Original Article

A Comparison of Universal Health Coverage Scheme Reimbursement for Primary Total Knee Arthroplasty under the Thai Diagnosis Related Group versions 5 and 6

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Background: Growing health care costs resulting from the increasing number of total knee arthroplasty [TKA] patients will affect the financial status of both payers and the government. The current reimbursement system, version 5 of Thai Diagnosis Related Group [TDRG], will be replaced with version 6.

Objective: To compare hospital reimbursement by computing the relative weight [RW] among patients undergoing primary TKA under the old and new versions of TDRG.

Materials and Methods: Data on patients who underwent primary TKA was obtained from the Naresuan University Hospital Financial Department. Data on each patient consisted of 16 files which included demographic data, length of stay [LOS], TDRG code, and RW of TDRG5. The data from those 16 files was then evaluated using TDRG6.

Results: A hundred seventy patients underwent primary TKA during the study period, 152 females and 18 males. In the comparative evaluation, the overall RW using TDRG6 decreased by 0.0611 (-1.6%) compared to TDRG5, but the difference was not statistically significant (p = 0.10). The mean RW of TDRG6 and TDRG5 for 08030 knee replacement with no significant clinical or cost complexity [CCC] was 3.524 and 3.627, respectively; 08031 knee replacement with minimal CCC was 4.337 and 4.104; and for 08032 knee replacement with moderate CCC was 7.381 and 5.999. The RW for the least comorbid patients (code 08030) under TDRG6 significantly decreased by 0.103 (-2.8%) compared to the RW of TDRG5 (p<0.01).

Conclusion: Under TDRG6, the RW of for primary TKA performed on patients with the least clinical and cost complexity [CCC] will be significantly reduced by 2.8%, but the RW for patients in the high CCC subgroups will increase compared to TDRG5. Overall, reimbursement for all primary TKA patients with TDRG6 will be slightly decreased (1.6%).

Keywords: Thai diagnosis-related group (TDRG), Clinical and cost complexity (CCC), Reimbursement, Total knee arthroplasty

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As the elderly population continues to grow at an unprecedented rate, the number of patients suffering from an end-stage knee osteoarthritis who require total knee arthroplasty [TKA] is on the rise[1]. Growing health care costs associated with the increasing number of TKA patients have put a strain on the whole health care system. These higher expenditures affect both the payers' and the government's financial status. Concerns over this issue

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have led to the development of a reimbursement system, the Diagnosis Related Group, which can provide quality care without resulting in financial hardship for either party.

Diagnosis Related Group [DRG] is a system for classifying inpatient cases and for measuring hospital output using the principles of the ISO-resource group for determining hospital reimbursement by the government. That classification system is based on diagnosis, procedures, comorbidities, discharge status, length of stay [LOS], and demographic data[2]. Even though the reimbursement was intended to be proportional to resource utilization based on the complexity of the patient's condition, studies have found a variability in reimbursement that does not accurately reflect resource consumption[3-5].

Thai Diagnosis Related Group [TDRG] was initiated by the Center for Health Equity Monitoring [CHEM], Faculty of Medicine, Naresuan University, Phitsanulok, Thailand. The first version of TDRG, implimented in 1999, consisted of 511 codes. That version was used to calculate reimbursement for acute inpatient care for the majority of patients under government-sponsored forms of insurance, i.e., the Universal Health Coverage Scheme [UCS], the Civil Servant (and public enterprise workers) Medical Benefit Scheme [CSMBS] and the Social Security Scheme [SSS]. The TDRG has been sequentially revised through two major processes: (1) reclassification based on the WHO updated International Classification of Diseases 10th Revision [ICD-10] and the International Classification of Diseases 9th Revision, Clinical Modification [ICD-9-CM] for severity refined, bilateral, and multiple procedures, and (2) recalibration with increased data pooling power which also offered all stakeholders an opportunity to provide input and feedback during the public comment process.

The current 5th version, TDRG5, which was implemented in 2012 with 2450 codes will be replaced with a new verision, TDRG6. This newly developed version will reclassify the major diagnostic category [MDC] and the clinical and cost complexity [CCC] systems, modify the formula used to calculate relative weight [RW], and will also add updated diagnosis and procedure codes. It is important for health policy makers to assure that TDRG6 will provide for appropriate hospital reimbursement. This study aimed to compare the differences in hospital reimbursement under the two versions of the system by computing RW generated using TDRG5 and that generated using TDRG6. Results will suggest ability of the newly developed TDRG6 to appropriately determine reimbursement for patients undergoing primary TKA.

Materials and Methods

Data from patients in the Universal Coverage Scheme [UCS] who underwent primary total knee arthroplasty [TKA] during October 2014 to September 2015 at Naresuan University Hospital was obtained from the hospital's financial department. Data tracking was done for patients whose principle diagnosis was osteoarthritis (coded as M17 in ICD-10 (WHO)), and those whose principal procedure was primary TKA, coded as 81.54 in the International Classification of Diseases 9th Revision, Clinical Modification [ICD-9-CM]. The information obtained consisted of demographic data, length of stay [LOS], data from 16 files containing all the patient's inpatient details, TDRG5 code, and relative weight [RW] under TDRG5. Based on the information in the 16 files, the reimbursement level for each patient was computed using the new TDRG6 revision software from the Thai Case Mix Centre. This study was approved by the Institutional ethic committee.

