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Thai Diagnosis Related Group (TDRG) System: A Comprehensive Analysis of Algorithmic Architecture, Economic Logic, and Comparative Global Context

กลุ่มวินิจฉัยโรคร่วมไทย: การวิเคราะห์ภาพรวมของการออกแบบอัลกอริทึม หลักคิดทางเศรษฐศาสตร์และการเปรียบเทียบกับบริบทของต่างประเทศ

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Abstract

This comprehensive analysis dissects the Thai Diagnosis Related Group (TDRG) System, which serves as the core financing engine for inpatient care of Thailand's universal health coverage (UHC). Introduced to replace distortionary fee-for-service models, the TDRG translates clinical work into standardized economic units, fundamentally shifting hospital incentives toward paying for outcomes rather than inputs. This study provides an exhaustive technical review of the algorithmic architecture, detailing its hierarchical decision-tree logic, which starts with Pre-MDC (pre-major diagnostic category) screening for high-cost groups, MDC assignment, and the sophisticated patient complexity level (PCL) engine used in the Australian Refined DRG (AR-DRG) framework. A key contribution is the exploration of the system's indigenization, noting specific adaptations for high-burden local conditions such as dengue hemorrhagic fever. Furthermore, the paper comparatively analyzes the TDRG against global systems, notably the US MS-DRG, highlighting Thailand's use of tropical-specific diagnosis codes (ICD-10-TM) and its reliance on complexity scoring over the US categorical severity tiers. The analysis identifies critical systemic vulnerabilities stemming from its reliance on standardized charge data (cost-to-charge ratios) for relative weight

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recalibration, which risks undervaluing labor-intensive care, and the persistent issue of coding quality leading to DRG creep. The conclusion recommends strategic evolution, urging a transition toward patient level information and costing system (PLICS) for accurate cost-based weights, the adoption of artificial intelligence (AI) for real-time auditing, and preparation for the mandatory transition to ICD-11 coding standards to ensure the TDRG remains a robust and equitable foundation for the nation's health equity objectives.

Keywords: Algorithm, Australia, DRG, Logic, Thailand

บทคัดย่อ

กลุ่มวินิจฉัยโรคร่วมไทย: การวิเคราะห์ภาพรวมของการออกแบบอัลกอริทึม หลักคิดทางเศรษฐศาสตร์และการเปรียบเทียบกับบริบทของต่างประเทศ

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บทความนี้วิเคราะห์ระบบกลุ่มวินิจฉัยโรคร่วม หรือ Thai Diagnosis Related Group (TDRG) ซึ่งเป็นกลไกหลักในการจ่ายค่ารักษาพยาบาลผู้ป่วยในภายใต้ระบบหลักประกันสุขภาพถ้วนหน้า (universal health coverage) ของประเทศไทย การทบทวนเชิงเทคนิคนี้นำเสนอโครงสร้างอัลกอริทึมของ TDRG ตั้งแต่การจัดกลุ่มก่อน MDC (pre-major diagnostic category) การกำหนด MDC ไปจนถึงระบบความซับซ้อนทางคลินิกของผู้ป่วย (PCL, patient complexity level) ที่อิทธิพลมาจาก Australian Refined DRG (AR-DRG) พร้อมการปรับให้เข้ากับบริบทท้องถิ่น เช่น การจัดกลุ่มโรคไข้เลือดออก (dengue hemorrhagic fever) นอกจากนี้ยังมีการวิเคราะห์เปรียบเทียบระหว่าง TDRG กับระบบ DRG ของประเทศอื่น โดยเฉพาะ US MS-DRG (United States Medicare Severity DRG) และการใช้งานรหัส ICD-10-TM (International Classification of Diseases, 10th Revision, Thai modification) พร้อมกับการใช้น้ำหนักเชิงความซับซ้อนแทนชั้นความรุนแรงของสหรัฐ บทความชี้ให้เห็นความเสี่ยงด้านการพึ่งพาระบบข้อมูลต้นทุน-ค่าใช้จ่าย (cost-to-charge ratios) สำหรับการปรับน้ำหนัก ซึ่งอาจลดคุณค่าของกลุ่มโรคที่ต้องใช้แรงงานรักษาพยาบาลมาก และยังประสบปัญหา DRG creep อย่างต่อเนื่อง ความเห็นเชิงนโยบายจึงเสนอให้เปลี่ยนผ่านไปสู่ระบบข้อมูลต้นทุนในระดับผู้ป่วย (patient level information and costing system, PLICS) เพื่อสะท้อนต้นทุนจริง ปรับใช้งานปัญญาประดิษฐ์ (artificial intelligence, AI) เพื่อการตรวจสอบข้อมูลการเบิกค่ารักษาแบบเรียลไทม์ และเตรียมพร้อมต่อมาตรฐาน ICD-11 เพื่อให้ TDRG เป็นรากฐานที่ยุติธรรมและสอดคล้องกับเป้าหมายความเป็นธรรมทางสุขภาพของประเทศ

