Continuous Quality Improvement of Nursing Care: Case Study of a Clinical Pathway Revision for Cardiac Catheterization

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ABSTRACT

Background: Taiwan’s Bureau of National Health Insurance (BNHI) has been gradually introducing Taiwan diagnosis related groups (Tw-DRGs) for inpatient cases since 2010. Challenged to adapt to payment system changes, hospitals must implement necessary management control systems or measures to maintain both fiscal soundness and medical care quality.

Purpose: This study investigated the outcome of management participation in work to revise cardiac catheterization clinical pathway operating procedures.

Methods: BNHI-qualified cases for Tw-DRGs 125 payment principles were recruited as study subjects to revise the cardiac catheterization clinical pathway. Researchers compared pre- and postrevision values in terms of mean medical care fees, patient volumes, healthcare quality, and length of hospital stay, as well as financial risk.

Results: Significant differences were observed in precardiac catheterization nursing care completion rates, mean lengths of hospital stay, diagnosis numbers, surgical treatment numbers, and numbers of complications or comorbidities. Medical utilization was also significantly lower (p < .05) after revision implementation.

Conclusions: Clinical pathway revision involves organization, procedural flows, and performance management. The revision successfully improved hospital finances and promoted medical care quality.

Key Words: clinical pathway revision, Taiwan diagnosis related groups (Tw-DRGs), continuous quality improvement.

Introduction

The Bureau of National Health Insurance (BNHI) began implementing a Taiwan diagnosis related groups (Tw-DRGs) approach for inpatient care in 2010. The BNHI has also provided financial incentives to encourage healthcare providers to enhance medical services and improve patient care quality and efficacy to control medical costs (Ellis and McGuire, 1993). The NHI payment system revisions have reduced hospital incomes; thus, hospitals must implement management control systems or measures such as the clinical pathway, case management, and continuous quality improvement to manage hospital operations and costs effectively and sustain medical care quality (Zhu, 2004).

The clinical pathway provides medical care guidelines that help nursing staff improve job efficiency. It helps eliminate unnecessary tests and complications for patients and improves overall patient satisfaction with nursing care. It also reduces length of hospital stay, which increases bed turnover rates and decreases medical costs (Hsu, Lai, Hsieh, Liao, & Lin, 2002). Continuous improvement in medical care quality provides services tailored to patient needs, helps achieve optimal medical results, and effectively balances costs and benefits (Blumenthal & Kilos, 1998; Chan & Ho, 1997). The clinical pathway approach further enhances the vital role played by nursing staff in delivering quality healthcare both before and after patient discharge. Thus, this approach represents a win–win situation for care providers and patients.

Cardiovascular diseases account for the first and second most important causes of mortality in Taiwan (Department of Health, Executive Yuan, Taiwan, ROC, 2010), with coronary heart disease as the major cause of heart failure and mortality. Cardiac catheterization skills have matured over the past two decades. Cardiac catheterization is usually required after a diagnosis of suspected coronary heart disease. Despite the extreme rise in cardiac catheterization
costs, even in comparison with other high-technological medical procedures (Tsai, Kung, Yang, & Chiou, 2003), cardiac catheterization remains the mainstream test and treatment approach for coronary heart disease in Taiwan (Lee, Lu, Liao, & Li, 2006).

Under former NHI guidelines, cardiac catheterization was categorized as a “test” on the case payment form. Following implementation of Tw-DRGs, hospital management is now required to conduct a map analysis for patients of different disease combinations to assess the overall efficacy of medical equipment, healthcare personnel, healthcare resources, and costs used. Hospitals must then establish clinical care guidelines for each Tw-DRG and use such as a tool to manage resource utilization. Most hospitals, however, have been unable to make accurate estimates and have overlooked the economic value generated during the nursing care process (Chang, 2009). To adapt to Tw-DRGs requirements, nursing care management must be prepared to provide expert services that can facilitate their hospital’s adaptation to Tw-DRGs in a manner that supports strategies, copes with organizational strategies, helps nursing staff recognize core values, and successfully meets and adapts to challenges. The expected result should be a collaborative and effective effort to control costs, manage resource utilization, and continuously improve medical care quality.

