling system is that it preserve morale and meet the personal needs of employees for days off, vacations, birthdays, and holidays. In addition, employees must believe that the scheduling process is fair and impartial. Unfortunately, many hospitals use manual scheduling systems that are unresponsive to subtle shifts in workload and that are perceived as being unfair. It is amazing that personnel are still manually scheduled in an industry that spends more than five billion dollars each week. For example, if 12 nurses are scheduled over a month so that each nurse works 22 days, disregarding all constraints, there would be 1.5 million schedules possible. 6 It is hard to imagine that human ingenuity, even under no other constraints, could develop the best schedule. A computerized scheduling system can select the best schedule without hours of
paperwork, hassles, and appeals. The computer can provide convincing documentation of fairness, demonstrating that weekend assignments and shift changes (AM to PM to nights) have been equalized. Frequently, one finds capable employees being promoted to “scheduler” without even having been taught the importance of, or techniques for, efficient scheduling. Computer-generated schedules are guided by efficiency and quality, and not by interpersonal relationships.

Nurses should be allocated to account for acuity of the level of care a patient needs. The goal is acuity-driven workload staffing, not merely census-driven staffing. However, even the most refined industrial engineering methodology can be undercut if management eschews flexibility in favor of a fixed decision rule; for example, that each nurse is allowed every other weekend off. Such a rule results in overstaffing on the weekend or on one or two of the weekdays. Nursing costs and morale can be improved by forecasting nontraditional staffing arrangements. Flexible use of part-time staff and combinations of two 12-hour shifts and two eight-hour shifts for some full-time nurses can ensure a better match between workload and FTEs.

Background

A fully functional EHR system is defined as having the capability to:

- Record patients’ clinical and demographic data;
- View and manage results of laboratory tests and imaging;
- Manage order entry, including electronic prescription and the ability to order tests and imaging; and
- Support clinical decisions, including warnings about drug interactions or contradictions.

A basic EHR system is one that allows just some of the first three of these functions. The fourth function of an ideal EHR is computerized physician order entry, or CPOE. When a physician uses CPOE to enter a prescription, the system alerts him or her to potential interactions with other drugs the patient is taking. Common dosages, contradictions such as pregnancy, and patients’ allergies are also flagged. Goals set by the federal government call for EHRs to be standardized and interoperable, meaning that multiple clinics and hospitals should be able to access and update them as patients seek treatment at multiple locations. The 2005 Rand Corporation Study suggests reducing 404,000 unnecessary deaths through EHR improvements, disease management, and prevention would save hospitals $51.7 billion.

Nurse scheduling systems set staffing patterns for registered nurses (RNs) and nurse extenders (NEs). NE technicians became popular because the hospital sector experienced difficulty in finding a sufficient supply of RNs for primary nursing staffs. Some nursing groups were not receptive to the NE concept because of fears that it represented a return to team nursing and under trained licensed practical nurses (LPNs) with a new job title. However, task delegation to NEs by itself does not undermine the standardization of nurse education. In fact, the realization that the nation needs more caregivers and that NEs will still be under the control of the nursing department prompted the nursing literature to become less militant. Now an NE is referred to in the literature as a “technical assistant to an experienced RN as a primary
partnership,” or an “executive administrative assistant assisting the executive nurse.” Such glowing titles may seem unimportant to economists, but in the workplace it is important for job retention that NEs not be labeled reborn LPNs who do “scutwork” or “menial tasks.” One profession’s menial task is another profession’s vital activity, so NEs spend most of their workday performing a “noninterpretive” collection of vital signs, EKGs, lab slips, and paperwork. One last factor that can impact productivity is outsourcing.

We have seen a climb up the value chain of services in recent years—from back office support functions to what the industry calls “knowledge outsourcing.” Knowledge outsourcing includes the offshore physician in India offering diagnostic services—particular imaging, such as X-rays and mammograms—and consultation specialists. Teleradiology in particular, in which X-rays are taken at one location and then transmitted to doctors at another site can enhance productivity and cut costs. Radiology images taken in the middle of the night are still read right away by a wide-awake radiologist working at the height of his or her own powers. In most cases, the offshore clinicians are trained in the United States. A second area where offshore outsourcing is working is in American hospitals in hardware network management and engineering design.

Data and Methods

Production-function studies of technical efficiency (productivity) have been done by economists since the 1930s. Production functions are useful to understand how resources are combined by the department or firm (hospital) to produce some particular level of output and ascertain how these resources complement or substitute for one another in the service production process. A number of recent studies have analyzed production functions in business and in the hospital sector.

The first major study of American hospital production functions involved a sample of 60 Ohio nonteaching hospitals. Hellinger utilized a translog (transcendental logarithmic) production function, which attenuates or eliminates restrictions on the functional form, thereby leaving as much generality and flexibility in the service production estimation process (in contrast to the traditional Cobb-Douglas model). The translog form used in this study involves two basic assumptions. First, managers monitor nursing costs when deciding the appropriate staff mix and range or level of hospital output and nurse workload. This assumption does not mean that nurse managers are perfect cost-minimizers operating at the production possibility frontier of 100 percent technical efficiency. The second assumption is that nursing departments exhibit constant returns to scale in producing their output. Consequently, there is no reason to presuppose that nurses are any more productive in a 900-bed hospital than in a 90-bed hospital. Previous hospital cost studies, not focused on the nursing department, report very shallow economies of scale of only 8 percent.

In comparing isoquants—curves producing the same output for different quantities of inputs—two extreme situations can exist. Under perfect complementary production between inputs, no substitution at all is possible between inputs A and B, and inputs A and B must always be used in fixed proportions (isoquants are straight downward sloping lines). Under the opposite extreme, perfect substitutability between inputs defines the isoquants as perfect right angles. In the first step
in the data analysis a translog production function will be estimated from data at 58 hospitals. The second step measures the curvature of the nursing isoquants and thereby the substitution among inputs (the elasticity of substitution).

Since nursing is a complex production process, we will be assessing a production process with six-dimensional isoquants. Between each pair of inputs partial elasticities of substitution will be measured (e.g., RN x NE substitution). The six basic inputs studied include:

- NE = nurse extender;
- RN = registered nurses;
- H = housestaff/residents and interns performing some nursing activities while understaffed;
- A = clerks, LPNs, and nurse aides;
- E = capital; and
- ElecF = inputs for Electronic Health Records, outsourcing radiology, and outsourcing laboratory tests.

Collection of data on labor inputs is straightforward and has been done in a number of previous studies. Nursing output is specified by a point-scoring system sold by the largest proprietary vendor of nurse workload and nurse scheduling systems. This same system tracks work hours to measure the contribution of nonphysician labor inputs (input factors 1, 2, and 4). Housestaff/resident and intern input was not measured on an annual basis, but in two years, 2005 to 2008. Filled residency slots have been largely time-invariant for the 16 sample teaching hospitals, and physician labor in nursing activities only ranges from 0.1 to 1.1 percent of nursing activities. To not include this measured work input in the analysis would slightly overstate the productivity of nursing departments in certain hospitals.

One last caveat must be presented concerning measurement error in this study: measurement of capital inputs must avoid the pitfalls of using depreciation charges to more accurately reflect differences in the age and productivity of the capital stock. I have used the same index employed in a previous study to adjust the capital expenses for differences across the 58 sample hospitals in the average age of their capital stock. For each hospital the ratio of accumulated depreciation to total assets is taken as a measure of age. Age-adjusted capital input was calculated as follows:

\[ E = UA \times \text{Exp}(M - R) \]  
\[ \text{Where } UA = \text{unadjusted capital expenses} \] 
\[ R = \text{ratio of accumulated depreciation to total assets} \] 
\[ M = \text{mean value of } R \text{ for the sample} \] 
\[ \text{Exp} = \text{inverse natural logarithm.} \]

The sample is a convenience sample of hospitals with nursing activity research programs. Obviously, the sample is not generalizable to all American hospitals. The more progressive hospitals, with active support for health services research, may have production technologies (scheduling and staff education) that are more advanced than the average American hospital. Each of the sample hospitals subscribed to the same nurse workload system, and the hospitals ranged in size from 106 to 904 beds. The hypothetical frontier production can be expressed as:

\[ y_{ij} = \Pi(X_{ijk}) \beta k u_{ij} \]  
\[ k \]
\[ \text{where } y_{ij} = \text{the nurse output of the jth hospital in the ith period for periods 1–4 (2002–2005)} \]
Xijk = kth input applied by the jth hospital in the ith period.

If the hospital realized its full technical efficiency at 100 percent, then uj takes the value zero, and if not, uj takes a value less than zero depending on the extent of its lost productivity. The euij term provides a measure of hospital specific productivity, and improvement in euij shall be reflected in higher mean productivity over time. Inefficiency is:

\[ U_{ij} = \ln y_{ij} - (\sum\beta_k \ln X_{ijk} + v_{ij}) \]  
(3)

Estimation of uj and euj is possible once density functions for u and v are assumed. Let u follow a half-normal distribution and v follow the full normal distribution. (The validity of the half-normal distribution was verified at the end of the analysis by plotting the combined residual (u + v), the hospital’s technical efficiency and the output levels.) Equation 2 can be rewritten as

\[ Y_{ij} = \pi (X_{ijk}) \beta_k e_{E_{ij}} \]  
(4)

where \( E_{ij} = u_{ij} + v_{ij} \).

The estimation of the maximum possible stochastic output, had the hospital realized its full technical efficiency, is carried out by applying maximum likelihood methods\(^2\) to equation 4. With this model one can estimate individual hospital technical efficiencies together with the mean technical efficiency using four years of panel data (dummy variable D (0,1) for the three years after the base year 2005). One can hopefully also target some factors causing variation in technical efficiencies in nursing among the 58 sample hospitals.

**Empirical Results**

Maximum likelihood methods of estimation were applied to equation 4 and the parameter estimates of the translog model are presented in Figure 1. The ratio of hospital specific variability in productivity was significant at the .1 level, indicating that productivity dominates in explaining the total variability of nurse output produced. Judging by the significance of the dummy variables, we can reject the hypothesis that productivity was time-invariant over the four years. Most of the parameters not involving the two weakest variables (H and E) are significant at the .05 level.

A second alternative partial elasticity can also be derived. The Allen elasticity of substitution holds constant the quantities of all other inputs, in addition to the level of nurse output. The Allen elasticities are related econometrically to the cross-price elasticity of demand for factors; for example, the demand for input 1 (NEs) to change the price of input 2 (RNs). The sign of a cross-price elasticity of demand (column 3 of Figure 2) by itself is an indicator of gross substitution—a negative sign indicating complementary factors, a positive sign indicating substitution. As line 15 of Figure 2 reveals, a negative sign on the elasticity of demand for NE labor with respect to the price of RN labor indicates that as RN labor becomes more costly, the labor of NEs is used less extensively in place of RNs. On the positive side this suggests that NEs and RNs are complementary team members, not in competition with each other. On the other hand, this suggests that a rapidly inflating and costly all-RN staff trades efficiency by avoiding the opportunity for NE-induced productivity gains. Moreover,
using nonemployee RNs, the temporary agency nurses, can cost many urban hospitals up to $60 to $110 per hour.

The NEs substitute fairly well and fluidly for clerks and LPNs (line 16 of Figure 2) while complementing RNs. A positive sign in line 12 (see Figure 2) on the elasticity of demand for NE labor with respect to the price of household (resident) labor indicates that, as housestaff labor (H) becomes more costly per hour, the labor of NEs is used more extensively in place of residents. As some state regulators and hospital managers have moved to restrict housestaff work week—fewer hours at the same fixed annual wage—this raises the hourly wage of the housestaff and raises the employment level of NEs. However, the negative sign in line 13 of Figure 2 reveals that no increase in RN employment can be expected as same states implement a maximum hourly workweek for housestaff/residents and interns.

Lines 10, 11, 14, and 19 in Figure 2 have the expected positive signs, indicating that labor can substitute for capital (.01 level of significance). Line 11 has the highest observed elasticity, suggesting that the highly skilled MD component of housestaff/residents—their technical diagnostic skill as doctors—partially substitutes for more equipment and physical capital. This generalization may be increasingly true in the future as more residents benefit from economic grand rounds, “think before ordering tests” educational programs, and the cost-effective clinical decision-making ethic of younger doctors trained in health economics.

From observing the three dummy variables at the top of Figure 1, more productivity for this sample of 58 hospitals was not time-invariant over the four-year period. Mean

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimate* (Maximum Likelihood)</th>
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<tr>
<td>D1, 2006</td>
<td>0.028</td>
</tr>
<tr>
<td>(17.8)</td>
<td></td>
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<tr>
<td>D2, 2007</td>
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</tr>
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<td>(30.1)</td>
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<tr>
<td>D3, 2008</td>
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<tr>
<td>(38.8)</td>
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</tr>
<tr>
<td>ßElecF/RN</td>
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</tr>
<tr>
<td>(26.9)</td>
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<tr>
<td>ßElecF/H</td>
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<td>(41.5)</td>
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<tr>
<td>ßElecF/A</td>
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<td>(47.8)</td>
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<td>(16.2)</td>
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<tr>
<td>(14.9)</td>
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<td>ßH,NE</td>
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<tr>
<td>(34.8)</td>
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<tr>
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<td>(13.9)</td>
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<td>(19.1)</td>
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<td>(35.8)</td>
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<td>(2.7)</td>
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<td>ßA,E</td>
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<tr>
<td>(11.7)</td>
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<tr>
<td>Constant α</td>
<td>0.043</td>
</tr>
<tr>
<td>(9.2)</td>
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</tbody>
</table>

* t-values in parentheses; log likelihood = -38.618
Note: NE = nurse extenders, RNs; H = house staff/residents and interns; A = clerks, LPNs, and nurse aides; E = capital; ElecF = electronic health records and outsourcing (lab and radiology).
nurse productivity for each cross-section equation improved from .74 to .81 from 2005 to 2008. In the most recent year, nursing departments were realizing only .81 of their technical efficiency (productivity) and while averages are interesting, distributions are more policy relevant.

Figure 3 lists the average productivity level across the 58 nursing departments and the factor input (NEs) with the two highest t-values (from Figure 1). Individual nurse productivity ratings range from .61 to .94. Figure 3 suggests discrete differences in production technologies as well as differences in input mix. This wide range could in theory reflect differences in organizational efficiency or differences in the availability and use of factor inputs.

<table>
<thead>
<tr>
<th>Input Pairs</th>
<th>Partial Elasticity</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. NE/NE</td>
<td>-0.189*</td>
<td>Complements</td>
</tr>
<tr>
<td>2. RN/RN</td>
<td>-0.162*</td>
<td>Complements</td>
</tr>
<tr>
<td>3. H/H</td>
<td>-0.170*</td>
<td>Complements</td>
</tr>
<tr>
<td>4. A/A</td>
<td>-0.125*</td>
<td>Complements</td>
</tr>
<tr>
<td>5. E/E</td>
<td>-0.254*</td>
<td>Complements</td>
</tr>
<tr>
<td>6. ElecF/ElecF</td>
<td>-0.228*</td>
<td>Complements</td>
</tr>
<tr>
<td>7. ElecF/A</td>
<td>0.512</td>
<td>Substitutes</td>
</tr>
<tr>
<td>8. ElecF/H</td>
<td>0.348</td>
<td>Substitutes</td>
</tr>
<tr>
<td>9. ElecF/RN</td>
<td>0.193</td>
<td>Substitutes</td>
</tr>
<tr>
<td>10. NE/E</td>
<td>0.156</td>
<td>Substitutes</td>
</tr>
<tr>
<td>11. H/E</td>
<td>0.332</td>
<td>Substitutes</td>
</tr>
<tr>
<td>12. H/NE</td>
<td>0.579</td>
<td>Substitutes</td>
</tr>
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<td>13. RN/H</td>
<td>-0.352</td>
<td>Complements</td>
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<td>14. RN/NE</td>
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<td>15. RN/NE</td>
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<td>16. A/NE</td>
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<td>-0.039</td>
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<td>18. A/RN</td>
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<td>19. A/E</td>
<td>0.081</td>
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</tr>
<tr>
<td>20. NE/ElecF</td>
<td>0.057</td>
<td>Substitutes</td>
</tr>
</tbody>
</table>

*The own-price elasticities have the expected negative sign. Note: NE = nurse extenders, RNs; H = housestaff/residents and interns; A = clerks, LPNs, and nurse aides; E = capital; ElecF = electronic health records and outsourcing (lab and radiology).
(e.g., a shortage of nurses). However, the eight hospitals with the worst nursing productivity at the top of Figure 3 employed no NE technicians, operated a 100 percent RN primary care nursing organization, and exhibited productivity 10 percent to 22 percent below average. The 20 hospitals in Figure 3 with the highest levels of nurse productivity made heavy use of NEs: nine used the team nursing organizational concept, but 11 employed primary care nursing with a 60 percent to 65 percent BScN-trained RN staff.21

### Discussion and Conclusions

In summary, the results suggest that:

1. Primary care nursing can be either highly productive or inefficient;
2. The all-RN staff, used in only 11 of the 58 hospitals, reports the worst productivity performance;
3. A shortage of nurses did not drag down productivity levels in Figure 3 as the six cities with the tightest nursing markets contained the nine hospitals with the highest level of productivity; and
4. Employment of NEs reduces wasted labor and enhances productivity.