คำสำคัญ: กลุ่มวินิจฉัยโรคร่วม, ประเทศไทย, หลักคิด, ออสเตรเลีย, อัลกอริทึม

Introduction

1. Introduction: The Strategic Imperative of Case-Mix Classification in Thailand

The landscape of healthcare financing in Thailand underwent a seismic shift with the introduction of the universal health coverage (UHC) reform in 2002. Prior to this, and indeed within the burgeoning private sector, retrospective payment mechanisms such as line-item budgeting and fee-for-service (FFS) dominated the hospital financing terrain. These models, while administratively straightforward, harbored inherent economic distortions. Line-item budgets, characterized by fixed annual allocations, often incentivized large hospitals, under-servicing and inefficiency, as providers faced no marginal benefit for treating additional patients or improving throughputs. Conversely, FFS models incentivized supplier-induced demand, encouraging the proliferation of unnecessary diagnostic tests, prolonged hospital stays, and the over-prescription of high-margin pharmaceuticals to maximize revenue[1] and high out-of-pocket burdens for the uninsured. In this context, the diagnosis related group (DRG) system was not merely adopted as a billing tool but was strategically deployed as a mechanism of health system reform. The Thai DRG (TDRG) serves as the "**currency**" of inpatient care, translating the complex, multidimensional reality of clinical treatment into a standardized economic unit. By classifying patients into clinically meaningful and hospital resource use homogeneous groups, the system allows the National Health Security Office (NHSO), the civil servant medical benefit scheme (CSMBS), and the social security scheme (SSS) to act as prudent purchasers of health services. This transition marked a move from paying for itemized inputs (doctors, drugs, beds) to paying for outputs (treated cases), fundamentally altering the incentive structures for hospitals across the Kingdom.[1] The core "**idea**" behind the TDRG algorithm is the statistical reduction of variance (RIV). In a raw distribution of hospital cases, the variation in resource consumption is immense—ranging from a simple appendectomy to a complex multi-organ transplant. The algorithm functions as a sophisticated filter, partitioning this chaotic universe into manageable "**bins**" (DRGs) where the variance in cost is minimized. The hypothesis is that within each DRG, patients are sufficiently similar that a single average price (the relative weight, RW) is a fair reimbursement for the hospital's effort. This report provides an exhaustive technical dissection of the TDRG system, exploring its algorithmic roots, its specific adaptations for a tropical middle-income context, and the path forward for its evolution.[1]

2. Theoretical Foundations and the "Idea" Behind the Algorithm

To understand the TDRG, one must first grasp the theoretical underpinnings that differentiate it from simple categorization systems. The algorithm is designed to balance two often conflicting objectives: clinical coherence and statistical homogeneity.

2.1 The Concept of the "Hospital Product"

The intellectual lineage of the DRG concept, originating from Yale University researchers Fetter and Thompson, posits that hospitals are multi-product firms. However, unlike a factory producing identical cars, a hospital produces "**treated patients.**" The DRG system defines these products.

- **Clinical coherence:** Patients in the same group must make sense to a clinician. It would be statistically possible to group "**leg fracture**" and "**appendicitis**" together if they cost the exact same amount to treat, but this would lack clinical face validity. Therefore, the TDRG (with the concept of Fetter and Thompson) first respects the organ system (MDC, major diagnostic category) before considering cost.[1]

- **Statistical homogeneity:** The resources consumed (proxied by length of stay and total hospital charge) by patients within a group should be similar. This "**iso-resource**" concept is crucial for fairness. If a DRG contains both cheap and expensive cases randomly, hospitals face financial risk. The TDRG algorithm accepts "**variance reduction**" techniques to ensure that the groups are tight enough to be predictable.[1]

2.2 The Algorithmic Logic: A Hierarchical Decision Tree

The TDRG algorithm does not assess all variables simultaneously. Instead, it employs a strict hierarchical logic, often visualized as a decision tree. The "**grouper**" software processes a single patient record (an episode of care) and forces it through a series of logic gates.

