

EFFECTIVENESS OF COPING STRATEGIES USED BY HOSPITALS IN RESPONSE TO IMPLEMENTATION OF A CASE-BASED PAYMENT SYSTEM BY THE NATIONAL HEALTH INSURANCE PROGRAM

Ching Chaw Huang,¹ Kuo-Piao Chung,² Nien-Chen Kuo,² and Chia-Ling Hung³

Background and Purpose: The introduction of the case-based payment system by the Bureau of National Health Insurance resulted in greatly increased pressure on the health care industry in Taiwan. This study examined the relationship between the coping strategies adopted and the results attained by accredited teaching hospitals and non-teaching regional hospitals when responding to this regulatory change.

Methods: A cross-sectional survey was conducted using a structured questionnaire to assess the hospitals' characteristics, and coping strategies at the technical, managerial and institutional levels in response to the case-based payment system, and to compare these strategies with self-evaluation of the effectiveness of these strategies. The questionnaire was sent in early October 2000 to the superintendents of the 129 hospitals that were accredited at the medical center, regional hospital, and district teaching hospital levels in the year 2000. Factor analysis was applied to group the strategies into categories and stepwise regression analysis was used to explore the relationship between the reported coping strategies adopted and their effectiveness as evaluated by participants.

Results: Among the selected hospitals, 89 responded with complete data, a 69% response rate. The following 7 factors were extracted from 30 coping strategies: information and financial analysis; service shifting and unbundling; service integration and quality improvement; service specialization and strengthening; education and training; financial incentives; and claim submission skill. After adjusting for accreditation level or ownership status, 2 main findings were noted. First, hospitals that implemented financial incentives strategies such as holding physicians responsible for all or part of the shortfall between actual claim submissions and actual reimbursements, and reducing or withholding payment to physicians beyond the standard length of stay, tended to increase medical revenue (odds ratio, 1.21). Second, hospitals that implemented service integration and quality improvement strategies, such as implementing a discharge plan, implementing clinical pathways and periodic review of quality indicators, attained higher patient satisfaction rate (odds ratio, 1.40).

Conclusions: This study suggests that hospitals confronting the implementation of a case based-payment system may benefit by adopting financial incentives strategies and by efforts to improve service integration and quality.

Key words: Financial management, hospital; Hospital administration; Hospital costs; National Health Programs; Reimbursement mechanisms

J Formos Med Assoc 2005;104:468-75

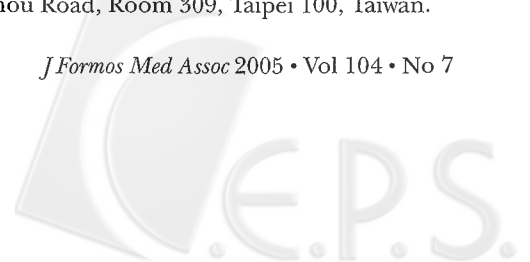
The implementation of the National Health Insurance (NHI) program in 1995 was one of the most significant events in the history of Taiwan's public health system. Following its implementation the nation's insured population increased from less than 50% in 1995 to more than 96% in 2001.¹ Access to health care became readily available. However, easy access to health care and the initial fee-for-service payment scheme failed to provide incentives for cost control. As a result, total aggregate health care expenditures escalated.²

One of the responses the Bureau of NHI (BNHI) made to the rapidly increasing cost of health care was to implement in stages a case-based payment system for inpatient procedures. When first introduced in 1995, the case-based payment system encompassed only 2 procedures: normal delivery and cesarean section. The number of case-based payment procedures was expanded to 26 in October 1997 and finally to 50 in July 1999. These 50 procedures, of which all but 4 are surgical in nature, account for about 40% of all

¹Department of Health Care Management, National Taipei College of Nursing, Taipei; ²Graduate Institute of Health Care Organization Administration, College of Public Health, National Taiwan University, Taipei; ³Taiwan Dental Association, Taipei, Taiwan.