Tw-DRGs payment system implementation in Taiwan has enhanced the value and importance of nursing care in maintaining healthcare quality. It can also reduce medical costs by reducing average lengths of hospital stay and eliminating unnecessary or duplicate tests (Miura, Dipiero, & Homer, 2009), adapt to medical payment policy changes, and enhance patient care and life quality. The authors designed this study to (a) investigate management participation in revising cardiac catheterization clinical pathway operating procedures; (b) compare differences between pre- and post-Tw-DRGs payment system implementation in terms of medical costs, inpatient medical service numbers, average length of hospital stay, financial risk and healthcare quality; and (c) assess the impact of Tw-DRGs on continuous quality improvement. Study results should provide a reference to nursing care managers.

Methods

Tw-DRGs 125 (circulatory disorders except acute myocardial infarction [MI], with cardiac catheterization and without complex diagnosis), announced by the BNHI in 2010, represented a test item of large volume and little variation in the hospitals studied in this case. Therefore, researchers chose first to investigate operation procedure revision outcomes for the clinical pathway. Aims included achieving treatment effect with minimum necessary resources and maximizing care quality at minimum expenditure (Huang, Hsu, & Huang, 2007).

The nursing department in the target hospital conducted all operation procedure review, implementation, and follow-up work related to the cardiac catheterization clinical pathway. Work to revise operation procedures for the clinical pathway began in November 2009 and finished in July 2010 (9 months). Revision work was categorized into the three distinct areas of organization management, procedural flow management, and performance management. Work was conducted in accordance with a three-stage schedule that included planning (October 2009 to December 2009), implementation (January 2010 to June 2010), and evaluation (July 2010). Planning stage tasks included (a) establishing a Tw-DRG clinical pathway revision task force (including cardiology physicians, ward clerks, NHI declaring clerks, disease classification staff, nursing staff, and a project manager) to create consensus within the medical team, (b) quick receipt of external information and effective dissemination of such to all hospital departments, and (c) revising Tw-DRG clinical pathway forms and systemic summary of unrevised clinical pathway order forms and medical costs. Also, based on Tw-DRGs, these tasks were included: develop payment principles, revise healthcare education leaflets (e.g., pre-exam precautions list, post-exam guidance, and patient healthcare education), and designate doctors’ order and clinical pathway forms (deleting unnecessary test items such as urine and uric acid tests and adding pre-exam nurse visits). Implementation stage tasks included (a) hosting seminars to introduce the revised clinical pathway content to doctors and nurses, (b) officially implementing revised clinical pathway forms, and (c) documenting implementation process and regularly discussing with healthcare staff to achieve intended level of effectiveness. Evaluation stage tasks included (a) reviewing of doctors’ orders for inpatient treatments that deviate from the revised clinical pathway and (b) analyzing hospital stay duration and medical cost data.

The Research Sample

Researchers recruited study subjects from a district teaching hospital in southern Taiwan. Subjects were categorized into Type A (preclinical pathway revision) and Type B (postclinical pathway revision) groups. Inpatients during the period of January to June 2009 (Type A) and January to June 2010 (Type B) were qualified and recruited as study subjects.

Sampling and screening criteria included the six components of the Tw-DRGs 125 principles announced by the BNHI. These included principal diagnosis, significant procedures, complications or comorbidities (C/C), gender, age, and discharge status. The study retrieved all research data from the hospital information system. Basic information column data included year and month of costs, patient date of birth, principal diagnosis code, secondary diagnosis code, principal surgery code, secondary surgery code, medical costs, weight value, and complication remarks. The study sample population included only patients with cardiac catheterization without complex diagnosis (except for acute MI) from the Tw-DRGs 125 population. The relative
weight (RW) was 0.9462, suggesting comparable disease severity. A total of 439 patients were enrolled as study subjects.

The study reviewed patient medical records retrospectively to confirm relevant nursing care quality indicators, that is, the precardiac catheterization nursing care completion rate, on the basis of the data extraction list. Researchers then analyzed this rate.