1. **Pre-MDC processing:** The algorithm first scans for "**catastrophic**" procedures or conditions that supersede organ-system classification. These include organ transplants (heart, liver, bone marrow) or long-term mechanical ventilation (tracheostomy). If a patient qualifies for a Pre-MDC, the classification stops here. This ensures that the most resource-intensive cases are identified immediately, protecting tertiary care hospitals from underpayment.[3]

2. **Major diagnostic category (MDC) assignment:** If not a Pre-MDC, the principal diagnosis (PDx) drives the case into one of 25 MDCs, generally corresponding to organ systems (e.g., MDC 05: circulatory system). This step ensures the clinical coherence mentioned above.[6]

3. **Partitioning (surgical vs. medical):** Within the MDC, the presence of a valid operating room (OR) procedure splits the path.
   - Surgical partition: Hierarchically ranked. A patient with a heart transplant and a hernia repair is grouped by the most resource-intensive procedure (the transplant).
   - Medical partition: If no surgical procedure is performed, the principal diagnosis determines the specific disease group (e.g., pneumonia vs. bronchitis).[1]

4. **Disease cluster (DC):** This is a unique feature of the DRG systems. The algorithm aggregates similar diagnosis codes into a "**disease cluster.**" The DC represents the base condition before severity adjustment (e.g., 05550: Heart failure and shock without significant cost and clinical complexity).

5. **Complexity adjustment (patient complexity level, PCL):** The algorithm then scans the secondary diagnoses to calculate a severity score (0–9). This is the "**refined**" part of the system, distinguishing it from early US models.

6. **Final grouping:** The combination of the DC and the PCL yields the final 5-digit DRG code (e.g., 05554: Heart failure and shock with catastrophic cost and clinical complexity).[1]

3. Detailed Algorithmic Architecture: Variables and Mechanics

The operational success of the TDRG relies on the precise definition and handling of input variables. The "**garbage in, garbage out**" principle is acute here; the algorithm is sensitive to the quality of clinical coding.

3.1 Input Variables and Standards

The TDRG Grouper requires a specific dataset:

- **Principal diagnosis (PDx):** The condition established at discharge to be chiefly responsible for the admission. Thailand uses ICD-10 and ICD-10-TM (Thai modification). The "**TM**" is critical because it contains expanded codes for tropical diseases (like dengue hemorrhagic fever grades) that are collapsed in the WHO ICD-10 or US ICD-10-CM.[8]
- **Secondary diagnoses (SDx):** Comorbidities (pre-existing) and complications (arising during stay). Also coded in ICD-10 or ICD-10-TM.
- **Procedures (Proc):** Significant operative and non-operative interventions. Thailand utilizes ICD-9-CM (clinical modification) for procedures. This is a legacy decision, as many countries (like the US) have moved to ICD-10-PCS or ACHI, but ICD-9-CM remains the standard for the TDRG Grouper.[1]
- **Age and weight:** Age is calculated to the day for neonates (MDC 15), admission weight in grams is the primary driver of the DRG, overriding diagnosis in many cases (e.g., a <1000g neonate is in a high-cost DRG than a >2499g regardless of specific problems).[5]
- **Discharge status:** Dead, transferred, or sent home. This affects the "**payment weight**" in some instances and to trace for complete treatment or split admissions.[5]

3.2 The Patient Complexity Level (PCL) Engine

The most sophisticated aspect of the "**idea**" behind the TDRG is its handling of patient severity. Unlike the early US HCFA-DRG (Health Care Financing Administration was the former name of Centers for Medicare and Medicaid Services), which essentially had a binary switch (complication/no complication), the TDRG uses an ordinal complexity score like the Australian Refined DRG (AR-DRG) logic.

The Diagnosis Complexity Level (DCL)

Every ICD-10, ICD-10-TM code in the secondary diagnosis list is assigned a raw "**DCL**" value ranging from 0 to 5 where 0 indicates the lowest of complexity and 5 indicates the highest.[16]

The Recursive Exclusion Logic

To prevent "**gaming**" and ensure clinical logic, the algorithm applies an exclusion list. If a secondary diagnosis is inherently related to the principal diagnosis, its DCL is zeroed out.