The last of these four conclusions indicates a number of avenues for future research. For example, the results at the end of the last column in Figure 3 weakly indicate that NEs, as with any labor input, may approach a level of diminishing returns. For example:

- Does having eight to ten NEs per ten RNs constitute a zone of diminishing returns?
- Does a primary care nursing staff with greater than 70 percent BScN-trained RNs constitute an inefficient staff-mix of diminishing returns?
- Does deploying five to eight NEs per ten RNs harm patient care quality?

Judging by the deployment of NEs at prestigious teaching hospitals, task delegation can enhance the quality of patient care.22

Finally, what additional tasks can be delegated to NEs beyond obtaining vital signs and EKG results, patient transport, procuring supplies and equipment, procedural assistance, and paperwork (e.g., lab slips)? Most of the 47 hospitals utilizing NEs have begun to utilize specialist technicians to dress wounds, monitor pumps and catheters, administer tube and IV feedings, and assess physical conditions. Progressive nurse managers will participate in careful studies to set standards, study task delegation feasibility, and circumscribe the job descriptions for NE technicians.23
Some nurse administrators believe that reducing staff results in employees working harder and translates into lower employee morale. Indeed, it is true that if the staff cuts appear abrupt and arbitrary and offer no incentive “carrot” to maintain performance, morale might decline and the most outstanding workers might look elsewhere for job security. Staff cuts can improve morale, however, if employees share in the benefits of cost reduction and understand the new incentives and why things must change. Sixteen of the top 21 high productivity nursing departments in Figure 3 utilized productivity-based incentive pay systems to reward nurses. Implementation of incentives, following a study of task requirements, common skills, job training, flexible staffing, and scheduling, causes the total organization to focus on making a given line of work most productive. With the help of incentives, a hospital can establish and maintain a dedication to high level of productivity and quality service.

At a time when hospital care is becoming more complex and patients are becoming sicker, productivity enhancement is critical. With future funding limitations, “barebones” reimbursement dictates that the recent tradition of a 100-percent RN primary care nursing must be abandoned. Development of an efficient staff-mix criterion in nursing should enhance nursing’s rising sense of professionalism. Maximizing RN hospital employment levels is hardly a desirable or economical goal unless America has a gross oversupply of nurses. Since no such oversupply exists, increased reliance on NEs is good economics, and good medicine. The current nursing shortage has not been eliminated.

The productivity gains of information technology and EHRs are obvious to most of the hospitals in this current study. Consider the medication cycle times. The time it takes for an order to be filled and administered to the patient was reduced in 2009 to eight minutes in one department from 84 minutes. Physicians enjoy the productivity gains. After physicians make hospital rounds in the morning, they do not have to call the nurse in the afternoon or at night to see how a particular patient is doing. They can look it up themselves on the computer and see the current patient information.

Physicians desire an integrated delivery system so the manner in which they enter an order is the same in both locations (private office, hospital). Pharmacists also love EHRs because the typical review time is trimmed from 60 minutes to 15 minutes. Moreover, inpatient lab tests can be reduced by 10 percent due to elimination of duplicate orders.

The five hospitals in this study that outsource radiology in Asia do not report a significant gain in department productivity. If all hospitals had a standard set of productivity measures in radiology, future researchers could better focus on the efficacy of outsourcing.

Health care is the largest sector of the American economy. Thanks to methods to enhance productivity, hospital productivity gains have been better than average. In the years 2000 to 2008 average productivity grew 21.8 percent; and the real income of working-age households declined 3.9 percent ($2,640). Productivity in the hospital sector grew 26.2 percent from 2000 to 2008, and the decline in real inflation adjusted wages was a mere $380. Now, we need the offer of gain-sharing incentive pay to give hospital workers wage enhancement in step with productivity gains.
REFERENCES

21. BScN = Bachelors of Science in nursing.
The current debate over health care reform highlights the pressure on health care providers to continue attempts to control costs. In response to these pressures the oversight of projects geared toward increasing both the efficiency and effectiveness of health care services has become a large component of management focus in today’s health care environment. Projects confronted by health care professionals today may range from projects aimed at improving or outsourcing services, implementation of new software or information systems, or the acquisition and integration of new provider networks.

The expanding importance placed on management of projects in all types of organizations has coincided with a significant body of literature that has focused on determinants of project success. In spite of the great interest in project success the evidence of project failure or at least projects that do not live up to expectations is far too common. The purpose of this article is to integrate factors shown to increase project success within a balanced scorecard (BSC) perspective. The health care industry continues to confront a state of major change. A BSC approach will provide those charged with carrying out major changes with practical guidance designed to increase project and organization success.

The balanced scorecard was popularized by Kaplan and Norton as a broad-based performance report utilizing both financial and non-financial performance measures designed to assist firms in enhancing performance and implementing strategy. The balanced scorecard proposed by Kaplan and Norton consisted of four dimensions:

1. Growth/innovation;
2. Internal processes;
3. Customer; and

These dimensions were chosen because the authors believed that they were likely the most critical aspects that enable organizations to successfully implement their business strategies. The name or number of the dimensions is not critical. However, when designing a balanced scorecard it is critical that management identify the dimensions that contribute to the ability to successfully implement and monitor their business strategies. Examples of using the BSC to enable organizations to successfully implement strategy are widespread. Norrie and Walker examined the benefits of using the balanced scorecard in the management of a project when working with a large telecommunications client. The authors found that a project following a balanced scorecard approach performed better on the key dimensions of on-time, on-budget, and on-quality than a project following traditional project performance metrics.
Figure 1 presents a basic framework for a balanced scorecard for projects. The framework provides a description of project assessment from the four classic scorecard perspectives: customer, internal project process, financial, and growth/innovation. The assessment criteria presented are broad but represent major considerations related to project success developed by Shenhar and Dvir⁶ and the Project Management Body of Knowledge.⁷ These assessment criteria are later expanded upon to reflect a more comprehensive, balanced scorecard evaluation approach designed to ensure project success.

The remainder of this article is organized into three parts. The first section discusses the project life cycle and the corresponding opportunities for measuring project success. The second section presents four dimensions of the balanced scorecard and links them to organizational and project success factors throughout the project life cycle. The final section presents a summary and conclusions. An abbreviated example of using a BSC approach to implement a centralized, electronic dental record system is provided in the Appendix at the end of this article. The new record system will provide a more efficient and secure method of collecting, utilizing, and sharing dental information throughout the medical center in order to improve overall patient care.

Life Cycles and Project Success

Projects by their very definition are temporary endeavors. A project is frequently conceptualized as a series of life cycle stages. The simplest life cycle model has four stages of initiating, planning, executing, and closing. At the end of each stage, an approval must be secured before the project continues. The model in this article includes project selection as part of the initiating stage as well as leveraging project benefits as part of the closing stage. Figure 2 shows this project life cycle model and the typical level of organizational effort and resources dedicated to the project over its life cycle. The figure also depicts outcomes or stage ending gates and other approvals and measures that take place over the project life cycle. Many organizations have more detailed project life

---

**Figure 1. Balanced Scorecard Approach to Project Monitoring and Control**

<table>
<thead>
<tr>
<th>Customer</th>
<th>Internal Project</th>
<th>Finance</th>
<th>Growth/Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>Integration</td>
<td>Schedule</td>
<td>Participant development</td>
</tr>
<tr>
<td>Quality</td>
<td>Risk</td>
<td>Cost</td>
<td>Knowledge management</td>
</tr>
<tr>
<td>Stakeholder satisfaction</td>
<td>Communications</td>
<td>Profit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procurement</td>
<td>ROI</td>
<td>Market Share</td>
</tr>
</tbody>
</table>

cycle models, but the concept remains the same.

The life cycle of a project begins with the selection and initiating phase. This phase would include feasibility studies and clearly identified objectives, including scope, benefits, risks, and preliminary projections of cost and time. The selection and initiating phase typically concludes with the approval of a project charter. Next, in the planning stage, the objectives subject to specific quality cost and time constraints are identified. In this phase a planning document of all actions necessary to execute the project is prepared. At the conclusion of the planning stage the project is launched and monitoring project progress occurs throughout the execution and completion cycles. The main purpose of monitoring include the opportunity for project members and organizations to learn and grow from lessons learned while executing the project. The completion cycle should include a post-audit of the degree to which initial objectives of stakeholders were, in fact, achieved. The process of monitoring and control, as well as evaluation of success, and learning and growth can be enhanced by measuring the progress of the project throughout its life cycle using a balanced scorecard approach.

**Evaluation of Project Success Using a Balanced Scorecard**

A project can be envisioned as a temporary organization. From this perspective it makes sense to evaluate the project considering factors that are used in assessing organizational performance. A project balanced scorecard should be developed that maps into the organization’s scorecard utilizing either the
four classic scorecard perspectives or those perspectives unique to the project being evaluated. For each perspective the scorecard should contain objectives, measures, and targets to be met during the project’s life cycle.

The scorecard should contain quantifiable measures associated with each stage of a project’s life cycle and should allow for qualitative inputs related to lessons learned. The balanced scorecard motivates project managers and their teams to concentrate on those criteria and objectives identified as most critical to the project’s strategic success.

Measures for the suggested scorecard dimensions can be based on factors for project success as identified by Shenhar and Dvir. These suggested measures of success typically focus on the closing stage, but identifiable evaluation measures must be delineated at each gate. Although these may mirror the final evaluation metrics, the information gathered from measurement throughout the project life cycle can identify potential problem areas, additional risks, and whether the project is on the path to a successful completion.

Thus, additional scorecard measures are included in the discussion below as adapted from best practices presented in A Guide to the Project Management Body of Knowledge. At each gate, one measure is often the key objective, and the sponsor may select up to four or five additional criteria that are important at a given project stage. Figure 3 expands the basic framework presented earlier in Figure 1 and provides suggested BSC measurements during the project life cycle.

This expansion presents potential key objectives at each stage of the project. Of course, the importance of certain measures will vary across organizations and projects. An organization may develop measures for each stage at the project outset. Alternatively, the organization may adopt a rolling wave approach by developing measures at the end of each stage of the project before the next stage begins. Regardless of the approach taken, passage through each approval gate should include a report that looks back over the time period since the last report, looks at the current time period between this report and the next one, and looks further forward to future events in the project. A discussion of considerations and corresponding measures related to each of the scorecard dimensions is presented below. In addition, a brief business case related to the implementation of a new dental records system and the corresponding scorecard dimensions and measures is provided in the Appendix at the end of this article.

Customer Perspective

Perhaps no perspective is more important in managing projects than the needs of the customer. This is true regardless of whether the customer is internal (the user of a new information system, for example) or external (related physician provider groups). From the customer perspective the BSC must monitor scope and quality of the project as well as include a constant assessment of how a project’s deliverables are aligned with stakeholder expectations. Potential measures associated with these critical project success factors are presented in Figure 3.

Scope

To prevent significant deviations from the project schedule or cost, the scope of the project must be defined, documented, communicated, and controlled. Changes to
Figure 3. Balanced Scorecard Measurement Suggestions During Project Life Cycle

<table>
<thead>
<tr>
<th>Project Gate/BSC Category</th>
<th>Customer</th>
<th>Internal Project</th>
<th>Finance</th>
<th>Growth/Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Project Selection</td>
<td>Statement of Work</td>
<td>High-level risks</td>
<td>Business Case</td>
<td>Organization's People and Systems</td>
</tr>
<tr>
<td>End of Initiating Stage</td>
<td>Scope overview • Business case • Stakeholder acceptance criteria</td>
<td>High-level risks • Commitment</td>
<td>Milestone schedule • Summary budget</td>
<td>Team pre-assignment • Previous lessons learned</td>
</tr>
<tr>
<td>End of Planning Stage</td>
<td>Requirements documentation • Scope baseline • Work breakdown structure • Communications of management plan</td>
<td>Human resources plan • Change management plan • Risk management plan • Risk register • Quality management plan with metrics • Procurement management plan • Project management plan</td>
<td>Schedule baseline with resources • Cost performance baseline</td>
<td>Team ground rules • Improve management of project meetings • Project kick-off</td>
</tr>
<tr>
<td>During Executing</td>
<td>Quality control measurements • Stakeholder notification and feedback • Project reports and records • Validated deliverables</td>
<td>Contract awards • Performance information • Change requests • Risk register updates • Procurement documentation</td>
<td>Performance measures through earned value analysis • Project termination decision</td>
<td>Team performance assessments • Process improvement • Replanning, • Lessons learned application</td>
</tr>
<tr>
<td>End of Executing Stage</td>
<td>Accepted deliverables • Initial realization of promised benefits</td>
<td>Complete project deliverables</td>
<td>Project termination decision • ROI</td>
<td>Celebration • Reward</td>
</tr>
<tr>
<td>End Closing</td>
<td>Ongoing support • Customer feedback</td>
<td>Final transition of project deliverables • Closed procurement</td>
<td>Contract closure • Final project accounting</td>
<td>Capture lessons learned • Reassign workers</td>
</tr>
<tr>
<td>During Leveraging</td>
<td>Full benefits realized</td>
<td>Reuse</td>
<td>Auditable result</td>
<td>Reapplication of lessons</td>
</tr>
</tbody>
</table>

Note: At each gate, one measure is often the key objective, and the sponsor may select up to about five additional criteria. Not all the choices are shown. Therefore, counting the key objective, no more than about six items would be reported at any gate.
Project scope should be processed through the change control system and variance analysis used to determine the impact of proposed changes. In addition, major components of the project should be identified, monitored, and checked off when parameters are accepted by the customer. Throughout the execution stage and closing, the project scope must be verified through a formal process documenting acceptance of the project deliverables.

Quality

A process to assure quality must be developed in the initiating and planning stages of the project. This process will ensure that work is performed correctly and the key stakeholders agree that the work is performed correctly. Control of quality requires monitoring the project to ensure everything is going according to plan, identifying when preventative or corrective actions are necessary, determining root causes of problems, providing specific measurements for quality assurance, and implementing change through the integrated change control system. The timing for inspections and quality audits may be included in project schedules and checklists that become part of a project BSC.

Managing Stakeholders

Assumptions of stakeholders must be understood and managed at the outset of the project. Stakeholders’ expectations regarding project deliverables, features of the project, timelines, costs, quality measures, and actions must be documented. These expectations must be clarified, achieved, and reconfirmed throughout the project. Confirmation procedures can be included in the project BSC and measured through the use of project team and customer checklists for major project features that are developed in relation to the project schedule over the project life cycle.

Internal Project Perspective

Internal project processes may be unique to the project or familiar to the organization. For example, a hospital will have many specified processes/sequences that must be followed for any proposed expansion of patient services or hospital facilities. No doubt these processes will have to be adapted to the current project; however, some processes may have to be changed or significantly modified due to the unique nature of the project.

On the other hand, a physicians’ practice that is considering merging with an integrated health care network for the first time represents a totally new endeavor. In this situation managing risk and effective communication of all aspects of the integration effort are critical internal processes that must be considered. Additionally, on many projects vendors and suppliers work very closely with internal resources and they need to be controlled accordingly.

Integration

The work that is expected must be communicated to each member of the project team including a description of their role and how it fits into the overall project. Trade-offs with respect to cost, time, quality, and scope must be identified, balanced, and managed. Frequently enhancements in one area of a project lead to sacrifice in others. These trade-offs must be managed and directed while closely monitoring project parameters defined in the scope statement. During execution this process is monitored and controlled primarily through the use of schedules and check lists.
Performance report data will be collected and actual compared with planned. When variances occur alternatives must be evaluated and corrective action taken. A process of change control should be developed that identifies, approves, and documents changes to the approved plan. The impact of any changes should be communicated through revised schedules and updated completion checklists. Integration of the internal project process requires communication of measurements and reports throughout the project life cycle as indicated in Figure 3.

Risk

Risks associated with roles and responsibilities must be identified, as well as risk associated with the scope, project requirements, and operations. Project risk should be analyzed and prioritized and potential causes and potential solutions should be developed. Contingency plans to resolve major project risks should be developed, and if possible, a contingency time, budget, or other resource reserves to resolve unanticipated risk should be allocated. Tools such as expected monetary value, statistical sums, and/or decision trees are useful for evaluating the impact of risk. Measures related to the monitoring of risks and how each was resolved at appropriate life cycle stages should be maintained.

Communications

An assessment of the project team’s information needs should be developed and information should be communicated accurately, promptly, and effectively. An information retrieval and distribution system must be established. A progress report must be developed and shared with all stakeholders and include an analysis from the perspective of all three time horizons: past, present, and future.

Procurement

To the extent that external vendors are used on a project, several additional issues including vendor selection, contract signing, and monitoring of vendor processes need to be considered. Critical milestones associated with the selection and use of vendors may be included in the project BSC.

Financial Perspective

The financial perspective of project performance is closely aligned with schedule and cost control. Therefore, the framework for financial performance measures for the project should be developed in the initiating and planning stages. This framework will provide the foundation to monitor the project through the execution phase and ultimately evaluate project success in the closing and leverage phases. An example of the link between the project life cycle and financial performance beginning with the development of the project schedule, cost control, and financial performance is provided in Figure 3.