**Data Processing**

The study adopted the corresponding cost calculated with the Tw-DRGs payment principles (i.e., fixed cost, R) and compared it with actual inpatient medical cost (R1) calculated on the basis of the fee-for-service policy. \( \Delta R \) was the difference \( (R - R_1) \) between the two costs. The ratio of cost difference over cost calculated using Tw-DRG payment principles \( \Delta R/R \) was determined for each DRG. The value of \( AR/R \) represented the inpatient medical services return rate, which also represented the financial risk of treating DRG patients (Chang, 2005).

Cost difference \( \Delta R \) was treated as a financial return of inpatient medical service. The ratio of this cost difference over fixed cost \( \Delta R/R \) was viewed as the inpatient medical service premium or loss ratio (Yan, Wu, Chou, & Mo, 2008).

Tw-DRGs 125 is circulatory system disease not involving acute MI that can be diagnosed using cardiac catheterization without complex diagnosis. Primary diagnosis codes are 37.21, 37.22, 37.23, 88.52, 88.53, 88.54, 88.55, 88.56, 88.57, and 88.58. Diagnosis codes for canceling a primary diagnosis or conducting a secondary diagnosis in cases with acute MI are 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, and 410.91. Patients assigned any one of several complication codes during catheterization are assigned to Tw-DRGs 124 (complicated diagnosis). These complication codes include but are not limited to 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 411.0, 411.1, 411.81, 411.89, 415.0, 415.19, 420.0, 420.90, and 420.91.

Patients undergoing cardiac catheterization who exhibit NHI recognized C/C such as C/C codes 413.9 (angina pectoris) and 404.92 (hypertensive heart and renal disease with renal failure) that are not recognized by Tw-DRGs 124 complex diagnosis codes (e.g., 411.1, unstable angina pectoris and 428.0, congestive heart failure) are not included in the Tw-DRGs 125 group. NHI requires that complex diagnoses and the resource commitment involved be justified by a statistically significant principal diagnosis.

**Measurements**

Researchers used SPSS software version 18.0 (SPSS, Inc., Chicago, IL, USA) for all data analysis work. Descriptive statistics include mean, standard deviation, and percentage-described demographic information (gender and age) clinical characteristics (length of stay, number of diagnoses, number of surgical and procedure, and number of C/C). Using NHI inpatient declaration files, researchers employed statistical analysis to analyze the rate of return earned by hospitals on inpatients. Researchers further used a t test to examine changes in number of diagnoses, surgical treatments, C/C, and average length of hospital stay. Comparing statistical data, this study defined a p value of >.05 as a nonsignificant difference (ns). The Tw-DRG code is based on the ICD-9-CM code. In addition to the principal diagnosis code, the secondary diagnosis code is also an important factor of influence over the DRG code. In other words, researchers assigned different DRG codes to cases with and without C/C, which also influence payment (Lin & Chu, 2008). Many previous studies have noted the rise of discriminatory disease code selection behavior after DRG implementation. Completeness of medical staff record-keeping work has also been shown to impact on disease coding results. Thus, apart from assessing potential changes to disease codes, this study analyzed statistical data to assess whether case hospitals had changed their practices in terms of C/C coding.

Variables analyzed in this study included gender and age. With regard to the latter, researchers followed the World Health Organization practice. The population was divided into four groups: teenagers (15–24 years of age), young adults (25–44 years of age), adults (45–64 years of age), and older people (over 64 years of age). The number of diagnosis codes based on disease category adopted the number of inpatient payment declarations stipulated by the BNHI. In other words, there was one principal diagnosis and four secondary diagnoses at most, calculated as the total number of diagnoses divided by the total number of cases. The number of surgical and procedure codes based on disease category adopted the number of inpatient payment declarations for surgical treatments stipulated by the BNHI. In other words, there was one principal surgical treatment and four surgical treatments at most, calculated as the total number of surgical treatment codes divided by the total number of cases. The number of C/C based on disease category was calculated as the total number of C/C divided by the total number of cases. DRG fixed cost \( R \) was calculated as (a) Tw-DRGs fixed payment = RW × standard payment rate × (1 basic treatment weight + pediatric weight + CMI weight + hospitals in remote regions weight), (b) verification of declaration for lower payment limit, (c) Upper limit of payment = Tw-DRGs fixed payment × 0.8. The actual medical cost \( R_1 \) was calculated based on the corresponding NHI payment standard for total treatments provided. The cost difference \( \Delta R \) was calculated as fixed cost, \( R - R_1 \). The ratio of cost difference over fixed cost \( \Delta R/R \) was calculated as (fixed cost, \( R - R_1 \))/DRG fixed cost.