Received: 2 June 2004 Revised: 23 August 2004 Accepted: 11 January 2005

Reprint requests and correspondence to: Dr. Kuo-Piao Chung, Graduate Institute of Health Care Organization Administration, College of Public Health, National Taiwan University, 19 Hsu Chou Road, Room 309, Taipei 100, Taiwan.



inpatient service charges.³ The switch from a fee-for-service payment system to a case-based payment system put immense financial pressure on the health care industry in Taiwan.⁴ Several studies in Taiwan investigated the measures taken by hospitals in order to mitigate the impact of the case-based payment system. Some researchers concluded that the preferred responses were intra-organizational strategies, such as raising the level of cost awareness and changing management structures.^{5,6} Others suggested that hospitals favored institutional level strategies, such as developing and promoting specialties that gave them a competitive edge, strengthening hospital personnel's understanding of the case-based payment system, and cutting the costs of drugs and supplies.⁷ However, these studies did not investigate whether these strategies were effective.

This study investigated the strategies adopted by hospitals in response to the regulatory change in the payment method, whether these strategies were successful, and whether a relationship existed between the extent of the implementation of these strategies and self-evaluated effectiveness such as positive changes in medical revenue, average length of stay and patient satisfaction rates.

Methods

Research instrument

This study used a cross-sectional survey as the investigation tool. The research targets were hospitals accredited at the medical center, regional hospital, or district teaching hospital level in the year 2000. The target population consisted of 15 medical centers, 48 regional hospitals, and 66 district teaching hospitals.

In the preface to the questionnaire, in order to facilitate cooperation among participants, we mentioned that this study was supported by the Department of Health and that summary results would be provided to responding hospitals. The structured questionnaire consisted of 4 parts: basic data about the hospital, including the level of accreditation, ownership status, and perceived level of competition faced; a list of 30 possible coping strategies, some or all of which a hospital might have employed in response to the case-based payment system; the hospital's own evaluation of the effectiveness of its coping strategies in terms of proportional changes in operating costs, medical revenue, earnings before taxes, average length of stay, slashed-claim ratio, average hospital bed occupancy rate, re-admission ratio, and patient satisfaction rate before the first expansion of the case-based payment system in September 1997 and after the second expansion to

cover 50 procedures in July 1999; and personal characteristics of the person completing the questionnaire, such as age, gender, education, work department/unit, and years of work experience. A 5-point Likert scale with scores ranging from very low (1 point) to very high (5 points) was used to measure the extent to which a strategy was executed if the strategy was adopted by the hospital. To establish the validity of the research instrument, 9 experts — 4 hospital superintendents, 2 vice-superintendents, and 3 specialists in hospital management — were invited to critique the questionnaire in terms of validity of the contents and clarity of the questions. However, some of the experts recommended combining certain questions and subdividing a few others.

A literature review was performed to search for a framework to categorize the coping strategies,⁸⁻¹¹ with the awareness that it is essential to consider the difference between health care organizations and other industries.¹² Several studies¹³⁻¹⁵ support the application of a classification framework developed by Cook et al¹⁰ for coping strategies in response to outside regulatory change similar to the implementation of the case-payment system in the NHI. Following this approach, we classified the 30 coping strategies into 3 categories: technical level ($n = 9$), managerial ($n = 8$), and institutional level ($n = 13$). The Cronbach's alpha coefficients for these categories were as follows: Overall 0.91, Technical 0.71, Managerial 0.79, and Institutional 0.90.

Data collection and analysis

The questionnaire was mailed to the superintendents of the 129 hospitals in early October 2000 with a second mailing in early November 2000. Ultimately, 89 hospitals responded. All returned questionnaires were reviewed and coded. If an item was not answered, the respondent was contacted by telephone for additional information. The response rate was 69%. Among these responses, 11 (12%) were from medical centers, 38 (43%) from regional hospitals, and 40 (45%) from district teaching hospitals. The highest return rate was from regional hospitals at 79%, followed by medical centers at 73% and district teaching hospitals at 61%. Thirty returns (34%) were from public hospitals and 59 (66%) were from non-public hospitals. Overall, chi-squared tests verified that the 89 responding hospitals were not statistically different from the target population with respect to accreditation level and ownership status.