Schedule Control

Control of the schedule requires documentation of the following:

- The work that should be done to date of report;
- A comparison with work that has been done to date of report;
- The schedule variance (if any);
- Reasons for any schedule variance experienced;
- The efficiency of the project to date with respect to schedule; and
• Revised estimates (if necessary) with respect to project completion date.

**Cost Control**

Control of the cost requires documentation of the following:

- The planned cost of the project to date of report;
- A comparison with cost that has been incurred to date of report;
- The cost variance (if any);
- The reasons for any cost variance experienced;
- The efficiency of the project to date with respect to cost; and
- Revised estimate (if necessary) with respect to project total cost.

**Profit and Market Share**

In addition to cost control and earned value, measures related to a project’s impact on organizational profit can be beneficial. When appropriate, measures of the project’s return on investment (ROI), its impact on the organization’s market share, and operating efficiency can also contribute to the assessment of project success.

**Growth/Innovation Perspective**

The growth/innovation dimension of a project is largely centered on qualitative individual and organizational measures of growth. Learning and growth for projects is somewhat different from that of ongoing organizations. Since individuals are frequently selected for projects due to the skill set they already possess, the growth/innovation dimension is more closely aligned with the development of the individual, as well as the organizational knowledge that results from producing the project rather than from formalized training and education. Therefore, the BSC focuses on individual and organizational lessons learned throughout the project life cycle. In addition, project team skill sets are monitored to ensure the project team has the necessary skill sets to meet future project life cycle milestones. Figure 3 presents examples of measurement considerations for the growth/innovation dimension over a project’s life cycle.

**Participant Development**

Role and responsibility assignments should be clearly communicated to the team members when they are assigned to a project. A recognition and reward system should be developed and participant performance reviewed at milestones throughout the project life cycle. The degree to which the team members were motivated and satisfied should be determined and the morale and energy of team members throughout project life cycles should be evaluated. An interview of team members can be utilized to determine their personal growth from participating in the project and the impact, if any, on the members’ desire to continue with the organization. An attempt to gather lessons learned and growth at each project milestone should be captured when feasible. Such an approach assures the identification of a project member’s growth as witnessed by the expansion of the member’s skill set. Preparing a list of project management skills that were developed by team members participating in the various phases of a project’s life cycle can be a valuable source of information for documenting employee growth and can be useful when recruiting and securing participants for future project teams.
Knowledge Management

The extent to which the project will contribute to future projects should be evaluated. Identification of project successes or failures is an important step in capturing lessons learned. Documentation of causes of success and/or failure and what can be done to avoid future failures or to recreate similar successes on future projects enhances organizational learning and growth. In addition, identification of new markets that may be opened as a result of the project, new or expanded services to be offered, and new technologies for future use should be reported. Finally, improvements in manager capabilities and the contributions to new business processes should be documented. Similar to participant learning and growth, an attempt should be made to document organizational lessons learned at each major milestone of a project’s life cycle. This approach ensures that the knowledge is not lost in the ever present pressure to wrap up and move on to the next project.

Summary and Conclusions

The on-going public debate associated with health care reform will no doubt lead managers of health care organizations to continue to try to identify projects that can increase the efficiency of management and provision of health care services while increasing or at a minimum not diminishing the effectiveness of these practices. Even the best of well intended projects can fail if the various stakeholders are not on board, or if the project fails to identify inherent risk, or appropriately consider the needs and concerns of the project’s end-users or customers. Shenhar and Dvir indicate that project success is a multi-dimensional, strategic concept that considers both short-term and long-term goals as well as the perspectives of all stakeholders.

This article has provided a framework for enhancing project success by relying on the incorporation of a balanced scorecard to monitor project results at critical milestones throughout a project’s life. Evaluation of projects from the perspectives of (1) customer, (2) internal project, (3) financial, and (4) growth/innovation using a balanced scorecard approach facilitates the success of projects and ensures that project outcomes are aligned with organizational goals and strategies.

It is also important to realize that the groundwork for project success is often laid long before any attempt to develop a balanced scorecard is ever undertaken. The use of a balanced scorecard approach to monitor project success requires that projects are carefully selected, aligned with organization goals, and can be related to the organizational strategy in a meaningful and measurable way.

Once a project aligned with goals and strategies of the organization is chosen, project members selected, and proper communication of goals has been provided to the project team, it is possible to develop a balanced scorecard to monitor the project over its life cycle. The development of BSC measures tied to the key milestones in a project’s life cycle can provide the opportunity to enhance the chance of project success. Benefits derived from the utilization of a BSC approach to project evaluation and control include improved communication between project sponsors and project managers as well as enhanced attention to customer needs and individual and organizational learning and growth.
Appendix

An Example Project Scope Overview, Business Case, and Milestone Schedule with Acceptance Criteria

In this appendix a partial example of applying a BSC approach to project management is presented. The example is adopted from a real project and illustrates measurement criteria as determined at the end of the initiating stage (charter approval). From the customer perspective, the important criteria were scope overview, the rationale behind the business case, and acceptance criteria. The milestone schedule and the financial aspect of the business case were the most important criteria from the financial perspective. These steps are numbered 1 through 4, respectively, and also in Figure A1. Furthermore, the acceptance criteria in this example suggest additional items to be identified and reported. These additional items are numbered 5 through 14 in Figure A1. Note that at least one item is identified for each project stage. The project sponsor and manager would then decide what additional measures the project manager needs to report at each project gate.

(1) Scope Overview

This project will implement a centralized, electronic dental record system that will provide a more efficient and secure method of collecting, utilizing, and sharing dental information throughout the medical center in order to improve overall patient care. This project will provide an ADT interface and will centralize scheduling and financial information from existing systems. This project will not incorporate any scanning functionality to incorporate paper records of any kind.

(2) Business Case

This project will increase capability by providing access to dental records for multiple caregivers, incorporating clinical guidelines and safety alerts, and by providing digital radiography at all clinic locations. It will save an estimated $100,000 per year by eliminating paper charts, granting ability to access current and historical dental data at multiple sites, and providing a database for better administrative reporting and research.
### Milestone Table

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
<th>Acceptance Description</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper, non-centralized record</td>
<td>Oct. 1, 2009</td>
<td>(5) List of needed features</td>
<td>Dental management</td>
</tr>
<tr>
<td>Needs assessment</td>
<td>Apr. 15, 2010</td>
<td>(6) Vendor choice</td>
<td>Dental management</td>
</tr>
<tr>
<td>Vendor selection</td>
<td>Aug. 8, 2010</td>
<td>(7) Signed contract</td>
<td>Legal, IS</td>
</tr>
<tr>
<td>XYZ contract negotiation</td>
<td>Sept. 1, 2010</td>
<td>(8) Software and hardware choice with contract</td>
<td>Dental management, IS</td>
</tr>
<tr>
<td>Digital radiography vendor and hardware selection</td>
<td>Oct. 1, 2010</td>
<td>(9) Functional software in test environment</td>
<td>IS, director, application specialist</td>
</tr>
<tr>
<td>Installation and configuration</td>
<td>Nov. 15, 2010</td>
<td>(10) Data from user departments added to database</td>
<td>IS, director, application specialist</td>
</tr>
<tr>
<td>Conversion</td>
<td>Jan. 15, 2011</td>
<td>(11) Training team</td>
<td>CIS/Director</td>
</tr>
<tr>
<td>Training</td>
<td>Jan. 15, 2011</td>
<td>(12) Successful use, no show-stoppers, customer accepts</td>
<td>IS, user departments, management</td>
</tr>
<tr>
<td>Go-live</td>
<td>Jan. 15, 2011</td>
<td>(13) Support plan, user departments</td>
<td>Service desk</td>
</tr>
<tr>
<td>Support/Maintenance</td>
<td>Jan. 15, 2011</td>
<td>(14) Ability to enter and retrieve information at all sites</td>
<td>Sponsor</td>
</tr>
<tr>
<td>Electronic, centralized record</td>
<td>Jan. 15, 2011</td>
<td>(15) Ability to enter and retrieve information at all sites</td>
<td>Sponsor</td>
</tr>
</tbody>
</table>
**Figure A1. Balanced Scorecard Measurement Suggestions During Project Life Cycle**

<table>
<thead>
<tr>
<th>Project Gate/BSC Category</th>
<th>Customer/Supplier</th>
<th>Internal Project</th>
<th>Finance</th>
<th>Growth/Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Project Selection by Executive Team</td>
<td>Customer wants, needs, and satisfaction</td>
<td>Quality and productivity improvement</td>
<td>Cost and schedule estimates of potential project</td>
<td>Business case (financial), milestone schedule, spending approvals, constraints</td>
</tr>
<tr>
<td>End of Initiating Stage</td>
<td>(1) Scope overview</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2) Business case</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3) Milestones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4) Acceptance criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Planning Stage</td>
<td>(5) Approved list of software features</td>
<td>(6) Vendor selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7) Signed contract with vendor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During Executing</td>
<td>(8) Software and hardware choice with vendor</td>
<td>Establish training team, Percent project completion to plan</td>
<td>Cost to percent completion comparison, project cost variance to budget</td>
<td>Percent of training team certified in software training practices</td>
</tr>
<tr>
<td></td>
<td>(9) Functional software in test environment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10) Data from user departments added to database</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Executing Stage</td>
<td>(11) Successful use, no show-toppers, customer accepts deliverables</td>
<td>Project cost variance to budget</td>
<td>(11) Percent of staff trained in new system</td>
<td></td>
</tr>
<tr>
<td>End Closing</td>
<td>(12) Support plan, user departments</td>
<td>Billing errors verse baseline</td>
<td>Increase in percent of reimbursed billing codes</td>
<td></td>
</tr>
<tr>
<td>Leverage Phase</td>
<td>(13) Percent of records successfully entered and retrieved system wide.</td>
<td>Billing accuracy improvement</td>
<td>Revenue enhancement arising from improved service coding, project ROI</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


3. Id.


8. See supra, n.6.

9. See supra, n.7.

10. See supra, n.6.
Contracting and Reimbursement in Transplantation

Nicolas Jabbour, Ashish Singhal, Remzi Bag, and Marwan S. Abouljoud

The cost and quality of health care delivery are coming under increased scrutiny by both public and private payer sectors with the clear intent of increasing the ability of the consumer to use value-driven decisions in purchasing health care services. However, they are not that simple for transplantation, as there are peculiarities associated with both the cost accounting and reimbursement that differentiate transplantation from other health disciplines including complex “carve-out” contractual agreements and reimbursement methods, high per-unit cost, and organ-acquisition cost centers resulting in case rates from private payers for various phases of transplantation care. In this setting of fixed reimbursement, the financial success relies on the ability to manage its expenses and the revenue complexities effectively and efficiently regardless of payer source. This integrity will be best protected when transplant physicians and surgeons understand their financial environment and fiscal relationships of their clinical decisions and outcomes. Keywords: contracting, reimbursement, transplant center economics, center of excellence, global case rate, organ acquisition costs, financial outcomes, MELD score.

As for any business, both cost and revenue estimates are central to ensure financial success of any health care facility. However, they are not that simple for transplantation, as transplant centers are resource intensive and expensive enterprises with high overhead. Moreover, the economics of organ transplantation involve complex contracting strategies and reimbursement methods with multiple payer mix. They may have an adverse fiscal impact if not managed appropriately. Therefore, to direct it better, hospital administrators along with transplant physicians must be aware of their financial environment, including types of payers, contracting terms, methodologies of payment and reimbursement, financial impact of their clinical decisions and outcomes, and most importantly, the ways to optimize overall reimbursement.

We herein present an overview about the contracting strategies and reimbursement methods involved in transplantation and also discuss the provider’s role (institution, transplant physicians, and surgeons) in achieving adequate reimbursement while maintaining volume, outcomes, and growth of the business.

Contracting Strategies

The growth of managed care has sparked a renewed interest in the economics of solid organ transplantation. It involves mix of payers with numerous contract types and payment methodologies during various phases for each type of organ transplanted (see Figure 1). In addition, to contract with a well

Nicolas Jabbour, MD, FACS, is the Medical Director of the Nazih Zuhdi Transplant Institute at INTEGRIS Baptist Medical Center, Oklahoma City, Oklahoma. He performs liver transplantation, hepatobiliary, and pancreatic surgery. He can be reached at nicolas.jabbour@integrisok.com.

Ashish Singhal, MD, Nazih Zuhdi Transplant Institute, INTEGRIS Baptist Medical Center, Oklahoma City, Oklahoma.

Remzi Bag, MD, Nazih Zuhdi Transplant Institute, INTEGRIS Baptist Medical Center, Oklahoma City, Oklahoma.

Marwan S. Abouljoud, MD, Henry Ford Transplant Institute, Detroit, Michigan.

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diversified and larger payer group, transplant centers need to meet the criteria for being a Center of Excellence (COE) (see Figure 2). This is a balancing act between the transplant program wanting to stay financially viable and putting the necessary effort to become a preferred COE as this is a critical way to ensure sufficient patient volume and revenue stream.

**Contracting Parties**

The contractual agreement involves payers, hospitals, and physicians. The payers can be regulatory payers, namely Medicare and Medicaid (Center for Medicare & Medicaid Services, CMS), or commercial payers, including transplant networks, insurance companies, third-party payers and reinsurers. The definition of providers is limited to hospital and physicians, since most contractual agreements include these two groups for the provision of transplant services. It should be clear that the relationship between hospitals and physicians might vary greatly between institutions. The hospital may employ the physicians, and in this case, there is only one contracted provider; whereas, when physicians are employed by a practice plan, or a school of medicine, there are two providers under contract who may need to develop their own internal contractual agreements: the physicians and the hospital. For instance, a practice plan may charge a hospital for services rendered by physicians on behalf of the hospital’s transplant program. In this case, the hospital will receive payments from the payer and in turn will compensate the practice plan for services rendered. Alternatively, the physicians and the hospital could both bill the

![Figure 1. Phases of Transplantation](image1)

![Figure 2. Criteria for Center of Excellence](image2)

**Notes:** CMS: Centers for Medicare & Medicaid Services; UNOS: United Network for Organ Sharing; JCAHO: Joint Commission on Accreditation of Healthcare Organizations.
payer separately, in which case each party recognizes revenue individually against their respective charges. These peculiarities will affect financial evaluations greatly, especially in the calculation of costs and in the recognition of revenue.

Cost Analysis

The overall cost or the production cost of the transplant episode or admission consists of physician services, hospital services, and organ acquisition costs (OACs). The total cost for the respective service is further divided into a fixed component and variable component (see Figure 3). The transplant center should capture these costs in real-time as it is the total cost against which reimbursement will be recognized.

A competitive pricing analysis must be conducted as the cost accounting principles vary greatly between institutions while payers use the local and national charge norms to determine negotiating contract pricing targets. This can be done using federal databases, databases maintained by state insurance and health departments, and data from the Health Care Financing Administration (HCFA) or other private groups; this would show how their organization pricing compares with that of their competitors.

Hospitals should also identify those payers that reimburse an unreasonably low fraction of full costs so that contractual terms can be appropriately bargained. All this requires a team approach for input by various departments including hospital leadership, contracting specialists, finance and billing departments, transplant surgeons and physicians, legal staff, utilization

### Figure 3. Overall Cost of a Transplant Episode

![Figure 3. Overall Cost of a Transplant Episode](image-url)
review, medical records, and managed care organizations.

**Physician Services**

Physician services do not lend themselves easily to cost analyses, since it is difficult to allocate cost to a patient encounter. This would require defining an hourly cost of physician time and allocation of cost based purely on a percentage of salary including benefits. Each physician or physician-group will then assign a ‘price’ for their services, also known as a ‘charge’ based on a percentile of national or regional standards published by groups. Thus, the real cost of the physicians is based on the aggregate cost of salaries and benefits, malpractice insurance, and other indirect costs, such as billing costs and other practice expenses. An hourly formula is used to bill the hospital for physician services rendered on behalf of the hospital cost centers, such as the organ acquisition cost center (OACC), but this requires careful documentation and time studies that can withstand federal audits. Physicians will need to complete such time studies diligently and accurately in order to be compensated fairly for services rendered and be able to defend their charges, as well, if and when audited.

**Hospital Services**

Hospital services for transplantation can be defined in terms of the type of patient encounter. The most straightforward consists of the transplant admission or episode. Costs assigned to this episode typically include costs incurred from 24 hours prior to the transplant procedure to the time of discharge of the patient from the hospital. Thus, if the patient is in the hospital for any period of time prior to transplant or readmitted to the hospital following transplantation, costs associated with these periods of care are not included in the calculation of cost for the transplant procedure unless the contractual arrangement does not allow for the separation of the cost related to these events.

**Organ Acquisition Costs (OACs)**

OACs are unique to transplantation and defined by a set of CMS regulations which are subject to audit by the Office of the Inspector General. In addition to the cost of procuring all solid organs, OACs include any costs incurred in the evaluation of all potential recipients and living donors at a specific institution for a defined period of time, regardless of whether the patients become actual transplant recipients. It accounts for as much as 20 percent to 60 percent of total estimated billed charges of transplant for a respective organ (see Figure 4). This includes the costs involved in evaluation, selection, maintenance, reevaluation of recipient candidates on waiting lists until transplantation occurred, and total cost of organ acquisition, including the cost of the organ plus direct and indirect expenses for both the donor and the recipient.