- **Example:** If PDx is "**cardiac arrest**" and SDx is "**ventricular fibrillation,**" the system excludes the SDx from the complexity calculation because ventricular fibrillation is an inherent component of cardiac arrest, not an additional complication.[1]
- **Reasoning:** This prevents "**double counting**" of the same physiological event to artificially inflate reimbursement.

The PCL Aggregation Formula

The final patient complexity level (PCL) for the episode is not a simple sum of the individual DCLs. Summing them would lead to "**score creep**" where multiple minor conditions equate to a catastrophic one. Instead, the algorithm uses a recursive formula (often proprietary or highly complex) that dampens the impact of additional codes.

- The logic ensures that a patient with one DCL=4 condition has a PCL of 4.
- A patient with ten DCL=1 conditions will have only PCL of 4.
- This creates a "**saturation effect,**" reflecting the marginal cost of care: the first major complication adds significant cost, but the tenth minor comorbidity adds very little extra cost.[5]

3.3 Relative Weight (RW) Recalibration Methodology

The "**price**" attached to each DRG is its relative weight (RW). The calculation of RW in the TDRG (specifically for Version 6.2) involves a rigorous statistical process comprising seven distinct steps[1]:

1. Data verification: Filtering incomplete records (e.g., missing length of stay: LOS, invalid sex). In v6.2, over 21 million admissions were analyzed, with ~69.7% passing quality checks.

2. Charge standardization: Hospitals have vastly different pricing structures (public vs. private). The TCMC standardizes these charges—often replacing the "**room and board**" charge with a calculated standard to remove the variance caused by "**luxury**" wards versus "**common**" wards.

3. Outlier trimming: Statistical outliers (cases with costs >3 standard deviations from the mean) are removed from the calibration dataset to prevent them from skewing the average weight. These cases are paid separately via outlier mechanisms, so they shouldn't influence the "**average**" weight.

4. Re-checking common DRGs: Ensuring that high-volume DRGs have stable means.

5. RW calculation: The core formula:

6. Adjustment for resource consumption: TDRG expert reviews the calculated

$$RW_{DRG} = \frac{\text{Mean Standardized Charge of DRG}}{\text{Global Mean StandardiXed Charge}}$$

weights. If the statistical weights for specific DRGs look too low (perhaps due to poor data recording in community hospitals), they are manually adjusted upwards to reflect "**appropriateness of treatment.**"

7. Normalization: The final weights are normalized so that the casemix index (CMI) of the entire country equals 1.0. This prevents "**inflation**" of the system where the average weight drifts upward over time without a real increase in patient complexity.[4]

3.4 Payment Adjustments: Inliers and Outliers

The final payment is not just *BaseRate* x *RW*. It is adjusted for length of stay (LOS – adjusted RW) to ensure fairness[12]:

- **Low outlier:** If a patient is discharged very early (e.g., <24 hours or below the "**low trim point**" - shorter than 1/3 of average LOS of that DRG), the full DRG payment is not made. Instead, a per-diem or prorated payment is calculated. This discourages "**churning**" (admitting patients for trivial reasons to get a full payment).

- **Normal range (Inliers):** Paid at the standard DRG rate.
- **High outlier:** If the patient stays longer than the "**high trim point**" (longer than 3 times of the average LOS of that DRG), the hospital receives the adjusted RW payment for that DRG calculated based on a marginal per-diem for the extra days. This acts as a stop-loss insurance for hospitals treating unexpectedly difficult cases.[13]

4. History and Evolution: From HCFA to Thai-Modified AR-DRG

The TDRG is not a static import; it is a living system that has evolved through a process of "**indigenization.**"

4.1 The Early Years: Research and Adoption (1993–2002)

In the early 1990s, the Health Systems Research Institute (HSRI) recognized the unsustainable trajectory of healthcare costs. Initial pilots focused on accident victims and high-cost care.

- **Version 1 & 2 (HCFA Roots):** When formally adopted in 1998 (v1) and 2001 (v2), Thailand used the US HCFA-DRG (Medicare) structure. This system had roughly 500 groups and was relatively simple. However, it was designed for an elderly US population and lacked sensitivity for tropical diseases and the pediatric/maternal heavy demographic of Thailand.[1]

4.2 The Strategic Pivot: Adopting the Australian Model (2003)

In 2003, with Version 3, Thailand made a critical decision to switch its "**grouper logic**" from the US HCFA model to the Australian Refined DRG (AR-DRG) model.