Model construction

The scores on the 30 strategies from the questionnaire responses were used as the independent variables in

our model. The control variables included ownership status, level of accreditation, and level of perceived competition. The dependent variables were reported changes in operating costs, medical revenue, earnings before taxes, average length of stay, slashed-claim ratio, average occupancy rate, re-admission ratio, and patient satisfaction rate. They were first treated as quinary in the univariate analysis and then treated as binary: decreased or increased in the model building, based on whether their effects were consistent with expectations. For example, patient satisfaction and medical revenue were expected to increase as a result of the strategies employed. If they did not increase (even if they remained unchanged), they were given a decreased value. Similarly, average length of stay and slashed-claim ratio were expected to decrease. If they did not decrease (even if they remained unchanged), they were given an increased value.

A principal component analysis was applied to extract the underlying factors among the 30 variables. Orthogonal varimax rotation was subsequently applied to the factors. Chi-squared test, 1-way analysis of variance and *t* test were used to analyze the relationship among hospital characteristics, these factors and their effectiveness. For each dependent variable, accreditation level, ownership status, and level of perceived competition, if applicable, were entered as the control variables. A stepwise logistic regression model was constructed for each dependent variable while simultaneously adjusting for other competing factors and control variables.

Results

A descriptive analysis revealed that at the technical level, the most common coping strategy, adopted by

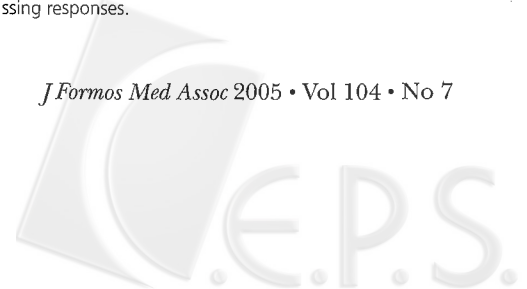
Table 1. Strategies adopted to cope with case-based payment system implementation.*

	Percent [†]	Valid total
I. Technical level strategies		
1. Adjust outlier claims to a level consistent with case-based limits	95.4	87
2. Manipulate within the "verified for actual payment" percentage	94.2	86
3. Perform regular and necessary examination before admission	83.7	86
4. Shift surgeries from inpatient areas to outpatient departments	82.6	86
5. Avoid prescribing medications upon discharge	77.9	86
6. Submit claims as early as possible	73.3	86
7. Transfer critical patients to other hospitals	64.0	86
8. Split of emergency hospitalization charge into an outpatient component and a case-based component	62.4	85
9. Avoid admitting patients during holidays	59.5	84
II. Management level strategies		
1. Aggressively cut costs of drugs and supplies	94.3	87
2. Develop a computer system to support case-based procedures.	94.3	87
3. Generate management reports to compare actual submissions vs actual reimbursements.	94.2	86
4. Display the real time status of a case-based procedure in progress, such as next item to perform and updated cumulative cost.	89.8	88
5. Analyze the cost of each case-based procedure.	86.4	88
6. Share cost savings in claim submission with physicians.	63.2	87
7. Hold physicians responsible for all or part of the shortfall between actual submissions and actual reimbursements.	40.7	86
8. Reduce or withhold payment to physicians for days beyond standard length of stay	38.6	83
III. Institutional level strategies		
1. Establish communication channels with BNHI	100.0	88
2. Conduct inpatient satisfaction surveys	100.0	86
3. Promote interactions between patient classification personnel and physicians	98.9	88
4. Implement discharge plans	97.7	86
5. Develop specialties that give the hospital a competitive advantage	96.6	87
6. Promote non-physician personnel's understanding of the case-based payment system	95.3	86
7. Review quality indicators of case-based procedures periodically	95.3	85
8. Send physicians to training or seminars	93.0	86
9. Implement clinical pathways	92.9	84
10. Encourage physicians to join the BNHI review group	92.0	87
11. Introduce new medical equipment	92.0	87
12. Train physicians in how to select primary diagnoses, primary procedures and how to avoid making a procedure case-based	87.4	87
13. Develop practice guidelines	87.1	85

* Answers of "very high" through "very low" were treated as "adopted that strategy".

[†] Percent of "strategies adopted" = (answers of "very high" through "very low")/total number of non-missing responses.

BNHI = Bureau of National Health Insurance.



95% of the hospitals, was to adjust outlier claims to a level consistent with the case-based limits (Table 1). The next 2 most commonly used coping strategies were to manipulate claim submissions within the "verified for actual payment" percentage (94%) and to perform regular examinations of patients before admission (84%). The least frequently adopted strategies were to avoid admissions during holidays (60%), to split emergency hospitalization into outpatient and case-based components (62%), and to transfer critical patients to a higher level hospital (64%).