The direct costs include tissue typing, donor and recipient evaluation, operating room and other inpatient ancillary services applicable to the donor, transportation, surgeons’ fees for recovering organs for transplantation, preservation and perfusion costs, and United Network for Organ Sharing (UNOS) registration charges.

The indirect costs include the salaries and benefits of all personnel involved in these activities, as well as costs directly attributable to these activities, including office rent, computers, office supplies, building and space, and even administrative and clinical
salary expenses. In addition, physician services necessary for these evaluations can be charged to the OACC.

All services mentioned above consist of a fixed component, which is primarily comprised of overhead costs: this includes size of the institution, the number of beds, salaries of nurses and other nonmedical staff such as administrators, building costs for the hospital, the cost of equipment, and the cost of maintaining the facilities and the equipment, as well as other costs, such as capital costs. This constitutes one of the main reasons for the variation in cost between institutions. The variable component includes every cost directly or indirectly associated with the procedure. These costs would not be incurred if the procedures were not performed. They may include operating room costs, laboratory costs, room and board costs, pharmacy costs, as well as other costs. Several factors may play a role in causing a great variability among transplant centers for this cost (see Figure 5).

**Contracting Terms**

Contract language must be clear as it can have a serious detrimental effect on revenue and must include concise definitions. Items, such as new technology reimbursement and payment terms, need to be defined to ensure accurate and prompt payments (see Figure 6). When in doubt, the services of an actuary may be of help in negotiating with payers. In addition, the contract should mention the language for “carved out” services and medical needs not directly related to the transplant event. These include but are not limited to radiofrequency ablation for liver tumours, chemotherapy or radiotherapy for tumours, post-transplant procedures, pharmaceuticals, non-transplant—related services,

### Figure 4. Organ Wise Estimated Billed and Organ Procurement Charges

<table>
<thead>
<tr>
<th>Organ</th>
<th>Estimated Billed Charges ($)</th>
<th>Organ Procurement ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kidney</td>
<td>259,000</td>
<td>67,500</td>
</tr>
<tr>
<td>Liver</td>
<td>523,400</td>
<td>73,600</td>
</tr>
<tr>
<td>Pancreas</td>
<td>275,500</td>
<td>68,400</td>
</tr>
<tr>
<td>Heart</td>
<td>787,700</td>
<td>94,300</td>
</tr>
<tr>
<td>Lung-Single</td>
<td>450,400</td>
<td>53,600</td>
</tr>
<tr>
<td>Lung-Double</td>
<td>687,800</td>
<td>96,500</td>
</tr>
<tr>
<td>Intestine</td>
<td>1,121,800</td>
<td>77,200</td>
</tr>
<tr>
<td>Kidney-Pancreas</td>
<td>439,000</td>
<td>122,300</td>
</tr>
<tr>
<td>Kidney-Heart</td>
<td>1,005,700</td>
<td>145,600</td>
</tr>
<tr>
<td>Liver-Kidney</td>
<td>763,500</td>
<td>127,000</td>
</tr>
<tr>
<td>Heart-Lung</td>
<td>1,123,800</td>
<td>151,900</td>
</tr>
</tbody>
</table>

dental, home health care, rehab, home infusion, durable medical equipment, ventricular assist devices, registry fees, travel, lodging, unusual blood products, and viral treatment.

**Figure 5. Factors Affecting Variable Cost**

- Geographic area
- Transplant center volume and incidence of complications
- Average number of organs procured per donor
- Underlying diagnosis and/or disease state
- Medical management (may reduce costs particularly with respect to hospital charges)
- Use of cost control mechanisms, such as:
  - Greater donor and recipient selectivity;
  - Critical pathways to reduce inpatient LOS;
  - Aggressive use of outpatient therapies;
  - Reduction of medical errors; and
  - Pharmacoeconomics.
- Compliance with federal and state regulations

*Note: LOS: Length of stay.*

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**Reimbursement Methods**

The multiple payer mix is challenging with payment arrangements ranging from a single global case rate that must cover all transplant-related services to individual payment arrangements for each stage of the transplantation process *(see Figures 7 and 8).* Billed charges serve as the basis for negotiated prices; however, a contracted price, not a billed charge, serves as the basis for an economic transaction. Therefore, transplant centers should be prepared to offer a global or single price for both hospital services (part A) and professional services (part B).

A global fee includes not only the procedure itself but also all related services and visits that occur within a designated time period prior and/or after the transplant event. In some cases, the price may include all services the patient requires up

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**Figure 6. Glossary of Contracting Terms**

- **Activity-base costing (ABC):** Bottom up approach to cost estimation and ties the allocation of cost to utilization of resources.
- **Allowable days:** Specified number of days assigned by type of transplant, *i.e.*, 12 days for kidney transplant and 24 days for liver transplant.
- **Case rate:** Rate that covers everything hospital provides during entire stay.
- **Ceiling:** “Lesser of” charges when charges exceed a certain level.
- **Cost-to-charge ratio (CCR):** Estimate costs assuming they are a percentage of charges.
- **Floor:** Clause for catastrophic cases, hospital will not be paid less than X percentage of charges
- **Fully allocated cost:** Cost of service after both direct costs and allocated costs are added up.
- **Global case rate:** Payer may “bundle” professional hospital and organ acquisition and define the time period for included services (admission, 30 days, etc.).
- **Outlier:** Transplant charge that far exceeds case rate and typically an agreed upon threshold.
- **Percent of charges:** Payer pays percentage of charges from hospital/physicians.
- **Per diem:** Amount payer pays per hospital day, includes all services.
- **Step-down method:** Allocating costs “not paid for” to services that are.
- **Stop loss:** Level of charges above which provider is no longer liable.
to one year after the transplant procedure. However, the contract language for case rate time period may differ among payers. For example, Payer 1: “…if member is discharged before case rate day maximum is reached, and readmitted to Hospital, reimbursement will be covered under case rate until the maximum period is reached…”. Payer 2: “…includes Hospital, Physician, and Ancillary services required from the day prior to transplant through the discharge of member from Hospital…” (no readmission language). Frequently, this situation is very disadvantageous to transplant centers as insurers pass on more risk to providers and only rarely separate payment may be permitted for initial evaluation, for services for unrelated problems, and reoperations for related or unrelated complications.

**Medicare**

In spite of the health care market movement to managed care, Medicare continues to be the predominant payer. According to the Transplant Management Group, Medicare accounted for 51 percent of kidney transplants nationally. In addition, a multi-organ transplant program could have as much as 40 percent of their total annual reimbursement coming from Medicare.
When Medicare is the primary payer, the hospital is compensated for the actual transplant procedure through the Part ‘A’ Diagnosis Related Group-Prospective Payment System (DRG-PPS). DRG is a system used by Medicare since 1983 to pay the hospitals a predetermined set rate based on the patient’s diagnosis rather than simply reimbursing whatever costs they charged to treat Medicare patients. This is based on the fact that patients within each category are similar clinically and are expected to use the same level of hospital resources.

Each DRG has its own dollar value and covers all costs directly related to the operation and inpatient hospitalization following a transplant procedure. This means that the financial risk associated with potential complications and longer lengths of stay reside with the transplant program. Surgeons and physicians bill for their services during the inpatient stay through part B Medicare and are paid 80 percent of the fee allowed by Medicare.

Organ acquisition costs (OAC), including pretransplant costs, are reimbursed on a dollar-per-dollar basis. When the organ is removed from a living donor, surgeons and physicians are paid 100 percent of allowable Medicare fees. This must be fully documented and submitted via the Medicare Cost Report. This reporting is also auditable by the Office of the Inspector General, and overreporting can result in heavy fines for the institution.6

Figure 8. Specific Reimbursement Mechanism Used by Individual Payer

Notes: MCOs: managed care organizations; OAC: organ acquisition cost; DRG-PPS: Diagnosis Related Group-Prospective Payment System; APC: ambulatory payment classifications.
To prevent overreporting, transplant programs must be able to support and verify all cost submissions. Items such as billing statements, pretransplant billing and registration procedures, staff time studies, and transplant department records can be used to ensure proof of reimbursed costs.\(^7\) For services in post-transplant period, reimbursement is usually according to the outpatient prospective payment system known as ambulatory payment classifications (APCs) and the hospital may be paid for more than one APC in a single patient case.

**Medicaid**

Medicaid accounts for less than 10 percent of the primary payer market for organ transplantation. As Medicaid is a partnership program between federal and state parties, these programs can vary widely from state to state. Some transplant programs are financially unable to accept the Medicaid payment rates for transplantation as reimbursement is significantly below transplant costs and it may be in the program's best interest to decline such an arrangement. On the other hand, some Medicaid programs are much more reasonable when it comes to reimbursement and can supply an acceptable amount of transplant volume to certain centers like Kentucky Medicaid.\(^8\)

**Commercial Payers**

All-inclusive global contracts are the most often used payment method by commercial payers. Global case rate is issued directly to the transplant facility where payment covers everything involved in the transplant process from organ acquisition costs to the transplant episode and for a set amount of time post-transplantation. However, many insurers will still want independent recognition of cost drivers. Thus, centers must still track and submit all incurred costs.

Tracking costs begins the day prior to the transplant and ends at the end of the global case rate period, or if a covered individual is still inpatient at the end of the global case rate period, on the date of discharge from the inpatient stay. If days for inpatient admission exceed the global case rate period for transplant, the reimbursement will revert to the outlier per diem rate for transplant until the date of discharge from inpatient stay (see Figure 9).

In a case where a referred transplant patient is not part of a policy in which the transplant program contracts and the transplant program is outside of a transplant network, agreements can be negotiated on an individual basis. Such an arrangement may benefit both parties if the transplant center is able to negotiate a reasonable case rate, because the local program is usually much more cost-effective for the insurance company in terms of savings on travel and lodging.

When a commercial payer is primary, both the inpatient charge and the standard acquisition charge are submitted to the carrier and Medicare becomes the secondary payer through a process referred to as “coordination of benefits” for any portion of the inpatient care or standard acquisition charge denied by the commercial payer (assuming that the recipient is eligible for Medicare benefits).

In the case of living donor transplantation, the commercial payer should be contacted prior to transplantation to determine whether it will accept separate charges from physicians and surgeons for the care of the living donor. If the recipients’ commercial payer refuses altogether, the transplant hospital becomes payer of last resort by charging those services to its OAC center.
**Figure 9. Sample Case Rates**

1. **“Lesser of” % of billed charges or case rate plus outlier per diem for days over allowable days, and floor (never paid less than X % of billed charges).**

   For example: Lesser of 90% of billed charges or case rate plus outlier no less than 60% of billed charges.

<table>
<thead>
<tr>
<th>Case rate</th>
<th>$170,000</th>
<th>Total billed charges</th>
<th>$500,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in case rate</td>
<td>12</td>
<td>Total length of stay</td>
<td>50</td>
</tr>
<tr>
<td>Outlier per diem</td>
<td>$3,000</td>
<td>Outlier days</td>
<td>38</td>
</tr>
</tbody>
</table>

   - 90% of billed charges $450,000
   - Case rate $170,000 + (38d x $3,000) $284,000
   - Floor 60% of billed charge $300,000
   - Reimbursement $300,000

2. **Case rate plus 1st dollar stop loss: % of charges of entire admission when exceed agreed amount.**

   Example 1. Lesser of 90% of billed charges or case rate plus outlier, or if billed charges are over $340,000, then entire case is paid at 80% of billed charges.

<table>
<thead>
<tr>
<th>Case rate</th>
<th>$170,000</th>
<th>Total billed charges</th>
<th>$500,000</th>
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<tr>
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<td>50</td>
</tr>
<tr>
<td>Outlier per diem</td>
<td>$3,000</td>
<td>Outlier days</td>
<td>38</td>
</tr>
</tbody>
</table>

   - 90% of billed charges $450,000
   - Case rate $170,000 + (38d x $3,000) $284,000
   - 80% of billed charges $400,000
   - Reimbursement $400,000

Example 2. Lesser of 90% of billed charges or case rate plus outlier, or if billed charges are over $340,000, then entire case is paid at 80% of billed charges (lower charge).

<table>
<thead>
<tr>
<th>Case rate</th>
<th>$170,000</th>
<th>Total billed charges</th>
<th>$300,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in case rate</td>
<td>12</td>
<td>Total length of stay</td>
<td>15</td>
</tr>
<tr>
<td>Outlier per diem</td>
<td>$3,000</td>
<td>Outlier days</td>
<td>3</td>
</tr>
</tbody>
</table>

   - 90% of billed charges $270,000
   - Case rate $170,000 + (38d x $3,000) $284,000
   - 80% of billed charge Not applicable
   - Reimbursement $270,000

*Continued*
Self-Pay

Certain individuals are willing to pay out of pocket for the complete cost of a transplant procedure. This is particularly true for international patients without health insurance as well as uninsured, underinsured, and self-insured individuals. In such situations, both the patient and the hospital need to clarify the terms of payment and how to address catastrophic outcomes and costs.

Unpredictable Cost

Almost all payer groups have provisions for many unforeseen costs relating to an individual transplant case for which no other financial remedy can be found and the transplant institution is responsible; this is not infrequently the situation in “complicated cases.” Under these circumstances, “outlier” payments may be allowed and is known as outlier protection or stop loss. The transplant center should have justifiably incurred excess expenditure relative to the contracted price for services and reimbursement may be essentially “capped” under a case rate or under a global payment schedule.

For Medicare, once charges exceed a specified amount above the DRG payment, reimbursement converts from a fixed payment to a percentage of charges. Commercial payers may also have a stop-loss provision that takes effect at some specified ceiling of costs above the global case payment. Once this threshold is met, the entire case reverts to an agreed upon percentage of billed charges.

Alternatively, a flat “per diem” hospital rate may be agreed upon as well. Although the extra payment does help with expenses once a certain level of expenditures is reached, the gap between the case rate and the stop-loss payment threshold can often be fiscally problematic. Costs that fall into this gap remain unpaid and become the full burden of the transplant center. Even when the cost ceiling is reached, the percentage of charges that is paid is usually insufficient to allow a margin and may not even cover the costs of the hospitalization and transplant procedure.

**Figure 9. Continued...**

<table>
<thead>
<tr>
<th>Charge over $340,000 x 0.5</th>
<th>$80,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlier case rate $284,000</td>
<td>$364,000</td>
</tr>
<tr>
<td>Reimbursement</td>
<td>$364,000</td>
</tr>
</tbody>
</table>

3. Case rate plus 2nd dollar stop loss: % of charges for billed above an agreed amount.

Example: Lesser of 90% of billed charges or case rate plus outlier, and billed charges are over $340,000 are paid at 50% of billed charges.

<table>
<thead>
<tr>
<th>Case rate</th>
<th>$170,000</th>
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<tbody>
<tr>
<td>Days in case rate</td>
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<tr>
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<tr>
<td>Outlier per diem</td>
<td>$3,000</td>
</tr>
<tr>
<td>Outlier days</td>
<td>38</td>
</tr>
</tbody>
</table>

90% of billed charges $450,000
Case rate $170,000 + (38d x $3,000) = $284,000
A certain percentage of a global payment can be allocated into a special general ledger account. Transplant programs can use this mechanism known as “consultant/risk pool” to help cover costs such as those in the outlier gap. Other examples include the receipt of a physician bill for consultations not reported during the global period before claim adjudication, and work-up costs for recipients who received these services at an off-site, out-of-network facility where an individual agreement does not exist. This pool can be applied to a particular global arrangement or to individual agreements in which payment is due. When and if the pool reaches a certain predetermined upper limit, no additional withholding would be taken against future accounts until the pool reaches a predetermined floor or upon distribution of funds at the end of each quarter.  

Discussion

In the simplest form, a profit-maximizing firm will seek to simultaneously reduce costs while increasing revenue. For transplantation, however, operations are not that simple and it is reasonable to believe that a multitude of factors are at play in achieving the enviable financial outcomes. Both payers and transplant centers need to reach a financially viable agreement for both parties. Reimbursement and contracting vary between payers and can have an adverse economic impact if not managed appropriately. At the same time, cost estimates can be complicated and are not easily determined. On the other hand, transplant programs cannot afford to sign losing deals and must, at a minimum, obtain agreements in which the organization will break even. Because of these inherent financial risks and complicated nature of these contracts, transplant institutions must be aware of opportunities to keep expenses low while remaining clinically successful. This mandates the in-depth understanding of the financial environment by the hospital and transplant physicians and surgeons and requires a collaborative approach to establish revenue optimization strategies. This will certainly have a significant effect on contract negotiation and may enable the hospital to contract with more payers.

The existing contracting and reimbursement models in transplantation show a complete separation between the medical and financial sides, putting more financial risk on providers. This is more than just a concern as the majority of transplant centers in the United States are low volume centers for respective organs. This may negatively affect the fiscal health of transplant programs even with a small number of high-risk patients. Consequently, it may lead transplant centers to exercise strict selection criteria for these patients resulting in systematic exclusion of many potential candidates from the list who may have been transplanted otherwise. Sound contracting and continuous improvements in practices would play a crucial role in providing fair treatment to patients and in receiving appropriate reimbursement to maintain the transplant center’s operations.