All the patients in Disease Cluster 0803, without regard to individual clinical or comorbidities [CC], were recruited. The fifth digit of the TDRG5 classification indicates the level of clinical complexity which ranges from the least complex to the most complex. The TDRG6 integrates the cost of treatment with the clinical complexity component of TDRG5, and hence is called the CCC (clinical and cost complexity) system.

Statistical analysis was done using descriptive statistics as appropriate. The Pearson correlation coefficient was used to identify associations between the RW of TDRG6 and TDRG5. Comparison of the difference in the RW from the two versions of TDRG was accomplished using the paired t-test. SPSS software (Statistical Package for Social Sciences, Version 17.0; SPSS Inc, Chicago, IL, USA) was used for all statistical analysis. Statistical significance was defined as $p<0.05$.

Results

One hundred seventy patients, 152 females and 18 males, who were covered by UCS underwent primary TKA at Naresuan University hospital had a complete data set. The procedures were performed by seven independent orthopedic surgeons. One hundred and fifty-two patients had unilateral TKA, while 22 patients had bilateral TKA. Descriptive data on the

patients including age and length of stay. RW of the primary TKA under TDRG5 and TDRG6 are shown in Table 1. The RW of primary TKA projected by TDRG6 is significantly correlated with the RW calculated using TDRG5 (0.807, $p< 0.01$). The RW for primary TKA using TDRG6 decreased by 0.061 compared to TDRG5 but the difference was not statistically significant ($p = 0.10$). TDRG6 reclassified the CC subgroups by integrating the cost of treatment into the calculation, resulting in some patients being allocated to a different level. For instance, 61 of 69 patients in CC subgroup 1 under TDRG5 were moved to CCC subgroup 0 under TDRG6. Two patients in CC subgroup 3 of TDRG5 were shifted to CCC subgroup 0 under TDRG6, while 11 patients were allocated to CCC subgroup 1 and one was reassigned to CCC subgroup 2 under TDRG6 (Table2). The RW of TDRG6 for individual CCC subgroups was changed from the RW of the same subgroup calculated under TDRG5. The mean RW of TDRG6 and of TDRG5 for code 0803 were 3.761 and 3.822; for code 08030, the values were 3.524 and 3.627; for code 08031, the values were 4.337, and 4.104; and for code 08032, the values were 7.381 and 5.999. The RW for code 08030 measured under TDRG6 decreased significantly by 0.103 compared to the RW under TDRG5 ($p<0.01$). However, there was no signficant difference between the RW of TDRG 6 and TDRG 5 for codes 0803, 08031 or 08032 (Table 3).

Discussion

Published reports have stated that some reimbursement systems might not be appropriate for a number of situations. For example, Padegimas et al[4] demonstrated that Medicare reimbursements for total joint arthroplasty in the United States are highly varied. They found that higher reimbursement was associated with a lower patient volume, lower patient satisfaction, a healthier patient population, and government ownership of a hospital.

The present study demonstrates that the RW for primary TKA under the forthcoming TDRG6 is significantly correlated with the RW of TDRG5. The findings also show that some patients will be shifted from a higher level of CC under TDRG5 to a lower level of CCC under TDRG6, and that the RW of 08030 by TDRG6 is significantly lower than the RW of the similar category under TDRG5 by a factor of 0.103, a reduction of 2.8% ($p<0.01$), while the RW of 08031 and 08032 under TDRG6 will increase by 5.7% and 23.0%, respectively, although that change is not statistically

Table 1. Descriptive data of the study group (n =170)

	Mean	SD	Minimum	Maximum
Age (years)	62.71	8.02	38	82
LOS (days)	5.95	1.96	2	20
RW with TDRG5	3.82	0.82	3.50	9.41
RW with TDRG6	3.76	0.77	3.10	8.26

SD = standard deviation, LOS = length of stay, RW = relative weight

Table 2. Changes in patient group with TDRG6 reclassification of CCC level

	TDRG5 CC system				Total
	08030	08031	08033	08034	
TDRG6CCC system					
08030	82	61	2	0	145
08031	2	8	11	1	22
08032	0	0	1	2	3
08033	0	0	0	0	0
Total	84	69	14	3	170

TDRG5 = Thai Diagnosis-Related Group version 5; TDRG6 = Thai Diagnosis-Related Group version 6

Table 3. RW for specific codes with TDRG6 and with TDRG5

	Mean difference	SD	95% confidence interval		*p*-value
			Lower	Upper	
08030	-0.103(-2.84%)	0.16	-0.13	-0.08	<0.01*
08031	0.233(+5.68%)	0.66	-0.04	0.51	0.10
08032	1.381(+23.02%)	1.49	-2.32	5.08	0.25

* Statistically significant ($p<0.05$)

significant. Lavernia et al[6] reported a correlation between the cost for primary TKA and both the level of severity of the illness [SOI] and risk of mortality [ROM] subclass for All-Patient Refined Diagnosis-Related Groups [APR-DRG]. Pugely et al[5] reported 85% of patients have at least one associated disease. They found an association between a patient with multiple comorbidities and additive resource need as well as LOS after primary TKA. Thus comorbidities clearly affect demands on resources, but reimbursement might not align with that reality.