At the managerial level, the most commonly adopted coping strategies were: to cut the costs of drugs and supplies aggressively; to develop an integrated computer system in support of the case-based payment; and to generate management reports that compared claimed amounts versus reimbursed amounts (Table 1). All 3 coping strategies were adopted by at least 94% of the hospitals. The least frequently adopted coping strategies were to reduce or withhold payment to the physicians for days of hospital stay beyond the standard length (39%), to hold physicians responsible for all or part of the shortfall between the claimed amount and the amount actually reimbursed (41%), and to share cost savings from claim submissions with physicians (63%).

It is obvious that hospitals in the sample preferred institutional level strategies. All hospitals established a communication channel with the BNHI, and conducted patient satisfaction surveys. Ninety nine percent of the hospitals promoted interactions between patient classification personnel and physicians, 98% implemented discharge plans, and 97% developed specialties that gave them a competitive edge. Although they were the least-used institutional strategies, both developing practice guidelines and training physicians on how to select the primary diagnosis and primary procedure and how to avoid making a procedure case-based were used by 87% of the hospitals — still a sizable percentage (Table 1).

Respondents subjectively evaluated the effectiveness of their strategies (Table 2). Operating costs increased for 37% of the hospitals but remained about

the same for 51%. Medical revenues were higher for 30% but were flat for 45%. Earnings before taxes increased for 16% but remained unchanged for 57%. The average length of stay decreased for 63% but increased for 2%. The slashed-claim ratio rose for 52% but remained unchanged for 31%. The bed occupancy rate decreased for 46% but was unchanged for 43%. The re-admission ratio decreased for 25% but showed little change for 65%. Finally, patient satisfaction rates increased for 26% but did not change for 56%.

With a Kaiser-Meyer-Olkin value of 0.67 and a Bartlett's sphericity test of 1102.71 ($p < 0.001$), the factor analysis yielded 7 factors that had an eigenvalue greater than 1 (Table 3). The percentage of variance explained by these factors was 67.15%. Based on the nature of variables whose factor loading was greater than 0.5, the 7 factors thus extracted were named and defined as follows: information and financial analysis; service shifting and unbundling; service integration and quality improvement; service specialization and strengthening; education and training; financial incentives; and claim submission skill.

Table 4 shows the results of the variance analysis which indicated that implementation of the information and financial analysis strategies resulted in increased medical revenue ($p < 0.05$), while improvements in patient satisfaction were associated with implementation of the service integration and quality improvement strategies ($p < 0.001$), service specialization and strengthening strategies ($p < 0.001$), education and training strategies ($p < 0.001$), and claim submission skill strategies ($p < 0.05$).

Table 5 shows the results of the stepwise logistic regression analyses. After adjustment for ownership status, a higher level of implementation of service integration and quality improvement strategies was associated with greater patient satisfaction (odds ratio, 1.40). These strategies included the implementation of discharge plans and clinical pathways, periodic review of quality indicators, and patient satisfaction surveys. Also, after adjustment for accreditation level, a higher level of implementation of financial

Table 2. Respondents' evaluation of the effectiveness of coping strategies with respect to performance indicators.

	Total n	Decreased by > 10% n (%)	Decreased by ≤ 10% n (%)	Unchanged n (%)	Increased by ≤ 10% n (%)	Increased by > 10% n (%)
Operating costs	81	0 (0.0)	10 (12.3)	41 (50.6)	22 (27.2)	8 (9.9)
Medical revenue	84	3 (3.6)	18 (21.4)	38 (45.2)	21 (25.0)	4 (4.8)
Earnings before taxes	75	3 (4.0)	17 (22.7)	43 (57.3)	11 (14.7)	1 (1.3)
Average length of stay	84	6 (7.1)	47 (56.0)	29 (34.5)	2 (2.4)	0 (0.0)
Slashed-claim ratio	86	0 (0.0)	14 (16.3)	27 (31.4)	44 (51.2)	1 (1.2)
Average occupancy rate	83	8 (9.6)	30 (36.1)	36 (43.4)	8 (9.6)	1 (1.2)
Re-admission ratio	83	4 (4.8)	17 (20.5)	54 (65.1)	7 (8.4)	1 (1.2)
Patient satisfaction rate	82	1 (1.2)	11 (13.4)	46 (56.1)	21 (25.6)	3 (3.7)

Table 3. Results of factor analysis.