Researchers categorized medical cost variables according to BNHI declaration guidelines as follows: diagnosis fees (including inpatient diagnosis fees and consultation fees), ward fees (including ward fees and nursing fees), tube feeding fees, laboratory fees (including CBC, GOT, GPT,
The age distribution was also strongly in favor of adult and older participants: 25–44 years (2.5%), 45–64 years (42%), and 65 years and over (55%). The average length of hospital stay was 1.83 days, the mean number of diagnoses was 2.45, the mean number of surgical treatments was 3.07, and mean number of C/C was 0.46. A total of 201 cases complied with the Tw-DRG between January 2010 and June 2010. Of these, 40.8% were men and 59.2% were women. Age distribution was also strongly in favor of adult and older participants: 25–44 years (2.5%), 45–64 years (45.8%), and 65 years and over (51.7%). The average length of hospital stay was 1.39 days, mean number of diagnoses was 3.68, mean number of surgical treatments was 3.01, and mean number of C/C was 0.65. Researchers used a t test to analyze descriptive data.

Findings showed significant differences in results for average length of hospital stay (p < .01), mean number of diagnoses (p < .05), mean number of surgical treatments (p < .05), and mean number of C/C (p < .05). Comparative results between pre- and postimplementation data included: reduction in average length of hospital stay by 0.44 days, increase in diagnosis number by 0.23, reduction in average surgical treatment number by 0.06, and increase in C/C from 0.46 to 0.65. The clinical nursing care quality index confirmed a significant difference in the precardiac catheterization nursing care completion rate (p < .05). The postcardiac catheterization 14-day readmission rate dropped from 1.87% to 1.79%. Table 1 shows relevant descriptive demographic data.

**The Impact on Medical Costs of Clinical Pathway Revision**

The case hospital began active promotion of operation procedure revisions for the clinical pathway in November 2009. Successful outcomes were observed on the basis of reduced medical costs. The 238 cases in 2009 faced a mean actual medical cost per case of 33,351 points, a cost difference of 6,396 points, and a ratio of cost difference over fixed cost of 0.17. The 201 cases in 2010 faced a mean actual medical cost per case of 29,473 points, a cost difference of 8,692 points, and a ratio of cost difference over fixed cost of 0.23. In terms of medical utilization, comparison of variables showed a statistically significant difference for both 2009 and 2010 (p < .05).

Then, results showed a postrevision drop in itemized medical costs for seven variables. These included mean diagnosis fees for each item (961 points prerevision vs. 720 points postrevision, p < .01), ward fees (1,949 points prerevision vs. 1,140 points post-revision, p < .01), laboratory fees (17,758 points prerevision vs. 16,815 postrevisiion, p < .01), X-ray fees (2,732 points prerevision vs. 1,583 points postrevision, p < .05), therapy procedure fees (521 points prerevision vs. 108 points post-revision, p < .05), pharmaceutical fees (550 points prerevision vs. 385 points post-revision, p < .01), and dispensing service fees (215 points prerevision vs. 184 points post-revision, p < .01). All were lower compared with prerevision 2009 point values, with a significant difference of p < .05. Table 2 displays descriptive demographic data.