A relatively large body of literature is available on volume-outcome relationship, however, there is a paucity of literature on outcomes and their fiscal associations. As the clinical outcomes are evaluated based on disease severity like MELD (model for end stage liver disease) score, Buchanan and colleagues have showed that MELD score was a significant cost driver for pretransplant, transplant, and total charges. They found that high-MELD score patients incur
significantly longer hospital stays and higher costs prior to and at the time of liver transplantation but did not have higher rates of readmissions. This was an important finding as the transplant admission charges represented approximately 50 percent of the total cost of liver transplantation.

In addition, both the clinical and financial outcomes following organ transplantation depend on the quality of the graft; however, no standardized measure of graft quality exists. Axelrod et al. have previously observed the increase in length of hospital stay and cost as the donor risk index increases, regardless of the MELD score. Furthermore, current federal regulations mandate the use of marginal organs for transplantation that are known to be associated with higher cost and inferior clinical outcomes. Therefore, it would seem important to recognize the impact of both recipient and donor variables on cost.

It is reasonable to propose that risk-adjusted reimbursement should be determined based on the severity of illness; this is critical as hospital stay, complication rates, overall results are directly related to disease severity. Alternatively, it may be possible that despite risk adjustment and expected clinical outcomes including utilization of resources, the relevant variables that can exacerbate the discrepancy between expected and actual outcomes, not only clinically but also financially, might not all be taken into account. However, this advocates that financial outcomes should be measured as equally important with other standard quality measures such as volume, clinical outcomes, and patient satisfaction.

**Conclusions**

In the setting of fixed reimbursement, the financial success of a transplant program relies on the ability to manage its expenses and the revenue complexities effectively and efficiently regardless of payer source. The business strategy would aim to increase volume by improving outcomes, securing well-negotiated managed-care contracts, practicing revenue optimizing strategies, and improving coverage of the market segments. Reimbursement schemes and pricing strategies should incorporate an evaluation of the severity of illness because reimbursement-to-cost ratios translate directly into financial outcomes. Lastly, physicians and surgeons are stewards of the transplant enterprise at large as they make all clinical decisions. Functional integrity will be best protected when they understand the regulatory and fiscal relationships peculiar to transplantation if they are to be competitive, viable, and fully reimbursed for the costs of their services. Hence, their participation in the fiscal process and acceptance of a fiduciary role and responsibility are critical to financial viability of a transplant center. This would mandate their trust in and the collaboration of their administrative partners, matched with transparency and an inclusive management style from hospital leadership.

**REFERENCES**


The Financial Impact of Post Traumatic Stress Disorder on Returning US Military Personnel

Jeffrey P. Harrison, Lynn F. Satterwhite, and Walter Ruday, Jr.

This article addresses the financial impact of post traumatic stress disorder (PTSD) on US military personnel returning from service in Iraq and proposes a strategy to ensure that adequate resources are available to provide evidence-based PTSD care. Prolonged exposure to combat stress has produced high rates of veterans with PTSD and other psychiatric disorders.

The study found that from 2003 to 2008 approximately 720,666 US military members deployed to Iraq. Based on that population at risk, if 15 percent of returning US military members will require health care services for PTSD, it is estimated that approximately 108,099 returning US military members will require treatment for PTSD. Based upon current deployment rates, government health care planners can anticipate the annual expenditure of $200 million on PTSD care. The study has managerial implications associated with ensuring high quality PTSD health care services for returning US military personnel. It has policy implications on the allocation of scarce health care resources within the Department of Defense (DoD) and Veterans Health Administration (VHA) health care systems to enhance the provision of PTSD services to military personnel and veterans. Keywords: post traumatic stress disorder (PTSD), US military personnel, veterans, evidence-based treatment, evidence-based medicine (EBM), transaction cost economics (TCE).

A recent study by Seal et al. found that among the 289,328 returning US veterans entering the Veterans Health Administration (VHA) health care system between 2002 and 2008, 21.8 percent were diagnosed with post traumatic stress disorder (PTSD) and 17.4 percent were diagnosed with a depressive disorder. Similarly, the RAND study showed high rates of PTSD in returning US military personnel. Based on that population at risk, the federal health care system must provide appropriate levels of PTSD services for the returning military service personnel. Although traumatic brain injury is a significant problem for returning US service members, it is beyond the scope of this article.

If significant numbers of returning US military members require health care services for PTSD, it is critical that the federal health care system be prepared to provide treatment. Without effective treatment, returning military personnel with PTSD could suffer considerable impairment in function and become a significant financial burden for the United States. As a result, the Department of

Jeffrey P. Harrison, PhD, MBA, MHA, FACHE, is an Associate Professor, Department of Public Health, at the University of North Florida, Jacksonville, Florida. He can be reached at jeffrey.harrison@unf.edu and (904) 620-1440.

Lynn F. Satterwhite, RN, MS, CNS, ANP, is an Instructor in the School of Medicine, Department of Psychiatry, Virginia Commonwealth University, and a Clinical Nurse Specialist and Nurse Practitioner at the Hunter Holmes McGuire Veterans Administration Medical Center, Richmond, Virginia.

Walter Ruday, Jr., LMSW, ACSW, is the Administrative Coordinator of the Jacksonville Substance Abuse Treatment Team Department of Veterans Affairs, Jacksonville, Florida.

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Defense (DoD) and VHA health care systems are focusing on their ability to provide evidence-based PTSD services. This requires the building of partnerships among researchers, clinicians, and health care providers to provide essential PTSD services. This large patient population supports further initiatives in improving the quality and efficiency of PTSD services. It also has policy implications on the distribution of health care resources to health care organizations which provide PTSD services to military personnel and veterans.

As of July 18, 2009, US casualties from Iraq include 4,319 dead and 31,446 wounded. Research would suggest that US military personnel in the Iraq and Afghanistan wars are receiving the best medical care available in the theatre of battle. Most recently, the practice of medicine is putting an increasing emphasis on adherence to standard clinical approaches developed through evidence-based medicine (EBM). EBM has been adopted to provide the best medical practices based on sound empirical research. There is a growing body of knowledge about PTSD in US military personnel and veterans, including a number of controlled studies on the best practices for treatment of PTSD.

By applying the research, it may be possible to estimate the health care resources necessary to meet the projected demand for PTSD treatment. Thus providers who are operating in an environment concerned with cost-control can project the additional resources necessary to give the highest quality medical care. Such a systematic analysis of PTSD reflects a commitment to excellence in health care delivery and allows organizations to measure performance and improve quality.

**Definition of Post Traumatic Stress Disorder**

The American Psychiatric Association defines PTSD as an anxiety disorder that develops as a result of exposure to an extreme traumatic event. This event involves actual or threatened death or serious injury to self or others. A common response from the individual could be extreme helplessness, horror, or intense fear. These individuals experience three clusters of symptoms which include re-experiencing, avoidance, and arousal.

Re-experiencing involves intrusive thoughts, vivid nightmares, or flashbacks of the events. The individual with PTSD may act and feel as if the event is happening again. There are triggers that illicit intense psychological or physical responses from the individual. Avoidance involves making efforts to avoid thinking, feeling, or talking about the experience. Additionally, individuals may avoid anything that reminds them of the trauma or not want to do the things they used to enjoy. The individuals may feel different from others and have difficulty expressing or having emotional feelings towards others. Some individuals may have amnesia for part of the traumatic event. The final cluster is arousal which involves sleep disturbances, irritability, anger, exaggerated startle reflex, and feeling as if they were looking over their shoulder or on guard. In order to be diagnosed with PTSD, the symptoms must impact the individual’s life in a negative way such as difficulties in social, occupational, or other important aspects of life.

Examples of extreme traumatic events include childhood sexual trauma, physical assault, serious accidents, terrorist attack, combat, and natural disasters such as fire, tornado, hurricane, flood, or earthquake. According
to the American Psychiatric Association, individuals who have symptoms for less than a month are considered to have acute traumatic stress disorder. After a month of symptoms patients are diagnosed with PTSD. Individuals with continued symptoms of PTSD after three months are considered to have chronic PTSD.

PTSD Within the Military Environment

Combat situations can have a negative impact on the mental status of returning soldiers. There is a growing body of knowledge on the effects of PTSD on US military personnel during the Vietnam, Persian Gulf, Iraq, and Afghanistan wars. Additionally, the National Vietnam Veterans Readjustment Study of 1983 was a congressional mandate for studying the psychological effects of war. Results demonstrated approximately 15 percent of men and 9 percent of women among Vietnam Veterans were diagnosed with PTSD. The first Gulf War showed PTSD rates of 9 percent to 24 percent. The current Iraq and Afghanistan conflicts are ongoing and as a result the full impact on mental health is not yet known. Since October 1, 2001, 1.64 million US military personnel have deployed to these wars. Studies have shown that up to 21.8 percent of returning service members have PTSD and depression.

Research shows that among US troops returning from Iraq and Afghanistan up to 300,000 may suffer from PTSD or major depression. This research also found that the majority of soldiers deployed were exposed to a combat-related event such as ambushes, seeing dead bodies, being shot at, or knowing someone who was seriously injured or killed. The top five reasons returning US military personnel fail to seek treatment for mental problems are:

1. The medications have significant side effects,
2. Treatment could negatively affect their career,
3. Treatment could cause denial of security clearance,
4. Family and friends are more helpful than mental health providers; and
5. Coworkers may lose confidence in their ability.

Treatment Modalities for PTSD

Efforts to prevent development of PTSD have been implemented since the Vietnam War. For example, mental health specialists are currently providing services including: education, briefings on suicide prevention, triage, and short-term treatment. However, the use of critical incident stress debriefing for early intervention to minimize the development of symptoms has not been supported by research.

Treating PTSD has been widely studied and there is a large body of evidence for best practices. There are clinical practice guidelines developed by the VHA and DoD for treatment of PTSD which are based on research from controlled and peer reviewed studies. These guidelines help clinicians choose treatments that have demonstrated positive results and are cost effective. According to these guidelines, the four top recommended psychotherapies for treatment of PTSD are:

1. Cognitive therapy;
2. Exposure therapy;
3. Stress inoculation training; and
4. Eye movement desensitization and reprocessing.

These therapies have strong evidence for improvements in global functioning and reduction in symptom severity. Other psychotherapeutic interventions that have demonstrated some benefit include:

- Imagery rehearsal therapy;
- Psychodynamic therapy; and
- PTSD patient education.

These therapies, as with most psychotherapy, can occur individually or in a group therapy format.

Cognitive therapies work on changing irrational beliefs that affect individuals adversely and challenge them to revise those beliefs into something more positive. Forms of Cognitive Therapy include Cognitive Restructuring, which assists the patient in making sense of their bad memories. Exposure therapy is a behavioral therapy designed to help reduce the level of fear and anxiety associated with reminders of the trauma, thereby also reducing avoidance. Stress Inoculation Training, another behavioral therapy, assists the patient in gaining self reliance in his or her coping ability in order to overcome the anxiety and fear resulting from trauma reminders. Behavioral theories also involve some cognitive therapies. These are based on the principal that the arousal response is a conditioned, emotional response and that exposure to the trigger without a negative outcome could relieve the arousal.

Eye Movement Desensitization and Reprocessing (EMDR) is a controversial therapy, but there is substantial evidence indicating its efficacy. EMDR involves identifying the trauma, emotions, and negative thoughts associated with the trauma then identifying the positive thoughts the patient would like to have when thinking of the trauma. There are bilateral stimulation or eye movements as the individual’s own brain makes sense of the disturbing material.

First line medications recommended by the VHA and DoD practice guidelines for PTSD treatment are the selective serotonin reuptake inhibitors (SSRIs). The US Food and Drug Administration has approved two medications for the treatment of PTSD; these are Sertraline (Zoloft) and Paroxetine (Paxil), which are useful in depression and anxiety. Other SSRIs have efficacy in treatment of PTSD. Benzodiazepines, which have long been used for treatment of anxiety disorders, are not recommended.

The National Defense Authorization Act of 2008 required the VA and DoD to develop a comprehensive approach for the management of health care and transition of service personnel. The US Government Accounting Office Report to Congressional Committees outlines the progress to date and addresses the future activities necessary to improve health care management. Substantial progress has been made in policy development and many projects are being piloted. The VHA and DoD now have policies for mandatory training on suicide prevention and screening for PTSD and other war-related problems. Mechanisms are in place to track notifications to health care providers so that these problems may be addressed and later evaluated. Recovery plans for returning service members have been developed, which include training of individuals who supervise and provide the care. Access to care continues to be evaluated with minimum standards for access to non-urgent care and other medical services.
Studies show that most people who live through a traumatic event do not get PTSD. However, risk factors include:

- Living through traumatic events;
- A history of mental illness;
- Getting hurt or seeing others hurt;
- Horror or extreme fear; and
- Having minimal social support after the event.

Among combat soldiers, risk factors include:

- Younger age;
- Combat exposure;
- Rank;
- Branch; and
- Multiple deployments.

Another factor that plays an important role is resiliency, which can reduce the risk of being diagnosed with PTSD. Use of resiliency includes seeking support from family and friends, finding a support group, feeling good about one’s own actions in a dangerous event, having good coping skills, and being able to respond effectively despite fear.17

The Long-Term Effects of PTSD

The costs and long-term effects of PTSD can be significant. Biologically, patients with PTSD face higher rates of unhealthy behavior, which could result in increased rates of many chronic illnesses such as cardiovascular disease, osteoporosis, arthritis, diabetes, certain cancers, and periodontal disease. Vieweg et al.18 studied body mass index (BMI) in a convenience sample of military veterans and found that those with PTSD had far greater rates of obesity than the current US population. Higher rates of unsafe sex are also associated with the affects of PTSD. All of these problems could add to the total cost of medical care in these veterans.

Socially, individuals with PTSD have higher rates of absenteeism at work and are less productive. PTSD can affect families resulting in domestic problems, difficulties in parenting, and possibly suicide. The literature contains much on the plights of homeless veterans and substance abuse.

The RAND19 study found that the cost of PTSD and major depression for two years after deployment ranged from $5,900 to $25,760. As a result, it estimated that the national cost of PTSD and depression for 1.64 million service members could range from $4.0 billion to $6.2 billion. Studies have shown that if 100 percent of PTSD patients received evidence-based treatment, a savings of approximately $1.7 billion or $1,063 per case would be realized. Based on their analysis, evidence-based treatment for PTSD and major depression would pay for itself within two years. These results show that the use of EBM protocols for PTSD and major depression would increase recovery rates, improve productivity, enhance the readiness of US military personnel, and provide benefits to society.20

Theoretical Foundation

Transaction cost economics (TCE) theory suggests that organizational structures exist to economize on the costs of exchanging goods and services in the marketplace while maximizing the quality of services provided. According to Stiels, Mick, and Wise,21 health care is a complex sequence of transactions among patients and providers which occurs in markets as well as within health systems. Since health care transactions involve the production of care and the coordination of
that care, it is imperative that they are executed smoothly and efficiently.

TCE is a conceptual framework for analyzing health care transactions and quantifying their impact on organizations, processes, and outcomes. In health care, these transaction costs come from the following:

- Monitoring outcomes;
- Information gathering;
- Administrative support;
- Negotiations;
- Transaction frequency;
- Idiosyncrasy of the exchange; and
- The degree of uncertainty in the market.

As a result, TCE would support the use of integrated health care delivery systems as an effective method of expanding the scope of PTSD services as well as reducing the transaction costs associated with providing high quality health care services.

Methods

To implement appropriate evidence-based treatment for PTSD, practitioners need to be well informed on the treatment protocols and health care leaders need to provide adequate financial support. As a result, health care organizations must develop standard treatment processes for PTSD and incorporate these standards to ensure patient safety and quality of care.

This study evaluates data on the number of US military personnel deployed in Iraq from 2003 to 2008. Based on the deployed population, we use historical rates of PTSD found in previous wars to project the number of PTSD cases in US military personnel returning from Iraq. Finally, using realistic projections on the cost of care per patient developed during the RAND 2008 study, we project future costs for PTSD patient care.

Results

This study documents that federal health care organizations and other health care providers are facing a growing need to provide PTSD programs. Additionally, the literature clearly indicates that a greater use of evidence-based treatment for PTSD patients provides an opportunity for significant improvement in health care quality.

As noted in Figure 1, the level of US forces deployed in Iraq during the study period ranged from a low of 132,444 in 2003 to a high of 156,000 in 2007. These data show a combined total of 720,666 US military members served in Iraq from 2003 to 2008.

Research on the rates of PTSD in prior wars show a range from 9 percent to 24 percent in returning military personnel. Figure 2 shows the projected rates of PTSD for US military members in need of PTSD treatment using the conservative historic PTSD

![Figure 1. US Troop Forces Deployed in Iraq](image-url)
rate of 15 percent. This shows that the projected number of new PTSD patients returning from Iraq range from a low of 19,866 in 2003 to a high of 23,400 in 2007.