	Factor loading	Eigen value	Variance explained	Cumulative
Factor 1. Information and financial analysis		3.56	11.86	11.86
II-4 Develop a computer system to support case-based procedures	0.77			
II-3 Analyze the cost of each case-based procedure	0.72			
II-6 Share cost savings in claim submissions with physicians	0.68			
II-1 Generate management reports to compare actual submissions vs actual reimbursements	0.65			
II-5 Display the real time status of a case-based procedure in progress, such as next item to perform and updated cumulative cost	0.64			
II-2 Aggressively cut costs of drugs and supplies	0.52			
Factor 2. Service shifting and unbundling		3.47	11.58	23.44
I-3 Avoid prescribing medications upon discharge	0.85			
I-1 Avoid admitting patients during holidays	0.78			
I-2 Shift surgeries from inpatient areas to outpatient departments	0.70			
I-6 Split of emergency hospitalization charge into an outpatient component and a case-based component	0.63			
I-4 Perform regular and necessary examination before admission	0.60			
Factor 3. Service integration and quality improvement		3.36	11.21	34.65
III-11 Implement discharge plans	0.87			
III-10 Implement clinical pathways	0.82			
III-12 Review quality indicators of case-based procedures periodically	0.65			
III-13 Conduct inpatient satisfaction surveys	0.55			
Factor 4. Service specialization and strengthening		2.94	9.80	44.45
III-7 Develop specialties that give the hospital a competitive advantage	0.69			
III-8 Introduce new medical equipment	0.68			
III-9 Develop practice guidelines	0.64			
III-4 Establish communication channels with BNHI	0.53			
III-1 Encourage physicians to join the reviewing group of BNHI	0.42			
Factor 5. Education and training		2.69	8.96	53.41
III-3 Promote interactions between patient classification personnel and physicians.	0.80			
III-5 Promote non-physician personnel's understanding of the case-based payment system.	0.63			
III-2 Send physicians to training or seminars.	0.57			
III-6 Train physicians in how to select primary diagnosis, primary procedure and how to avoid making a procedure case-based.	0.56			
Factor 6. Financial incentives		2.18	7.25	60.67
II-8 Hold physicians responsible for all or part of the shortfall between actual submissions and actual reimbursements	0.77			
I-9 Submit claims as early as possible	0.71			
II-7 Reduce or withhold payment to physicians for days beyond standard length of stay	0.65			
Factor 7. Claim submission skill		1.95	6.48	67.15
I-7 Adjust outlier claims to a level consistent with case-based limits	0.81			
I-5 Manipulate within the "verified for actual payment" percentage	0.71			

BNHI = Bureau of National Health Insurance.

incentives strategies was associated with increased medical revenues (odds ratio, 1.21).

Discussion

In order to minimize non-response bias, it is desirable to have as high a rate of return as possible. Although Babbie¹⁶ set 50% as the adequacy level, Bailey¹⁷ argued that 75% was necessary. For a representative sample, Schutt¹⁸ concluded that more than two-thirds must respond. The 69% response rate in our study appears

to be adequate. More importantly, as already stated, the characteristics of the respondents were not significantly different from the target population.

Regarding the question of representation, among those respondents who completed the questionnaire, 62 (70%) also provided job-related information. Although we did not confirm their exact job titles or whether they belonged to their respective hospital's senior management, these 62 respondents had an average of 10.3 years of work experience, and 80% indicated that they had worked at their respective hospitals for 5 or more years. Based on these data,