**Discussion**

The main objectives of the clinical pathway revision were to improve medical care quality, maximize the effectiveness of available medical resources, define consistent and standard medical care procedures, and control medical costs. Changes in medical payments and patient care management necessitates that clinical nurses both tailor their services to target patient needs and adopt an outcome-driven approach to control costs (Pont, Higgins, James, Fay, & Madden, 1993). Revisions also require that nurses reduce service overlap through collaboration with physicians to assess patient clinical care outcomes effectively. Kahn et al. (1990) evaluated the impact of the DRG-based prospective payment system on care quality for five different medical conditions that included congestive heart failure, myocardial infarction, pneumonia, cerebrovascular accident, and hip fracture. Results indicated that, whereas severity of disease...
resulted in longer hospitalization stays, stays significantly decreased after implementation of the prospective payment system. Results of this study also indicated a significant difference between average pre- and postrevision lengths of hospital stay. Such was attributable to preadmission healthcare education and nursing visits on the date when patients were admitted for scheduled cardiac cauterization. The achieved mean length of hospital stay of 1.39 days was much lower than the geometric mean of 2 days announced by BNHI (2010). Such a reduction is consistent with the result presented by Chen et al. (2008). Patient admission numbers also declined. In terms of the annualized effect on mean length of hospital stay, reductions in the United States of 9.0% and 7.7% in 1984 and 1985, respectively, were reported by Guterman and Dobson (1986) after DRG implementation. However, it has also been pointed out that the longer DRG is in place, the slower the reduction in length of hospital stay becomes. A study by DesHarnais, Chesney, and Fleming (1988) also found significant decreases in mean ICU and CCU stay lengths after the enforcement of a prospective payment system for geriatric medical insurance. The reduction in mean length of hospital stay detected at the case hospital may reflect rapid adaptation of hospitals to system changes. In addition, this study found that nursing care quality, as reflected in the precardiac catheterization nursing care completion rate, improved significantly after clinical pathway revision. Such is consistent with the findings of Hunter and Segrott (2008). Clinical nursing staff can accurately implement doctors' orders and conduct routine nursing care to improve the capacity and efficiency of clinical nursing care and, thus, reinforce their professional social value and status.

### TABLE 1. Descriptive Demographics (N = 439)

<table>
<thead>
<tr>
<th>Variable</th>
<th>January 2009 to June 2009</th>
<th>January 2010 to June 2010</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>M</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>41.6</td>
<td>1.83</td>
</tr>
<tr>
<td>Female</td>
<td>139</td>
<td>58.4</td>
<td>1.39</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–24</td>
<td>1</td>
<td>0.4</td>
<td>3.45</td>
</tr>
<tr>
<td>25–44</td>
<td>6</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>45–64</td>
<td>100</td>
<td>42.0</td>
<td>70</td>
</tr>
<tr>
<td>&gt;65</td>
<td>131</td>
<td>55.0</td>
<td>53</td>
</tr>
<tr>
<td>Length of stay</td>
<td>1.83</td>
<td>1.70</td>
<td>1.39</td>
</tr>
<tr>
<td>Number of diagnoses</td>
<td>3.45</td>
<td>1.06</td>
<td>3.68</td>
</tr>
<tr>
<td>Number of surgical procedures</td>
<td>3.07</td>
<td>0.35</td>
<td>3.01</td>
</tr>
<tr>
<td>Number of C/Cs</td>
<td>0.46</td>
<td>0.69</td>
<td>0.65</td>
</tr>
<tr>
<td>Completion rate of precardiac catheterization</td>
<td>0.65</td>
<td>0.12</td>
<td>0.89</td>
</tr>
<tr>
<td>Completion rate of postcardiac catheterization</td>
<td>0.86</td>
<td>0.05</td>
<td>0.91</td>
</tr>
<tr>
<td>Postcardiac catheterization 14-day readmission</td>
<td>1.87</td>
<td>0.08</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Note. ns = nonsignificant; C/C = complications or comorbidities.
The Tw-DRG clinical pathway revision task force included disease classification professionals, team discussion, and reviews geared to enhance medical record-keeping and encoding accuracy or precision. This significantly increased the number of disease codes (diagnoses, surgical procedures, C/C) from an original 3.45 to 3.68 ($p < .05$) and the number of C/C codes from 0.46 to 0.65 ($p < .05$). This result confirmed the efficacy of Tw-DRGs in improving in-hospital disease categorization coding behavior and quality, which changed disease variation and efficiencies. This study finding result mirrors that of Berta, Callea, Martini, and Vittadini (2010). Despite the study of Lezzoni et al. (1992), which stated that disease complications should be determined by correct selection of the secondary diagnosis code rather than by increasing the number of secondary diagnoses, only an effective C/C is able to reflect a higher RW into DRGs. Thus, careful monitoring of such derivations must start from initial implementation of the Tw-DRG payment system.