The authors previously investigated reimbursement for primary TKA under TDRG5 and found that the hospital received significantly more payment for sicker patients. Interestingly, hospital charges which were classified as hospital cost was not correlated with the patients' CC subgroup level. As a result, the hospital made significantly more profit from patients with a higher CC subgroup level. The TDRG6 has incorporated that category of cost into the CCC system. This reclassification may more appropriately reflect payment based on actual cost and resource use, and may also discourage upcoding or overcoding and selection bias by health care providers. However, the number of patients in the high CCC subgroup level under TDRG6 was too small to evaluate the statistical significance. These findings warrant further investigation to validate the value of TDRG6.

Hospitals should plan to accommodate this change in several ways. Pongpirul et al[7] has described three potential approaches for hospital manipulation of DRG data: corporate (nonclinical), clinical, and coding practices (3C). In another study, Pongpirul et al[8] reviewed hospital coding practices at 10 different hospitals in Thailand and found the coding process included at least seven major steps involving eight professional health care disciplines, resulting in great variation across hospitals. This variation may affect the CCC system. Another study revealed a difference in level of agreement of coding for patients who had undergone primary TKA done by a hospital coder and by an individual with orthopedic experience[9]. The hospital coder calculated complication and comorbidity rates of 1.4 and 2.9 per patient, while the orthopedic team reported 0.7 and 3.7 per patient, respectively. This comprehensive analytical approach may help hospitals to deal with changes in reimbursement under the impending TDRG6.

Cost containment is another strategy that hospitals could use to counterbalance any reduction in reimbursement for primary TKA. An initial effort to restrain cost by decreasing LOS has been reported to result in no additional complications after surgery. That effort may be one reason for the reported dramatic decline of hospital LOS following TKA[10,11]. Some studies have reported allocation of cost to hospital services. Healy et al[12] stated that 78% of the cost associated with TKA was generated in the operating theater, the nursing unit, the recovery room, and the pharmacy. They also found that 80% of the cost was incurred during the first 48 hours of hospitalization[13]. Effenberger et al[14] also demonstrated that the cost generated by personnel, implants, medication, medical technology services, and administration was variable. In the same way, a previous report by the authors of the current study revealed that the specific practices of individual surgeons significantly affected LOS, hospital charges, and thus reimbursement under the current version of TDRG5. Another finding total knee prosthesis in UCS operated by the Government Pharmaceutical Organization [GPO] might deduct hospital costs. In our study, we found no difference in terms of LOS, RW, or profit and loss that could be defined as a discrepancy between reimbursement and hospital charge.

There were some limitations in this study. First, the data was obtained from a single institution, a teaching hospital which performs more than 300 primary

TKAs per year. Other hospitals may have different patterns of patient demography and complexity as well as variability in facilities, cost allocation, and, in particular, the base rate for reimbursement calculations. Second, the number of patients classified as being in a high level of CCC subgroup was too small to show statistical significance of the RW alteration.

Conclusion

The overall reimbursement for primary TKA under the Universal Coverage Scheme with TDRG6 will be slightly decreased (1.6%). Specifically, the relative weight [RW] of TDRG6 for a primary TKA performed on patients with the least clinical and cost complexity [CCC] will be slightly but statistically significantly reduced by 2.8% compared to TDRG5. However, TDRG6 tends to increase the RW for patients in high level of CCC subgroups compared to the similar categories in TDRG5. Reimbursement for primary TKA under the impending TDRG6 may reasonably compensate hospitals for sicker patients, and consequently may minimize selection bias among health care providers.

What is already known on this topic?

Evaluation of TKA patient records has demonstrated that TDRG version 5 provides for reasonable reimbursement of patient's cost for primary TKA in Thailand, and it seems to reimburse appropriately for comorbid patients. The 5th version or TDRG5 will be replaced with the new TDRG version 6 [TDRG6]. This newly developed version will reclassify major diagnostic categories [MDC] as well as the clinical and cost complexity [CCC] system. It will also modify the formula used to calculate relative weight [RW] as well as add updated diagnosis and procedure codes.

What this study adds?

This study suggests that in anticipation of the newly developed TDRG6 as relates to reimbursement among patients undergoing primary TKA in Thailand, it is important for health policy makers, payers, and health care providers to be reassured that TDRG6 reimbursement will appropriately reflect resource utilization based on differences in complexity of the patient's condition.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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