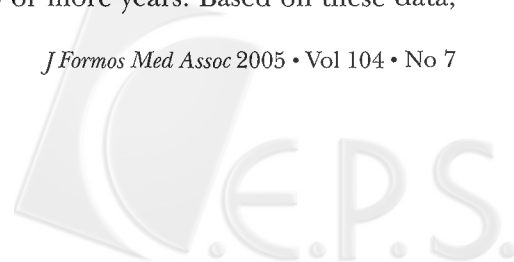


Table 4. Variance analysis of coping strategies and their effectiveness.*

Variable and statistical test	Information and financial analysis Mean (SD)	Service integration and quality improvement Mean (SD)	Service specialization and strengthening Mean (SD)	Education and training Mean (SD)	Claim submission skill Mean (SD)
Medical revenue					
Total	17.41 (6.67)	13.33 (4.44)	15.05 (4.77)	12.62 (3.93)	6.60 (2.60)
Decreased or unchanged	16.28 (6.84)	12.80 (4.44)	14.42 (5.08)	12.15 (4.11)	6.30 (2.49)
Increased	20.22 (5.38)	14.61 (4.25)	16.48 (3.68)	13.71 (3.33)	7.33 (2.75)
t test	$t = -2.466^\dagger$	$t = -1.659$	$t = -1.862$	$t = -1.624$	$t = -1.656$
Patient satisfaction rate					
Total	17.48 (6.62)	13.33 (4.50)	15.15 (4.76)	12.69 (3.84)	6.68 (2.59)
Decreased or unchanged	16.76 (6.51)	12.00 (4.39)	13.91 (4.68)	11.67 (3.98)	6.25 (2.60)
Increased	19.27 (6.68)	16.55 (2.91)	18.04 (3.61)	15.09 (2.04)	7.74 (2.28)
t test	$t = -1.516$	$t = -4.463^\ddagger$	$t = -3.859^\ddagger$	$t = -4.963^\ddagger$	$t = -2.391^\ddagger$

* Only factors that had a statistically significant impact on self-evaluated effectiveness at the $p < 0.05$ level are listed.

$^\dagger p < 0.05$.

$^\ddagger p < 0.001$.

SD = standard deviation.

Table 5. Stepwise logistics regression analysis of effectiveness of strategies on performance indicators.

	Medical revenue (n = 76)			Patient satisfaction rate (n = 70)		
	exp(β)	95% CI		exp(β)	95% CI	
		Lower	Upper		Lower	Upper
Control variable						
Accreditation level						
Medical center (reference)						
Regional hospital	0.237	0.046	1.205	NA	NA	NA
District teaching hospital	0.060*	0.010	0.363	NA	NA	NA
Ownership status						
Public (reference)						
Private	NA	NA	NA	0.173*	0.047	0.634
Independent variable						
Service integration and quality improvement	NA	NA	NA	1.397*	1.144	1.705
Financial incentives	1.207 †	1.032	1.411	NA	NA	NA
Intercept	0.973			0.009		

* $p < 0.01$.

$^\dagger p < 0.05$.

CI = confidence interval; NA = not available.

they were judged to be knowledgeable regarding their respective hospitals. The legitimacy fostered by governmental financial support and the promise of feedback of summary results might well have encouraged these hospital administrators to provide reliable results.

The survey tool had a high level of content validity. The level of agreement among the experts on the questions was 0.92. The survey as a whole had good internal consistency with an overall Cronbach's alpha coefficient of 0.91. Although the Cronbach's alpha coefficient for technical level strategies was 0.71, this is still an acceptable level.¹⁹

The 7 factors extracted in the factor analysis are consistent with the categorization of strategies by Cook et al.¹⁰ For example, service shifting and unbundling

and claim submission skill belong to the technical level, information and financial analysis and financial incentives to the managerial level, and service integration and quality improvement, service specialization and strengthening and education and training to the institutional level.

Among the strategies comprised by the financial incentives factor are those which hold physicians responsible for the shortfall between actual submissions and actual reimbursements and also for cost of hospitalization beyond the standard length of stay. Providing direct financial incentives to impact physician behavior has been supported by many studies.²⁰⁻²² It is thought that monitoring and controlling the length of stay and freeing up needed beds may increase medical revenue.

Among the strategies covered by the service integration and quality improvement factor, clinical pathways have been widely reported to improve patient satisfaction.²³⁻²⁵ Other studies have found that clinical pathways are not associated with any increase in patient dissatisfaction.^{26,27} However, there are also findings that the association between discharge planning and patient satisfaction is inconsistent.^{28,29} Variation analysis, re-admission rates, infection rates, and perceptions of patients and staff have been found to be good approaches and measures for quality indicators.³⁰ It is possible that service integration and quality improvement might result in synergies when combining separate strategies as a whole, if clinical pathways could extend to discharge planning, and quality indicators were reviewed periodically. Some or all of the strategies in this factor might help to facilitate change in physician behavior and the process of patient care and thus lead to improvement in patient satisfaction. In other words, hospitals could benefit from continuous improvement by shaping adopted strategies (both in depth and breadth).