Additionally, the data show an aggregate patient population of 108,099 with PTSD from 2003 to 2008. These data show that responding health care organizations need additional resources to meet the growing demand for PTSD care. It is also interesting to note that the DoD and the VA health care organizations are increasingly recognizing the critical importance of a comprehensive approach to providing ongoing PTSD health care operations. Also, as military members resign or retire, other US health care organizations can anticipate an increasing need for PTSD treatment within the general population.

McCrone, Knapp, and Cawkill in their research completed an economic impact study of PTSD within a military population. They found the impact of PTSD is not only felt by those people who suffer the disorder but also by families, employers, and society as a whole. This documents that PTSD has a negative economic impact on society due to reduced personal income, lower work performance, and an increase in the utilization of treatment and support services. They believe cost-benefit analysis (CBA) is the most appropriate method to evaluate the economic impact of PTSD. This approach is unique in that it addresses the extent to which a treatment or policy is socially worthwhile in the broadest sense, with all costs and benefits being valued in monetary units. If benefits exceed costs, the CBA would recommend providing the treatment. With two or more alternatives, CBA evaluation would recommend the one with the greatest net benefit. Economic evaluations such as CBA examine cost in relation to the level of outcome to show the best alternative. Looking specifically at PTSD, an improved quality of life could be evaluated consistent with resource consumption to provide a better understanding of the economics of the disorder and the alternative treatment options.

This CBA approach for the economic analysis of PTSD is supported by RAND, which incorporated treatment costs, decreased wages, lost work productivity, and suicide costs in its economic model to measure the impact of PTSD. RAND found a baseline cost of $10,151 per case cost of PTSD for returning US military personnel. As noted in Figure 3, the projected cost of PTSD for US military personnel returning from Iraq ranges from a low of $201,659,766 in 2003 to $237,533,400 in 2007. Most importantly, the potential total cost of PTSD in returning US military personnel during the study period could approach $1,097,312,949.

<table>
<thead>
<tr>
<th>Year</th>
<th>US Forces Deployed</th>
<th>Projected PTSD @ 15%*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>132,444</td>
<td>19,866</td>
</tr>
<tr>
<td>2004</td>
<td>133,916</td>
<td>20,087</td>
</tr>
<tr>
<td>2005</td>
<td>145,291</td>
<td>21,793</td>
</tr>
<tr>
<td>2006</td>
<td>138,500</td>
<td>20,775</td>
</tr>
<tr>
<td>2007</td>
<td>156,000</td>
<td>23,400</td>
</tr>
<tr>
<td>2008</td>
<td>145,285</td>
<td>21,792</td>
</tr>
<tr>
<td>Total</td>
<td>720,666</td>
<td>108,099</td>
</tr>
</tbody>
</table>


*Calculated using PTSD rate of 15%.
Discussion

Our research shows that the DoD, the VA, and other health care providers are experiencing a significant growth in patients requiring PTSD care. TCE shows that costs can be reduced and quality improved by coordination of care across the continuum of health care services. Fortunately, recent investments in health information technology provide an opportunity for health care organizations to improve the quality of care they provide PTSD patients. This can be done by sharing of best practices and participating in research on PTSD to improve the quality and efficiency of the care they provide. Additionally, we believe health care leadership should continue to refine outcome measures utilized for benchmarking best practices in PTSD care.

As shown in our research, improved treatment of PTSD in returning US military personnel requires additional resources be allocated to the health care treatment system. Specifically, we found the cost of returning US military personnel with PTSD exceeds $200 million annually. Additionally, as these resources are made available, it is essential that evidence-based treatment be provided to maximize patient recovery rates. Finally, it is important that the future allocation of resources be made to ensure that discharged military personnel are able to access care within their local community.

From an operational perspective, as additional US military forces are ordered into Iraq, the research suggests that additional mental health providers will be required to care for a growing PTSD patient population. It is important to note that our research is part of an incremental process to examine current research and benchmark best practices in PTSD care. As a result, clinicians and health care leaders need to use such research to improve PTSD care. Recent innovations assist health care professionals with clinical decision-making for PTSD by integrating patient information with recommended clinical protocols to provide the best EBM. Additionally, electronic medical record (EMR) systems can be linked with decision support systems to give alerts when patient status changes. According to Harrison and Palacio, the Veterans Health Administration (VHA) EMR is currently in use in 1,300 VHA medical centers, outpatient clinics, and nursing homes. The VHA EMR allows approximately 100,000 VHA clinical providers to access patient medical records as well as place orders for services or medications through this single interface. Such health information systems can be linked with the latest wireless health information technology being deployed on the battlefield to maximize the quality of care. Most importantly, integrated databases provide a way to project workload and plan for future resource

### Figure 3. Projection of Resources Necessary to Treat US Troop Forces Deployed in Iraq for PTSD

<table>
<thead>
<tr>
<th>Year</th>
<th>PTSD Cases @ 15%</th>
<th>Projected Cost of PTSD*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>19,866</td>
<td>$201,659,766</td>
</tr>
<tr>
<td>2004</td>
<td>20,087</td>
<td>$203,903,137</td>
</tr>
<tr>
<td>2005</td>
<td>21,793</td>
<td>$221,220,743</td>
</tr>
<tr>
<td>2006</td>
<td>20,775</td>
<td>$210,887,025</td>
</tr>
<tr>
<td>2007</td>
<td>23,400</td>
<td>$237,533,400</td>
</tr>
<tr>
<td>2008</td>
<td>21,792</td>
<td>$221,210,592</td>
</tr>
<tr>
<td>Total</td>
<td>108,099</td>
<td>$1,097,312,949</td>
</tr>
</tbody>
</table>

*Calculated using PTSD per case cost of $10,151.

allocation. By adequately forecasting potential demand for PTSD services, organizational factors such as excessive clinical workload, inadequate resources, and poor clinical practice can be minimized thereby improving the quality of PTSD care.

Conclusions

PTSD is an emotional illness that has developed as a result of exposure to a significant traumatic event. There is research that shows it has been a part of the aftermath of combat as long as there have been wars, and its effects on the victim, the victim’s family, as well as society are great. Specifically, PTSD has been linked to increased rates of domestic problems, parental problems, substance use problems, financial problems, occupational problems, and suicide. The cost associated with treating PTSD is high although EBM and today’s technology allow a greater capacity to provide treatment for those in need. Without effective treatment, the long-term costs and negative consequences would be increased. Fortunately, DoD, the VHA and other health care providers have the potential to meet the growing need for PTSD care if adequate resources are provided.

Harrison, Nolin, and Suero27 found that greater coordination of clinical services enhances operational efficiency and improves quality of care. This suggests that providing coordinated evidence-based PTSD care will improve outcomes and enhance efficiency. It will also improve communications among patients, providers, and health care organizations.

From a policy perspective, directing additional resources into PTSD care has the potential to reduce health care costs while improving the health status of patients with PTSD. With the number of individuals with PTSD growing, the challenges of providing cost-effective PTSD care will increase. As a result, policymakers should support further research in EBM to evaluate whether PTSD can be treated by coordinating preventive services, outpatient care, and inpatient health services. Such an approach will also allow for the efficient use of medical resources and facilitate collaboration among all stakeholders leading to improvements in PTSD care.

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Health Care Policy and the HIV/AIDS Epidemic in the Developing World: More Questions Than Answers

Paul J. Flaer, Paul L. Benjamin, Francisco I. Bastos, and Mustafa Z. Younis

When the United Nations declared “health care for all” (at the conferences at Alma-Ata in 1978 and the Ottawa Charter in 1986), the declarations were largely premature to impact the upcoming HIV/AIDS epidemic. These UN declarations still apply today, as multitudes of humanity continue to die from what amounts now to be a treatable chronic disease. Can the wealthier, industrialized countries stand by and watch the decimation of the populations of the developing world by HIV/AIDS? The global “health 9/10 gap,” relates that only 10 percent of global health resources go to developing countries—i.e., those having 90 percent of the poorest world populations. The World Bank/World Health Organization has been at the forefront of providing resources for the global HIV/AIDS epidemic, but for many countries of the developing world (especially Sub-Saharan Africa) it may be too little, too late. This work explores the application of an ecological model to global policy against HIV/AIDS, highlighting access to antiretroviral drugs (ARV). ARV distribution is constrained by patents and laws protecting the intellectual property rights of the international pharmaceutical corporations. In response to this situation, more questions arise. Will governments in the developing world invoke compulsory licensing (patent-breaking) in their negotiations with the international pharmaceutical corporations to provide medications against HIV/AIDS in their countries? Can international political and financial negotiations with these pharmaceutical corporations speed the growing push for a solution to this solvable crisis? The answers may lie in the “Brazilian model,” that is a developing world government using all means available to provide ARV drugs for all its citizens with HIV/AIDS. The basis of this model includes negotiating with the pharmaceutical corporations over patent rights and importation of copied drugs from the Far East. Keywords: HIV/AIDS Policy, Brazil, ARV, Compulsory Licensing, World Bank/World Health Organization.

The application of public policy in the provision of HIV/AIDS medications to a target population (i.e., in this case, developing world countries) requires the accurate assessment of needs, access, costs, and avenues of distribution. Moreover,

Fernando I. Bastos is a senior researcher at FIOCRUZ - Oswaldo Cruz Foundation, Rio de Janeiro, Brazil. He is the chairman of graduate studies on epidemiology at the National School of Public Health-FIOCRUZ and a physician who has extensive experience working on studies assessing populations at high-risk of HIV infection in Brazil. He holds the degrees of Medical Doctor from State University, Rio de Janeiro, and a PhD from the National School of Public Health, FIOCRUZ.

Mustafa Z. Younis is a Professor of Health Economics & Finance at Jackson State University, Jackson, Mississippi. He teaches courses in Health Financial Management, Health Economics, Health Policy and Comparative/International Health Systems, and has extensive experience in international health. He holds the degree of Doctor of Public Health from Tulane University, New Orleans, Louisiana.

Paul J. Flaer is a doctoral fellow in the Stempel College of Public Health, Florida International University, Miami, Florida. At the Dade County Dental Research Clinic, Jackson Memorial Medical Center, he provides pro bono dentistry to disadvantaged populations in Miami, Florida. He holds the degrees of Doctor of Dental Surgery from Medical College of Virginia, Richmond, Virginia, and the degrees of Doctor of Education and Master of Public Health from Florida International University.

Paul L. Benjamin is an attending practitioner providing pro bono dentistry for disadvantaged populations and teaching of dental residents at the Dade County Dental Research Clinic/Jackson Memorial Medical Center in Miami, Florida. He holds the degree of Doctor of Medicine Denarius from the University of Florida, Gainesville.

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extent of adherence to prescribed medications, knowledge of side/adverse effects, and the use of advanced drug regimens (i.e., combination drug therapy or HAART—highly active antiretroviral therapy) are key factors in HIV/AIDS program implementation. Public programs, in an approach to accessing ARV (antiretroviral drugs) for countries of the developing world, are the means of last resort to access and treat the high morbidity and mortality of HIV/AIDS in the developing world.

**Compulsory Licensing**

In Brazil, copying ARV drugs under compulsory licensing (i.e., patent-breaking) and importing ARV drugs manufactured in highly competitive third world developing countries such as Thailand, India, and China, has subsequently lead to lowered prices and increased availability of the drugs to affected populations. However, questions arise about diffusion of this Brazilian innovation to other developing world countries:

- Can developing countries apply this Brazilian system of market competition to obtain ARVs and drugs for the treatment of deadly opportunistic infections?
- Moreover, can each developing country effectively distribute ARV drugs; i.e., do they have an adequate public health infrastructure?
- Can these developing countries negotiate drug acquisition from the international pharmaceutical corporations according to policies workable and favorable to the interests of both parties?

The bottom line is that the pharmaceutical corporations want drugs that are available and distributed to patients at low cost or free of charge.

Families and communities throughout the developing world are being destroyed solely by the lack of access to life-saving HIV/AIDS medications. Entire cultures and ways of life are being decimated by the ravages of a killer disease easily treated with effective ARV drugs. Gone are the days of difficult dosing and onerous side effects by ARV drugs that existed in the early years of the HIV/AIDS epidemic. Today, newer drugs used in combination therapy (HAART) are well tolerated and have fewer side effects than medications in the initial years of HIV/AIDS treatment. 4

A possible solution to containing the HIV/AIDS epidemic in developing countries may be a modified approach to compulsory licensing of HIV/AIDS drugs. A worldwide-unified approach to compulsory licensing on the “Brazilian model” could be accomplished by UN agencies—especially the World Health Organization (WHO) acting in concert with the World Bank. 5 UN involvement could present a single and unified voice to negotiate with the pharmaceutical corporations over the cost of ARV drugs for the developing world. The economic, geopolitical importance, and relative success in dealing with the HIV/AIDS crisis by Brazil serves as a model for other nations. 6 In addition to leading the developing world in the HIV/AIDS crisis, Brazil sponsored a resolution that placed access to ARV medications as a fundamental human right in the context of previous UN declarations of “health care for all.” 7 In Brazil, although use of ARV/HAART resulted in moderately decreased rates of transmission, it significantly lowered both morbidity and mortality of HIV/AIDS. 8
The HIV/AIDS epidemic is the greatest public health crisis in modern history but has also become the greatest battle over intellectual property rights. Applying the “Brazilian model” to health care of afflicted HIV/AIDS patients evokes consideration of the following elements of emerging policy for treatment and prevention:

1. Invoking a national policy of compulsory licensing; that is, a system of market competition that has previously proved successful (by Brazil)—leading to deep discounts on patented ARV medications from the international pharmaceutical corporations in the face of patent-breaking in the market economies of the developing world.

2. Guiding the implementation of policy by monitoring of modes of treatment of HIV/AIDS and subsequent opportunistic infections by means of effective surveillance systems.

3. A progressive approach to HIV/AIDS intervention, using the media, open discussion in the public schools, and the targeting of those highest at-risk or living in marginalized communities; for example, IDUs (injection drug users), MSM (men who have sex with men), pregnant women, youth, and sex-workers.

4. Harm reduction strategies such as promotion of abstinence and use of barrier protection along with the presence of needle exchange programs in the community.

5. Pharmaceutical laboratories manufacturing ARV medication in the highly competitive market environments of developing countries, such as Thailand, India, and China, could successfully compete in the international market in providing ARV medications at low prices that the populations in the developing world could afford.

6. The presence or development of a functional public health infrastructure for treatment and prevention of both HIV/AIDS and subsequent opportunistic infections.

7. ARV/HAART therapy and medications for the treatment of opportunistic infections must be available at no or low cost to the patient. Advanced second line, third line, and specialty drugs should be employed in HIV/AIDS therapy as the rule rather than the exception.

8. Capacity to produce ARV drugs in developing world countries, usually in the form of an existing pharmaceutical industry, is important for local production of HIV/AIDS drugs. (Note that Brazil’s pharmaceutical industry is the tenth largest in the world.)

Discussion

Article 25 of the United Nations’ Universal Declaration of Human Rights (1948) affirms the right of all humanity to receive needed medical care and services. This declaration, although preceding the HIV/AIDS crisis, directly applies to the present day pandemic. In the developing world, treatment is most often initiated with CD4+ counts less than 200 or until the patient becomes symptomatic. In industrialized countries this count is usually at a lower end of 500. Such delays, besides their costs in human suffering, also promote economic loss and instability due to the increased costs of treating more severe
cases, overall increases in morbidity/mortality, and subsequent increased levels of transmission within the population. To optimally meet global responsibilities of industrialized nations, the response to the HIV/AIDS epidemic in the developing world might include the following characteristics:

1. Governments in the developing world working in a crisis mode to provide HIV/HAART to its citizens;
2. Wealthier governments supporting the fight against HIV/AIDS in the developing world;
3. International pharmaceutical corporations providing free or low cost ARV drugs—irrespective of corporate profit and the specter of compulsory licensing; and
4. Industrialized nations making the worldwide and collective investment to fight what effectively amounts to a global health crisis.

Conclusion

Health care education and the Hippocratic Oath teach practitioners to ease suffering, prevent death, and above all “do no harm.” Since the inception of the AIDS epidemic, many health practitioners in developing countries feel that they cannot work with integrity and follow the Hippocratic Oath when life-saving drugs for HIV/AIDS are not available. Despite global support by teams of health care workers, controlled nutrition, and aggressive treatment of opportunistic infections, patients’ immune systems continue to fail due to HIV/AIDS. Those in developing countries who could have gone into remission with treatment by ARV medications continue to die. Addressing the HIV/AIDS epidemic in the developing world brings attention to other important social and health issues such as food supply, poverty, ability to work, and domestic political stability. In addition, the prevalence of co-infections, i.e., a high morbidity of tuberculosis, hepatitis, syphilis, and malaria, presents almost insurmountable problems for health care in countries already ravaged by the HIV pandemic. Without treatment with life-saving ARV, the early deaths of HIV-infected patients have devastating effects on families, communities, and ultimately pose a dilemma for the stability of developing nations. In this time of global financial crisis, it makes good sense for nations in the developing world to manufacture, instead of importing, HIV/AIDS drugs for treating their populations. Self-production of ARV/HAART subsidized by developing world governments saves money otherwise earmarked for their importation and even stimulates local industry. Early in the HIV/AIDS crisis, Somerville and Gilmore at the International Conference on AIDS (1989) concluded that the HIV/AIDS epidemic “must be examined within a framework that enables them to be comprehensively and thoroughly analyzed and connected with wider health and social issues.” The “Spaceship Earth” concept applies here: We all live together on an increasingly interdependent world where disease, poverty, and socio-political unrest in one country eventually impact us all.