Potential factors involved in unscheduled patient readmissions include hospital release before full recovery, patient failure to comply with physician instructions, improper hospital release or delayed release, inadequately trained medical staff, patient failure to recognize the severity of his or her condition, and deterioration or loss of control over the patient’s medical condition (Kuo, Wang, & Lin, 2007; Lin, Tsai, Chiang, & Koo, 2010). Unscheduled patient readmissions can increase medical costs as well as complicate care for both the patient and his or her family (Boling, 2009; Chow et al., 2008). The significant reduction in 14-day readmissions for Tw-DRGs 125 cardiac catheterization patients found in this study was similar to that observed by Gau, Ting, Yeh, and Chang (2008) but different to results obtained by Chen, Chu, Chien, Su, and Wu (2006). A potential reason for the latter difference is better implementation of healthcare plans by nursing staff at our case hospitals, which helped reduce readmissions. The results of this study support the efficacy of having a fully staffed and competent medical team and maintaining a hospital release plan in reducing hospital patient readmissions.

Cardiac catheterization that meets the difference criteria for circulatory system disease (MDC5) and that is not an acute MI case will employ complex BNHI-defined diagnoses to establish lines of demarcation. Tw-DRGs 124 includes complex diagnoses, whereas Tw-DRGs 125 does not. Destabilization of a patient’s condition increases medical resource expenditures, which changes the SD of laboratory fees. If a complex diagnosis was not coded from the medical record on the basis of the disease categorization rule, it can only be categorized into the Tw-DRGs 125 population. A study by Ellis and McGuire (1993) suggested the payment system may change medical service efficiencies. In this study, we discovered that, in terms of the ratio of Tw-DRG cost difference and actual medical cost difference over fixed cost (for each case), the case hospital financial

<table>
<thead>
<tr>
<th>Variable</th>
<th>January 2009 to June 2009</th>
<th>January 2010 to June 2010</th>
<th>( p )</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>SD</td>
<td>( M )</td>
</tr>
<tr>
<td>Diagnosis fees</td>
<td>961</td>
<td>1161</td>
<td>720</td>
</tr>
<tr>
<td>Ward fees</td>
<td>1949</td>
<td>7480</td>
<td>1140</td>
</tr>
<tr>
<td>Tube feeding fees</td>
<td>35</td>
<td>540</td>
<td>0</td>
</tr>
<tr>
<td>Laboratory fees</td>
<td>17758</td>
<td>3143</td>
<td>16815</td>
</tr>
<tr>
<td>X-ray fees</td>
<td>2732</td>
<td>6056</td>
<td>1583</td>
</tr>
<tr>
<td>Therapeutic procedure fees</td>
<td>521</td>
<td>2981</td>
<td>108</td>
</tr>
<tr>
<td>Blood–plasma fees</td>
<td>52</td>
<td>427</td>
<td>17</td>
</tr>
<tr>
<td>Hemodialysis fees</td>
<td>124</td>
<td>889</td>
<td>99</td>
</tr>
<tr>
<td>Special materials fees</td>
<td>8351</td>
<td>5654</td>
<td>8325</td>
</tr>
<tr>
<td>Drug fees</td>
<td>550</td>
<td>958</td>
<td>385</td>
</tr>
<tr>
<td>Dispensing service fees</td>
<td>215</td>
<td>138</td>
<td>184</td>
</tr>
<tr>
<td>Injection service fees</td>
<td>96</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Actual medical cost (R1)</td>
<td>33351</td>
<td>21018</td>
<td>29473</td>
</tr>
<tr>
<td>Cost difference (( \Delta R ))</td>
<td>6396</td>
<td>3966</td>
<td>8692</td>
</tr>
<tr>
<td>Ratio of cost difference over fixed cost (( \Delta R/F ))</td>
<td>0.17</td>
<td>0.09</td>
<td>0.23</td>
</tr>
</tbody>
</table>

Note. ns = nonsignificant.