Contrary to the experience common under prospective payment systems,^{29,31,32} none of the factors in this study had a significant impact on the average length of stay. The effect of the case-based payment system,³¹⁻³³ and the effect of adopting strategies such as clinical pathways,^{33,34} have both been reported to decrease length of stay. Under a case-based system, a hospital will mobilize to meet regulatory requirements. In addition, the hospital may also implement clinical pathways to reduce cost and to shorten the length of stay as a first priority. For example, the implementation of a clinical pathway in transurethral resection of the prostate resulted in the decrease of the length of stay by as many as 2 days after adjusting for other factors.³⁴ As a result, there is little room for further reduction in the length of stay. A recent study supports our finding that trends toward decreasing length of stay over time may reduce the impact of clinical pathways on this outcome.³⁵ This reduced effect on the length of stay may be something to be aware of because the future implementation of the diagnosis-related group (DRG)-based payment system by the NHI will involve fixed payments as well as a length-of-stay component.

There are some limitations to the present study. Although every attempt was made to solicit the best possible cooperation from participating hospital administrators, some still might not have been forthcoming with financial data. Using the claim data from BNHI we were able to validate the general movement of medical revenue, re-admission ratios, and the number of patient transfers among the hospitals between 1997 and 1999. However, the actual operating costs,

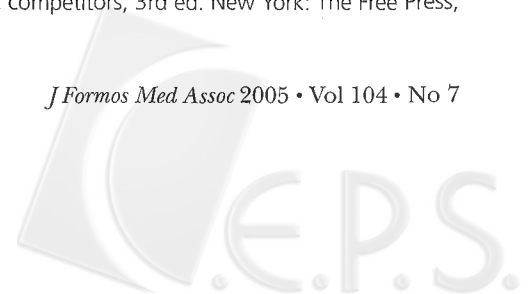
earnings before taxes, patient satisfaction rates, and slashed-claim ratios clearly had to come from the hospitals; it was not easy to approximate the extent of underestimation or overestimation.

The findings of this study may prove particularly helpful to hospitals as they confront the migration from a case-based payment system to the full scale adoption of a DRG-based payment system as is planned by the NHI.

ACKNOWLEDGMENTS: This study was supported by an assigned grant from the Department of Health (2000), Taiwan. The authors are indebted to Ms M. H. Monica Cheng for her assistance in data collection and data entry, to the 2 reviewers and the editor for their invaluable comments, and to Professor Robert Myrtle of the Department of Health Service Administration at the University of Southern California and Professor Laura Morlock of the Department of Health Policy and Management at the Johns Hopkins University for their editing of the manuscript and insightful comments.

References

1. Government Information Office, Public Health. Taiwan Yearbook 2003. Taipei: Taiwan Government Information Office. 2003. Also available at: URL: <http://www.gio.gov.tw/Taiwan-website/5-gp/yearbook/chap16.htm#2> [in Chinese]
2. BNHI: An Overview of National Health Insurance. Taipei: Taiwan Bureau of National Health Insurance; 2000:17-24. [in Chinese]
3. Chuang YC, Chen L: A medical management model under PPS/DRG. *Chin J Public Health* 1994;13:485-99. [in Chinese; English abstract]
4. Lee YC: The impact of National Health Insurance case payment system on the health care behavior of hospitals. Taiwan DOH funded research DOH85-HI-1006, 1996. [in Chinese; English abstract]
5. Lee NZ, Yang MC: Possible strategic responses of hospitals to National Health Insurance. *Hospital* 1995;28:8-19. [in Chinese; English abstract]
6. Lee FC: Research on hospital strategies responding to the claims review system of National Health Insurance: a case study of a medical center in Northern Taiwan. Graduate Institute of Health Care Organization Administration, National Taiwan University. Unpublished master's degree thesis, 1996. [in Chinese; English abstract]
7. Hung HL: Strategies adopted by hospitals toward case payment under National Health Insurance. Institute of Hospital and Health Care Administration, National Yang Ming University, Taiwan. Unpublished master's degree thesis, 1998. [in Chinese; English abstract]
8. Porter ME: Competitive strategy: Techniques for analyzing industries and competitors, 3rd ed. New York: The Free Press; 1980:3-33.