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Private Health Insurance in Australia: Community Rating, but at What Price(s)?

Luke B. Connelly and Henry Shelton Brown III

Australia has voluntary private health insurance (PHI) markets in which open enrollment and community-rated premiums are mandated by government. Historically, adverse selection in these markets led to a substantial decline in coverage, giving voice to fears about the viability of PHI markets in the longer-run. In order to preserve community rating but improve the PHI pool, the Australian government instituted a novel scheme of age-based penalties (ABPs) for individuals who join a PHI fund later in life. This article computes the price of PHI under the so-called Lifetime Cover (LC) scheme and shows that the LC scheme \textit{per se} is not appropriately calibrated to prevent another adverse selection death spiral.\footnote{Based on our results, we recomputed age-based penalties that would result in a fair price of PHI for all age groups. The premium multipliers we derive suggest a premium ratio of 10:1 for the oldest and youngest joiners. Our premium multiplier sequence is well-approximated by a linear ABP scheme that is approximately three times that of the present LC scheme for older joiners.}

Based on our results, we recomputed age-based penalties that would result in a fair price of PHI for all age groups. The premium multipliers we derive suggest a premium ratio of 10:1 for the oldest and youngest joiners. Our premium multiplier sequence is well-approximated by a linear ABP scheme that is approximately three times that of the present LC scheme for older joiners. Key words: private health insurance (PHI), premium, community rating, Lifetime Cover (LC), subsidies, taxes.

In most countries, private health insurance (PHI) membership is not compulsory. In voluntary PHI markets, an attendant problem is adverse selection: many individuals who would benefit from buying PHI are unwilling to do so, either because the premiums available exceed the expected PHI benefits or because they are denied coverage due to discoverable risk factors, such as chronic diseases.

In Australia, where PHI is voluntary and open enrollment is mandated, an adverse selection death spiral\footnote{In the United States, it is well-known that many millions are uninsured. The percentage of uninsured persons in the United States in 2001 was five times higher for people ages 19 to 34 (40 percent uninsured) than for people ages 55 to 64 (8 percent uninsured).\cite{1} One concern has been with the denial of PHI cover to people with chronic diseases, or PHI offers that entail prohibitively high (and perhaps unfair) premiums. Some states in the United States have reacted by making the denial of coverage illegal through guaranteed issue and community rating laws.\cite{4} Of course, the recently passed health care reform bill mandates private insurance for most individuals who are not eligible for public insurance.\cite{5}} had characterized PHI markets. In response to this problem, Australia has made a novel attempt to counteract adverse selection through, \textit{inter alia}, an age-based penalty (ABP) scheme. Individuals who buy and maintain PHI avoid the ABP altogether. Furthermore, those who maintain PHI are guaranteed to have the option of being privately insured at the prevailing community-rated premium, irrespective of their risk profile at any point in the future.

In the United States, it is well-known that many millions are uninsured. The percentage of uninsured persons in the United States in 2001 was five times higher for people ages 19 to 34 (40 percent uninsured) than for people ages 55 to 64 (8 percent uninsured).\footnote{In the United States, it is well-known that many millions are uninsured. The percentage of uninsured persons in the United States in 2001 was five times higher for people ages 19 to 34 (40 percent uninsured) than for people ages 55 to 64 (8 percent uninsured).\cite{1} One concern has been with the denial of PHI cover to people with chronic diseases, or PHI offers that entail prohibitively high (and perhaps unfair) premiums. Some states in the United States have reacted by making the denial of coverage illegal through guaranteed issue and community rating laws.\cite{4} Of course, the recently passed health care reform bill mandates private insurance for most individuals who are not eligible for public insurance.\cite{5}} One concern has been with the denial of PHI cover to people with chronic diseases, or PHI offers that entail prohibitively high (and perhaps unfair) premiums. Some states in the United States have reacted by making the denial of coverage illegal through guaranteed issue and community rating laws.\footnote{In the United States, it is well-known that many millions are uninsured. The percentage of uninsured persons in the United States in 2001 was five times higher for people ages 19 to 34 (40 percent uninsured) than for people ages 55 to 64 (8 percent uninsured).\cite{1} One concern has been with the denial of PHI cover to people with chronic diseases, or PHI offers that entail prohibitively high (and perhaps unfair) premiums. Some states in the United States have reacted by making the denial of coverage illegal through guaranteed issue and community rating laws.\cite{4} Of course, the recently passed health care reform bill mandates private insurance for most individuals who are not eligible for public insurance.\cite{5}} Of course, the recently passed health care reform bill mandates private insurance for most individuals who are not eligible for public insurance.\footnote{In the United States, it is well-known that many millions are uninsured. The percentage of uninsured persons in the United States in 2001 was five times higher for people ages 19 to 34 (40 percent uninsured) than for people ages 55 to 64 (8 percent uninsured).\cite{1} One concern has been with the denial of PHI cover to people with chronic diseases, or PHI offers that entail prohibitively high (and perhaps unfair) premiums. Some states in the United States have reacted by making the denial of coverage illegal through guaranteed issue and community rating laws.\cite{4} Of course, the recently passed health care reform bill mandates private insurance for most individuals who are not eligible for public insurance.\cite{5}}

Luke B. Connelly, PhD, is Professor of Health Economics, (UQ Node) Director, Australian Centre for Economic Research on Health (ACERH UQ); Associate Director, Centre of National Research on Disability and Rehabilitation Medicine (CONROD); and School of Economics, The University of Queensland, Mayne Medical School. He can be reached at l.connelly@uq.edu.au.

Henry Shelton Brown III, PhD, is Associate Professor of Health Economics, Division of Management, Policy and Community Health, Michael & Susan Dell Center for Advancement of Healthy Living, Institute for Health Policy, University of Texas School of Public Health—Austin campus. He can be reached at h.shelton.brown@uth.tmc.edu.

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although some have vowed to challenge the so-called “personal mandate” provision on constitutional grounds and for other, political reasons.

Another concern in the United States has been with the consequences of being reclassified as high risk. The Health Insurance Portability and Accountability Act (HIPAA) of 1996 ensures that high-risk individuals cannot be dropped or have their premiums increased by more than others insured by that firm. These policies may have the unintended consequence of increasing the average risk level of those who are insured although recent work has found little evidence of this in individual markets. Adverse selection implies that an increased average risk level, in this case by mandating that private insurers cover high risks at a premium below their expected benefit, may drive the better risks among the insured out of the market or into low-risk pools in other firms. This may result in a net reduction in PHI rates at the population level and may lower economic welfare.

The Australian ABP scheme offers the following alternative: for those who buy and maintain PHI when they are young and relatively healthy, there is guaranteed issue at the community-rated premium, independent of any subsequent risk level. If one becomes high risk while not privately insured, however, although there is still guaranteed issue, an increasing ABP is also imposed on the PHI premium, and it applies for all subsequent PHI periods. Thus, in a sense, the Australian arrangements are similar to those in US jurisdictions that have mandated guaranteed issue for the uninsured, but have not regulated premiums. Both policies “punish” new joiners, either by adding an ABP to the community-rated premium or by allowing (perhaps prohibitively) high risk-rated premiums. The Australian government also has pursued two more conventional policies to promote the purchase of PHI: a tax on middle-to-high-income earners for not buying PHI and a direct ad valorem subsidy on the insurance premium for purchasers of PHI.

This article examines the extent to which a range of PHI policy measures in Australia have affected the price of PHI, defined as the ratio of premiums to expected benefits, by age. Using data on PHI expenditures, by age, as well as data on hospitalization frequencies, and episodic costs, we compute the price of PHI for each age group in the Australian population with PHI and examine the dynamics of prices and membership over time.

We conclude that the propensity for an adverse selection death spiral still exists in Australian PHI markets, but that this has been kept in check by tax penalties that the Australian government has imposed on middle-to-high-income earners who do not buy PHI. We also offer an alternative scheme of age-based taxes that is nevertheless consistent with the general framework of the existing LC scheme.

**Background**

Australia has a system of public insurance that is universal and compulsory. Despite this fact, more than 40 percent of the population holds private health insurance (PHI) for hospitalization. This is one of the highest rates of PHI coverage in the world for countries with universal health care. This relatively high rate of PHI coverage has, however, not been achieved without considerable government intervention. Between 1984 and the late 1990s, PHI coverage fell from 50 percent to 30.1 percent of the population as a result of
adverse selection in community-rated PHI markets. This has been characterized as an adverse selection death spiral. Over the past decade, the Australian government has made a number of attempts to raise the level of PHI coverage in Australia by introducing a series of tax-and-subsidy measures and age-related late-joiner penalties to boost PHI coverage. The range of measures has been discussed in some detail in the existing literature. PHI coverage in Australia has not only grown, but also appears to have stabilized in recent quarters.

The measures in place in Australian PHI markets, at the time of writing, include:

1. The subsidy (or rebate) on PHI policies;
2. The Medicare Levy Surcharge (MLS) tax on mid-to-high-income earners who do not have PHI; and
3. The LC scheme, which penalizes people who join the PHI pool later in life. The ABP is calculated by taking the number of years beyond 30 and multiplying this number by 0.02, or 2 percent. Note that the penalty is paid in every year after initially purchasing PHI.

Specifically, the rebate applies to all PHI policies based on the age of the oldest person covered. The subsidy is 30 percent of the premium paid for individuals 65 years, 35 percent of the premium paid for 65 to 69 year-olds, and 40 percent of the premium paid for individuals 70 years and older. The subsidy may be taken either as a reduction in the price of the policy at the time of purchase, or as a tax rebate when an income tax return is filed. The MLS is payable by individuals who earn $50,000 or couples/families that earn $100,000 but do not have PHI; it is calculated as 1.0 percent of taxable income. The ABPs essentially involve loading the base premium by a fraction that is calculated as the number of years beyond 30 that a person first took out PHI, times 0.02 (e.g., a person who joined at 40 years pays a premium that is 1.2 times the base premium for the duration of membership).

The Model

Under standard PHI theory, when faced with a choice between a risky income distribution with mean \( k \) and a certain income \( k \), a risk-averse individual prefers the latter. Thus, the welfare of a risk-averse person is raised when he or she purchases PHI at the actuarially fair price:

\[
P_i = \frac{z_i H_i}{(1)}
\]

where \( P_i \) is the actuarially fair premium for the ith individual, \( z_i \) is the probability of the loss event (e.g., of hospitalization) for the ith individual and \( H_i \) is the value of the loss (e.g., the cost of the hospital episode) to the ith individual if the event occurs. Note that the premium \( P \) is in fact the price of a PHI policy, not the price of PHI per se. The price of PHI \( p \) is the price per dollar of expected benefit or, equivalently, the ratio of the expected loss to the premium:

\[
p_i = P_i / z_i H_i
\]

Note that it follows from (1) that \( P_i / z_i H_i = 1.00 = p_i \), i.e., by definition, a premium is actuarially fair if the price per dollar of expected benefit is one.

Actuarially unfair prices for PHI are, however, common place in practice. Typically emphasized reasons for this include the
existence of asymmetries of knowledge between the insurer and insured about risk and loss expectations, for administrative loadings, and monopoly pricing. Institutional arrangements such as mandated community rating, where low-expected-loss individuals (ls) pay the same premium for a policy as high-expected loss individuals (hs), result in unfair prices. There is also evidence, though, that cross-subsidization also occurs in experience-rated PHI markets.

Under community rating, the premium for PHI is invariant with respect to an individual’s risk and loss expectations. For precisely this reason the price of PHI, defined as the price per dollar of expected PHI benefit, is not uniform across risk and loss types. Assuming only two risk types, ls and hs, community rating may be characterized as a system of insurance cross-subsidies from ls to hs. In a competitive community-rated PHI market with equal proportions of ls and hs, no excess profits, and no taxes or subsidies of PHI we may write:

\[ C_l^p = P + \lambda_l P \quad (3) \]
\[ C_h^p = P - \lambda_h P \quad (4) \]
\[ \lambda_l = \lambda_h \quad (5) \]
\[ C_l^p > C_h^p \quad (6) \]

where \( C_l^p \) is the price charged to low-expected-loss individuals, \( C_h^p \) is the price charged to high-expected-loss individuals, \( \lambda_l \) is the premium loading for ls, and \( \lambda_h \) is the premium discount for hs. Under the assumptions above, \( C_l^p > \$1.00 \) and \( C_h^p < \$1.00 \), i.e., for every dollar of expected benefit, ls pay more than one dollar and hs pay less than one dollar. Thus, the uniform premium (\( P \)) results in unfair prices that are are favorable to hs and unfavorable to ls. However, note that some ls may still find the purchase of PHI welfare-maximizing. Whether or not this is the case depends jointly on the degrees of risk aversion and premium unfairness.

An aforementioned source of inefficiency that is associated with community rating is adverse selection, wherein h-types are over-represented in the PHI pool.

Let \( z \) represent the mean risk in the population and be the mean loss. Thus, the community-rated premium is \( zH \). For an individual, the premium payable for a given policy, under the Australian ABP scheme may be represented as:

\[ p_i = (1 + A \times 0.02) \times zH - R_i \quad (7) \]

where \( A \) is the number of years beyond 30 that a person first took out PHI and \( R \) is the applicable (age-based) rebate/subsidy. The price of PHI, as previously defined, (2), thus becomes

\[ p_i = \frac{C_l^p}{z_i} - \frac{C_h^p}{z_i} = \frac{(1 + A \times 0.02) \times z_i H_i - R_i}{z_i H_i} \quad (8) \]

The imposition of the ABPs is intended to attract and maintain customers from an early age. In particular, the healthy young may insure against future penalties, which would otherwise arise due to the ABP, by maintaining PHI when \( p_i \) is less than one. Thus, it is useful to sum (8) across all ages after 30 and compute the implicit (real) annual price of PHI when it is computed for a particular joining age. This necessitates adding subscript \( A \), which corresponds to the period of initial purchase past age 30, and \( L \), which corresponds to the point of death, as
Now assume, for simplicity, that all three PHI measures apply to all consumers (1. and 3., in fact, always do) and that this policy covers the entire loss $H_i$ of insured individuals, otherwise known as full PHI.

A utility-maximizing individual’s decision whether or not to buy PHI may be represented as a choice between an uncertain (uninsured state) income distribution with expected income-utility:

$$E(U) = zU(Y - H - T) + (1 - z)U(Y - T);$$

$$T = f(Y; Y > 50,000)$$

(10)

where $T$ is the MLS tax penalty, and the certain (insured state) income-utility:

$$U = U(Y - (1 + A \times 0.02) \times zH - R)$$

(11)

Recall that $R_i$ is positive for all purchasers of PHI and $T \geq 0$, depending on income. Thus, neither of these measures is predicted to lower the likelihood that good risks buy PHI. On the other hand, as has been emphasized elsewhere, the incentives produced by the age-based penalties of the ABP scheme do not uniformly increase the attractiveness of PHI (i.e., increase (11)). The ABPs could, for example, discourage older “low-risk” individuals from initially taking out PHI while they remain low-risk.

The utility functions (10) and (11) are not estimable. However, recall from (1) that a risk-averse individual will always choose the certain equivalent (11) in preference to a risky distribution (10) with the same expected value. By extension, one can infer that if the value of (8) < $1.00, the individual will prefer to purchase PHI rather than self-insure. Of course, values of (8) > $1.00 are sometimes consistent with welfare-maximizing purchase of PHI for the reasons outlined above. We also estimate (9) based on the youngest cohort in the sample. In this article, we use these facts and the available data to estimate the impact of an array of Australian government policies on the desirability of PHI.

**Methods and Data**

Using PHI industry data on membership and expenditures, along with industry premium data, we estimate the price of PHI by age and gender, simulate the effects of the applicable taxes and subsidies on those prices, and compare them to actuarially fair (but community-rated) premiums for five-year age groups. Essentially, we estimate (8) and (2) and compare the results of these to show whether the price of PHI is actuarially fair in each age group. In addition, we compute the expected income and certain income components of (9) and (10) for income levels where the tax penalties apply and ask whether or not, solely on the basis of the income tax implications, might individuals/families purchase a PHI policy even though the premium is unfair (i.e., when (8) > (2))?

Finally, we produce some illustrative results of the ABP scheme and tax provisions for low-risk old individuals who have not previously held PHI. The only other
work of this nature that has been conducted for Australia was undertaken by Butler. His work was, however, primarily concerned with estimating elasticities for PHI and was conducted for a pre-ABP period.

The PHIAC data available to us are five-year age-group aggregates, by gender, disaggregated into hospital and ancillary PHI cover. The data do not enable us to determine which members hold both hospital and ancillary cover, so our exclusive focus is on the hospital PHI. Quarterly observations are available on:

(i) The number of members;
(ii) The proportion of the Australian population with PHI;
(iii) The total PHI benefits paid; and
(iv) The number of hospital episodes.