The Tw-DRG clinical pathway revision task force included disease classification professionals, team discussion, and reviews geared to enhance medical record-keeping and encoding accuracy or precision. This significantly increased the number of disease codes (diagnoses, surgical procedures, C/C) from an original 3.45 to 3.68 ($p < .05$) and the number of C/C codes from 0.46 to .65 ($p < .05$). This result confirmed the efficacy of Tw-DRGs in improving in-hospital disease categorization coding behavior and quality, which changed disease variation and efficiencies. This study finding result mirrors that of Berta, Callea, Martini, and Vittadini (2010). Despite the study of Lezzoni et al. (1992), which stated that disease complications should be determined by correct selection of the secondary diagnosis code rather than by increasing the number of secondary diagnoses, only an effective C/C is able to reflect a higher RW into DRGs. Thus, careful monitoring of such derivations must start from initial implementation of the Tw-DRG payment system.
premium increased. The premium increase from 0.17 in 2009 to 0.23 in 2010 achieved the defined level of significance. The actual medical cost per patient also fell from 33,351 to 29,473 points, a finding comparable to results obtained by Gurzick and Kesten (2010). This suggests the efficacy of implementing the clinical pathway in reducing medical expenses. Results showed the case hospital achieved the government’s goal of both enhancing healthcare provider medical service efficiency and controlling medical costs.

Conclusions
The empirical results of this study demonstrate that proposed revisions to clinical pathway operating procedures in terms of organizational, procedural, and performance management significantly and systemically impacted on the case hospital. Changes in average length of hospital stay, numbers of C/C, and financial risks can all be attributed to revisions in the clinical pathway operating procedure.

Revisions not only improved hospital finances but also further provided realistic benefits in terms of improved medical care quality. In terms of allotting nursing resources, under the Tw-DRGs payment system, medical staff may work together to develop clinical or care guidelines or clinical pathways for each specific Tw-DRG class as well as standardize treatment procedures to reduce quality of care variability. Before discharge, patients received health education on disease, self-care skills, arrangements for postdischarge essential care, and a thorough discharge plan to facilitate a successful transition. Such is deemed essential to reduce readmission rates that result from inappropriate care.

Medical institutions should also provide continuous education to nursing staff focused on the operation and impact of the Tw-DRG system. This can both help nurses understand the impact of the current NHI system on quality of care and also improve adaptive measure outcomes.

Limitations
Despite careful data collection and analysis, several limitations in this study were unavoidable. Literature guidance instructs that, in addition to the indices measured in this study, data such as rate of re-emergency visit within 3 days and readmission rate within 14 days should also be included in the analysis if a comparison for the revision of operation procedure for the clinical pathway is to be conducted. Such is necessary to measure accurately the long-run (actual) effect on rate of readmission and medical costs. Such indices were not included as relevant factors in this study. We intend to include more flexible factors in subsequent studies.

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護理照護之持續性醫療品質改善 ——
以Tw-DRGs125之臨床路徑為例

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背　景
健保局自2010年起，住院案件將逐年導入台灣版診斷關聯群（Taiwan diagnosis related groups, Tw-DRGs），當支付制度改變時，醫院為了生存必需採取管理控制的系統或方法，以維持合理的成本及醫療照護的品質。

目　的
探討護理管理者介入參與心導管檢查臨床路徑作業流程修正之成效。

方　法
選擇符合健保局公告Tw-DRGs 125支付原則之案件為對象，進行心導管檢查之臨床路徑修正，並比較修正前後其醫療服務價值、照護品質、平均住院天數及財務風險等差異變化。

結　果
臨床路徑修正後，心導管檢查前護理照護完整率、平均住院天數、診斷數、手術處置數及合併症／併發症數達到顯著差異，且醫療資源耗用均較臨床路徑修正前為低，並呈現顯著差異（p < .05）。

結　論
臨床路徑修正從組織、流程到成效管理，醫院方面不僅得到經濟效益的改善，同時對醫療品質的提昇也具有實質的助益。

關鍵詞：臨床路徑修正、診斷關聯群、持續性醫療品質改善。

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