9. Miles RE, Snow CC: Organizational Strategy, structure and process. New York: McGraw-Hill; 1978:31-93.
10. Cook KS, Shortell SM, Conrad D, et al: A theory of organizational response to regulation: the case of hospitals. *Acad Manage Rev* 1983;8:193-205.
11. Ginter PM, Swayne LM, Duncan WJ: Strategic management of health organization. 2nd ed. Blackwell Publishers Inc.; 1995: 211-58.
12. Liedtka JM. Formulation hospital strategy: moving beyond a market mentality. *Health Care Manage Rev* 1992;17:21-6.
13. Gay EG, Baker KJ, Amidon R: An appraisal of organizational response to fiscally constraining regulation: The case of hospitals and DRGs. *J Health Soc Behav* 1989;30:41-55.
14. Smith HL, Piland NF, Phillipp AM: Responses to prospective payment by rural New Mexico hospitals. *Health Serv Res* 1991; 26:547-81.
15. Trinh HQ, Begun JW: Hospital response to the implementation of prospective payment. *Health Serv Manage Rev* 1998;11: 163-73.
16. Babbie E: Survey research methods. Belmont (CA): Wadsworth; 1990:182.
17. Bailey KD: Methods of social research. 3rd ed. New York: The Free Press; 1987:168-9.
18. Schutt RK. Investigating the social world: The process and practice of research. 2nd ed. Thousand Oaks (CA), Pine Forge, 1999.
19. Nunnally JC: Psychometric theory. 2nd ed. New York, McGraw-Hill, 1978.
20. Miller RH, Luft HS: Managed care plan performance since 1980. A literature analysis. *J Am Med Assoc* 1994;271:1512-9.
21. Cave DG. Profiling physician practice patterns using diagnostic episode clusters. *Med Care* 1995;33:463-86.
22. Robinson JC: Theory and practice in the design of physician payment incentives. *Milbank Quarterly* 2001;79:149-77.
23. Bertholf L: Clinical pathways from conception to outcome. *Top Health Inf Manage* 1998;19:30-4.
24. Flickinger JE, Trusler L, Brock JW: Clinical care pathway for the management of ureteroneocystostomy in the pediatric urology population. *J Urol* 1997;158(3 Pt 2):1221-5.
25. Geradi T: A regional hospital association's approach to clinical pathway development. *J Healthc Qual* 1994;16:10-4.
26. Leibman BD, Dilliogluligil O, Abbas F, et al: Impact of a clinical pathway for radical retropubic prostatectomy. *Urology* 1998; 52:94-9.
27. Buckley CJ, Patterson DE, Manning LG, et al: Quality vascular surgical care: the importance of innovation and change in an era of dwindling reimbursement. *South Med J* 2001;94:411-6.
28. Parkes J, Shepperd S. Discharge planning from hospital to home. *Cochrane Database Syst Rev* 2000;(4):CD000313.
29. Naylor MD, Brooten D, Campbell R, et al: Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA* 1999;281:613-20.
30. Gaucher EJ, Coffey RJ: Total quality in healthcare: from theory to practice. Jossey-Bass Inc.; 1993:469-78.
31. Kahn KL, Keeler EB, Sherwood MJ, et al: Comparing outcomes of care before and after implementation of the DRG-based prospective payment system. *JAMA* 1990;264:1984-8.
32. Lave JR, Frank RG: Effect of the structure of hospital payment on length of stay. *Health Serv Res* 1990;25:327-47.
33. Lin HC, Tung YC, Chen CC, et al: Relationship between length of stay and hospital characteristics under the case-based payment system in Taiwan: using data for vaginal delivery patients. *Chang Gung Med J* 2003;26:259-68.
34. Liao SL, Chu SH, Chen YT, et al: The impact of implementation of clinical pathway in one hospital---application of transurethral prostatectomy in NTUH. *J Formos Med Assoc* 1998;97:345-50.
35. Dy SM, Grag PP, Nyberg D, et al: Are critical pathways effective for reducing postoperative length of stay? *Medical Care* 2003; 41:637-48.