Since the insured event is hospitalization, the mean probability of the insured event in the jth age group \( z_j \) may be derived by dividing (iv) by (i). Similarly, the mean cost per insured event for the (insured) members of the jth age group \( z_j \) may be derived by dividing (iii) by (i). This is the mean fair premium for the jth age group \( z_j H_j \), derived. All price data were converted to constant 2006–2007 Australian dollars. Due to seasonality in the quarterly series, we report annual means for our series.

Detailed data on the characteristics (e.g., the inclusions and coinsurance provisions) of hospital policies purchased were not available to us, nor was the value of premiums collected. Furthermore, no matching time-series of premiums is available. Thus, in order to compute the price of PHI, we must make an assumption about the policy types purchased. To be conservative, we selected the lowest-price hospital PHI policy available from the largest Australian private health insurer, Medibank Private Ltd. The policy chosen is called “First Choice Hospital” and it contains the most basic inclusions this insurer offers at the premium of $586.79 in Australia’s most populous state, New South Wales. There are several reasons that this is a conservative assumption. First, this policy is unlikely to be attractive to older consumers, high-expected-loss types, and couples planning to use private hospital services for childbirth. Second, and notwithstanding our assumption that full PHI is available, this policy has some coinsurance provisions.

Finally, note that we do not know how the benefits data are distributed as between individuals and households, let alone the family composition of households that have PHI. Although family premiums are computed simply as twice the singles premium, unfortunately the effect is not a simple linear transformation with respect to the computation of our price \( \pi \) variable. Specifically, when we compute the price of PHI for children of dependent age, we essentially ignore the fact that the majority of these children must be covered by parents’ or guardians’ policies. This is quite an important limitation, which we address by constructing family unit scenarios towards the end of this article and recomputing the price of PHI.

Results

Figure 1 presents the central results on the price of PHI, by age group and gender, with and without the rebate. Recall that a premium \( (P) \) is actuarially fair if it results in a price \( (p) = \$1.00 \) per dollar of expected benefit: a price of more than \$1.00 suggests a premium that is actuarially unfair and unfavorable to the insured, while a price of less
than $1.00 suggests a premium that is unfair but favorable to the insured. The effect of the rebate is, universally, to reduce the price of PHI. However, Table 1 shows that the premiums for the zero to four to 45 to 49 age groups are, on average, unfair and unfavorable, with or without the subsidy. The premiums for women and persons ages 25 to 39 are unfair but favorable, presumably due to the predominance of obstetrics and related

Figure 1. Estimated Mean Prices of PHI in Australia, with and Without the PHI Rebate, by Gender and Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Persons</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$p_A$</td>
<td>$p_A-R_A$</td>
<td>$p_A$</td>
</tr>
<tr>
<td>0–4</td>
<td>$2.40$</td>
<td>$1.68$</td>
<td>$2.17$</td>
</tr>
<tr>
<td>5–9</td>
<td>$9.43$</td>
<td>$6.60$</td>
<td>$8.62$</td>
</tr>
<tr>
<td>10–14</td>
<td>$8.81$</td>
<td>$6.17$</td>
<td>$8.91$</td>
</tr>
<tr>
<td>15–19</td>
<td>$3.59$</td>
<td>$2.51$</td>
<td>$3.88$</td>
</tr>
<tr>
<td>20–24</td>
<td>$2.36$</td>
<td>$1.65$</td>
<td>$2.92$</td>
</tr>
<tr>
<td>25–29</td>
<td>$1.30$</td>
<td>$0.91$</td>
<td>$3.10$</td>
</tr>
<tr>
<td>30–34</td>
<td>$1.03$</td>
<td>$0.72$</td>
<td>$3.22$</td>
</tr>
<tr>
<td>35–39</td>
<td>$1.26$</td>
<td>$0.88$</td>
<td>$2.70$</td>
</tr>
<tr>
<td>40–44</td>
<td>$1.57$</td>
<td>$1.10$</td>
<td>$2.22$</td>
</tr>
<tr>
<td>45–49</td>
<td>$1.36$</td>
<td>$0.96$</td>
<td>$1.63$</td>
</tr>
<tr>
<td>50–54</td>
<td>$1.04$</td>
<td>$0.73$</td>
<td>$1.11$</td>
</tr>
<tr>
<td>55–59</td>
<td>$0.75$</td>
<td>$0.53$</td>
<td>$0.74$</td>
</tr>
<tr>
<td>60–64</td>
<td>$0.52$</td>
<td>$0.36$</td>
<td>$0.49$</td>
</tr>
<tr>
<td>65–69</td>
<td>$0.36$</td>
<td>$0.24$</td>
<td>$0.33$</td>
</tr>
<tr>
<td>70–74</td>
<td>$0.26$</td>
<td>$0.16$</td>
<td>$0.24$</td>
</tr>
<tr>
<td>75–79</td>
<td>$0.21$</td>
<td>$0.13$</td>
<td>$0.19$</td>
</tr>
<tr>
<td>80–84</td>
<td>$0.19$</td>
<td>$0.11$</td>
<td>$0.17$</td>
</tr>
<tr>
<td>85–89</td>
<td>$0.17$</td>
<td>$0.10$</td>
<td>$0.16$</td>
</tr>
<tr>
<td>90–94</td>
<td>$0.17$</td>
<td>$0.10$</td>
<td>$0.16$</td>
</tr>
<tr>
<td>95+</td>
<td>$0.19$</td>
<td>$0.11$</td>
<td>$0.17$</td>
</tr>
</tbody>
</table>

Note: Data are presented in 2006 Australian dollars (AUD1 = USD0.74; 31 June 2006) and were computed using Equation (8).

services in this age group. Gross premiums are closest-to-fair in the 50 to 54 years age group, but in all, older age groups are unfair but favorable to the insured.

The effect of the rebate on actuarial fairness, around this age group, is the most noteworthy: prices net of the subsidy become actuarially unfair and favorable to the insured around this age point. Notably, the price of PHI for the oldest old is extremely low, with or without the rebate. Without the PHI rebate, 70+ year olds were paying 23 cents or less per dollar of expected PHI benefit. With the 40 percent PHI rebate, this age group now pays less than 14 cents per dollar of expected benefit.

Finally, note that the first two columns of price data on “persons” provides an effective way of considering whether or not PHI premiums are fair, on average, for an adult couple of the same age. The PHI premium for a couple is simply double that of the single premium.

Of course, the data presented in Figure 1 depend on several simplifying assumptions, the most important of which are that:

(i) The insured population buys a prescribed individual, rather than family policy; and
(ii) That the policy chosen is the most frugal available.

Additionally, the unfair prices in Figure 1 ignore the ABPs, which make policies for all age groups > 25 to 29 more expensive. Note, though, that the magnitudes of premiums for the oldest old suggest that even the applying the maximum ABP scheme penalty, a 70 percent premium loading for people who join at 65 years or older may not be particularly dissuasive: 1.7 times the prices currently paid by these groups still generates an actuarially unfair and favorable price for the oldest of the old. Note that the lifetime average price of PHI for those over 30 is $0.45 overall, $0.67 for men, and $0.39 for women.

Figure 2 presents the results in Figure 1 with the ABPs added by sex and by age that

---

**Figure 2. Estimated Annual Mean Prices of PHI in Australia by Gender and Joining Age, with 2006 Age-Based Penalties (ABPs)**

<table>
<thead>
<tr>
<th>Joining age</th>
<th>Persons (male/female means)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>$1.00</td>
<td>$2.15</td>
<td>$0.68</td>
</tr>
<tr>
<td>37</td>
<td>$1.36</td>
<td>$1.92</td>
<td>$1.08</td>
</tr>
<tr>
<td>42</td>
<td>$1.29</td>
<td>$1.53</td>
<td>$1.11</td>
</tr>
<tr>
<td>47</td>
<td>$1.05</td>
<td>$1.12</td>
<td>$0.98</td>
</tr>
<tr>
<td>52</td>
<td>$0.82</td>
<td>$0.80</td>
<td>$0.83</td>
</tr>
<tr>
<td>57</td>
<td>$0.59</td>
<td>$0.56</td>
<td>$0.64</td>
</tr>
<tr>
<td>62</td>
<td>$0.41</td>
<td>$0.37</td>
<td>$0.44</td>
</tr>
<tr>
<td>67</td>
<td>$0.27</td>
<td>$0.24</td>
<td>$0.31</td>
</tr>
<tr>
<td>72</td>
<td>$0.22</td>
<td>$0.19</td>
<td>$0.24</td>
</tr>
<tr>
<td>77</td>
<td>$0.19</td>
<td>$0.17</td>
<td>$0.20</td>
</tr>
<tr>
<td>82</td>
<td>$0.17</td>
<td>$0.17</td>
<td>$0.19</td>
</tr>
<tr>
<td>87</td>
<td>$0.17</td>
<td>$0.15</td>
<td>$0.17</td>
</tr>
<tr>
<td>92</td>
<td>$0.19</td>
<td>$0.17</td>
<td>$0.19</td>
</tr>
</tbody>
</table>

**Note:** Data are presented in 2006 Australian dollars (AUD1 = US$0.74; 31 June 2006) and were computed using Equation (8).

a person initially purchased PHI. The subsidy and ABPs are included. The first column lists the price of PHI \( p \) using equation (8). For simplicity, we report the ages initially joined at the mid-points of the age intervals in Figure 1. For instance, for all persons, the price of PHI for a 42 year old buying private PHI for the first time is $1.29, which is actuarially unfair and unfavorable. Note that the tax mainly affects the price of PHI at the highest ages, which is not surprising because it increases with age. This is also the average price paid for PHI by age.

For instance, a person buying PHI for the first time at age 57 would pay an average of $0.59 for PHI between the ages of 57 and 92, which is higher than the average price of $0.45 per year if he or she initially bought PHI at age 30. The price is higher than he or she would pay without ABP or if he or she was an insured individual at some point between ages 30 and 57. However, PHI is still overwhelmingly actuarially unfair but favorable.

Clearly, the initial tax is too high, which may keep low risk individuals from initially buying PHI after age 30. This may in fact drive out low-risk individuals under age 40, for whatever reason (liquidity constraints, temporary unemployment), did not buy PHI at age 30 and therefore must pay the tax to initiate coverage. At older ages, the increased expected expenditures far outweigh the tax penalties for not maintaining HI.

Thus, this combination of subsidies and ABPs may entice only the most risk averse to take out and maintain private PHI from age 30. Why, then, has PHI membership recently stabilized as a proportion of the Australian population? The income tax penalty, calculated at one percent of taxable income for individuals who earn over $50,000 and couples/families that earn in excess of $100,000, is the obvious explanation. Note, for example, that the price of the PHI product we selected, net of the 30 percent subsidy is $410.75 (= 0.70 x $586.79), while the tax penalty for not having PHI is $500 for a single person who earns $50,001. Clearly, there is a strong financial incentive for individuals with mid-to-high income to buy PHI even when the price is actuarially unfair and unfavorable. Taxing individuals into PHI is unlikely to be efficient though, for reasons that are well-established. 22

Other Scenarios

As was outlined above, a serious limitation of the estimates presented in Figures 1 and 2 is that they ignore the fact that, under family policies, dependents essentially get a “free ride.” This is an important issue because the effective price for families with dependents will be lower than is suggested by the data in Figures 1 and 2. In this section, we present some indicative simulations of family purchasers of PHI. The simulations are conducted only for those adult age groups in Figure 1 for whom the price of PHI suggested unfair individual premiums.

The simulations assume that no LC penalties are incurred. Dependents are assumed, conservatively, to be in the zero to four age range for household units with up to three dependents. This is the dependent age range with the highest expected benefit per insured. Simulations with a fourth dependent assume that the fourth child is in the five to nine year age range. The results are presented in Figure 3.

Under these scenarios, most household units face actuarially unfair but favorable prices, i.e., substantial cross-subsidization
from individuals to families with dependents is evident under the current arrangements. An obvious way to introduce greater fairness in the premium structure is to re-compute family premiums as summations of fair age-based premiums for individuals. In the next section, we produce the premium multipliers that enable this to be done, given the present composition of the PHI pool.

**Lifetime Fairness**

What alternative scheme might work that would improve efficiency, but does not depend on harsh income tax penalties? Taking both community rating and the LC principles as institutional constraints, our answer is to impose a premium structure that creates fair lifetime premiums. This can be achieved for any given joining age, by solving (9) for $p_i = $1.00. Furthermore, assume that cross-subsidization from singles to families is also abolished: family premiums are determined as the summation of individual, fair, lifetime policies.

Figure 4 presents (second column) the premium multipliers that, if applied for a lifetime of PHI cover, result in fair annual premiums for joiners in each age group, on average. It also shows (third and fourth columns) the material effects of these multipliers on premiums for two PHI products that were offered by Medibank Private Ltd in 2006. These computations suggest, for example, that children who are enrolled from birth (ages zero to four) and maintain cover would pay just over half of the community-rated premium, while individuals ages 70+ pay more than five times the community-rated (or “base” premium). Note that this penalties-and-discounts scheme means that the oldest first-joiners pay approximately ten times the premium that is paid by individuals who have held PHI since early childhood.

Interestingly, for the five-year age groups represented in Figure 4, a linear regression
also fits the data very well: with only a constant and age-step “trend,” the coefficient of determination (R2) is approximately 0.95. The age-based trend coefficient is 0.31. Since our regression uses five-year intervals, this coefficient suggests that an ABP (or discount, as the case may be) of the order of 6 percent per annum on average is a reasonable approximation to our premium multipliers. This ABP is three times the magnitude

<table>
<thead>
<tr>
<th>Joining Age</th>
<th>Fair Lifetime Premium Multiplier for Joining Age</th>
<th>Estimated Premiums: Most Basic Policy, No Rebate</th>
<th>Estimated Premiums: Most Comprehensive Policy, No Rebate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>0.54</td>
<td>$317</td>
<td>$787</td>
</tr>
<tr>
<td>5–9</td>
<td>0.55</td>
<td>$323</td>
<td>$800</td>
</tr>
<tr>
<td>10–14</td>
<td>0.72</td>
<td>$420</td>
<td>$1,042</td>
</tr>
<tr>
<td>15–19</td>
<td>1.04</td>
<td>$611</td>
<td>$1,515</td>
</tr>
<tr>
<td>20–24</td>
<td>1.26</td>
<td>$737</td>
<td>$1,828</td>
</tr>
<tr>
<td>25–29</td>
<td>1.45</td>
<td>$848</td>
<td>$2,103</td>
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<td>35–39</td>
<td>1.61</td>
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<tr>
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<td>$1,037</td>
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<td>45–49</td>
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<td>65–69</td>
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<td>$2,650</td>
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<td>70–74</td>
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<td>80–84</td>
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<tr>
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</tr>
<tr>
<td>95+</td>
<td>5.26</td>
<td>$3,088</td>
<td>$7,661</td>
</tr>
</tbody>
</table>

of that which currently applies under the Australian LC scheme, even when extended to individuals ages < 31.

Discussion

In the United States, many states have guaranteed issue laws for the uninsured. In the individual market, high-risk individuals cannot be denied the right to purchase PHI. For those with PHI, HIPPA regulations ensure that persons currently insured cannot be dropped nor have their premiums raised to prohibitively high levels. While these laws increase access for high-risk individuals, PHI is too harsh on initial non-purchasers and too lenient on those initially buying PHI at higher ages. Applying, for example, Herring and Pauly’s finding that high-risk older males consume approximately eight times more benefits than low-risk males, one can easily see that a cap on the maximum difference between premiums paid of 0.7 times will not induce low-risk individuals to purchase and maintain PHI. Indeed, it is interesting to note that our proposed premium multipliers lead to premium relativities that are of the order discovered by Herring and Pauly.

Our proposal is likely to strike protestation on equity grounds. One may, for example, object that young adults should not be captives of the historical decisions of their parents (i.e., be ineligible for a discount because their parents did not buy PHI); that elderly people may be too harshly penalized by the scheme (or have earned entitlements that we do not account for); and so forth. A system of transfer payments may be an efficient way to address equity concerns of this kind.

One important limitation of our study is that the data available to us pertain to purchasers of PHI. One would typically expect the self-selected pool to constitute an adverse selection of individuals, although some recent evidence suggests that the tax penalties on mid-to-high income individuals for not purchasing PHI may confound this prediction. In any event, improvements in the risk-composition of the pool would necessitate recalibrations of the age-based tax rates we have proposed here. Moreover, one would wish to base the initial calibration and recalculation on more finely disaggregated industry data than are publicly available.

Finally, the Australian government has recently increased the MLS income thresholds from $50,000 to $73,000 for singles and from $100,000 to $146,000 for couples/families. Our results suggest that many young individuals (ages < 31) who earn less than the threshold amounts will have a strong financial incentive to drop their PHI coverage as a result of the threshold changes. By contrast, the modifications of the ABPs we propose would make the price of PHI fairer and encourage younger people to join and maintain PHI, without imposing punitive taxes on non-joiners.

REFERENCES

2. Id.
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8. Supra, n.4.
10. Supra, n.1.
12. These thresholds were, for the first time since the introduction of the MLS, adjusted recently. The thresholds are now set at $73,000 for individuals and $146,000 for couples/families.
14. Supra, n.9.
20. Supra, n.18.
23. Supra, n.15.
24. Id.