- **Why Australia?** The AR-DRG system was viewed as more "**clinical**" explainable to teaching hospitals. It introduced the PCL complexity scoring system (splitting DRGs into 0, 1, 2, 3 and 4 levels based on severity), whereas HCFA relied on a simpler CC/No-CC split. This granularity was essential for Thailand's tertiary hospitals that must not be excluded from UHC, which attracted complex cases that were undervalued by the US model.[1]

4.3 The Era of Expansion and Contraction (Version 5 to 6.3)

- **Version 5 (2012):** The system expanded massively to 2,450 DRG groups. The ambition was to capture every nuance of clinical practice. However, this led to "**statistical fragmentation.**" Many groups had too few cases to calculate a reliable average cost, leading to volatile payments.[14]
- **Version 6.2 (2017) & 6.3 (2020):** The pendulum swung back towards stability. The number of groups was reduced to roughly 1,500. The TCMC realized that a smaller number of robust groups was better than a large number of volatile ones. This version also improved the logic

for “**bilaterality**” (e.g., distinguishing between one knee replacement and two in the same admission) and “multiplicity” (repeated operations on the same site)[1] which existed since v.4.

5. Comparative Analysis: TDRG vs. Global Counterparts

To fully appreciate the TDRG, it is instructive to compare it with the two dominant global families of case-mix systems: the US MS-DRG and the Australian AR-DRG.

5.1 TDRG vs. US Medicare Severity DRG (MS-DRG)

The US system evolved from HCFA-DRG to MS-DRG in 2007, adopting a 3-tiered severity model.

Comparison Insight: The US MS-DRG is heavily optimized for an elderly population with chronic heart/lung conditions. The TDRG retains a broader focus, capable of handling the bimodal distribution of disease in developing

Table 1 Summary of Special Features between Thai and US Models. [1]

Feature	TDRG (v6.2/6.3)	US MS-DRG	Implications
Severity tiers	5 levels (0–4) via PCL	3 Levels (no CC, CC, major CC)	Thai system offers finer granularity at the “catastrophic” end, better for ICU reimbursement in resource-limited settings.
Diagnosis coding	ICD-10-WHO, ICD-10-TM (Thai modification)	ICD-10-CM (US modification)	Thai codes include tropical specificities (e.g., dengue grades) absent in US codes.
Procedure coding	ICD-9-CM	ICD-10-PCS	The US uses a completely new, highly specific procedure coding system. Thailand retains the older, simpler ICD-9-CM, easing coder burden but losing surgical detail.
Outlier logic	Construct adjusted RW formula for low-outlier and high-outlier based on marginal hospital resource uses per day of medical and surgical DRGs	Cost outlier (total cost threshold)	Thai logic focuses on stay duration (LOS) for outlier grouping and uses charge as a proxy for cost; US focuses on total charges converted to cost.
Neonates	Birth weight dominates grouping	Diagnosis dominates	Thai system protects hospitals caring for low-birth-weight infants more explicitly via weight-based groups.

nations (infectious diseases in the young, NCDs in the old).[17]

5.2 TDRG vs. Australian Refined DRG (AR-DRG)

The Thai system is a “**cousin**” of the Australian system, sharing the same DNA.

Comparison Insight: While algorithmically similar, the Australian system is supported by a much richer data ecosystem (routine micro-costing). Thailand uses the logic of Australia but the data of a middle-income country (charges), which creates a performance gap.[10]

5.3 Regional Influence: The Thai Model as an Export

The TDRG has become a template for other ASEAN nations.

- **Vietnam:** Explicitly piloted a DRG system based on the Thai variant. The Thai Casemix Centre provided the grouper logic and training, helping Vietnam bypass the “**adoption of Western model**” phase and go straight to a “**tropicalized**” model.[15]
- **Indonesia (INA-CBG):** Uses a similar case-mix approach but often faces criticism for having too few groups and less transparent calibration compared to the mature Thai system.[22]

Table 2 Summary of Similarity between Thai and Australian Models.

Feature	TDRG	Australian AR-DRG	Implications
Grouper logic	AR-DRG derivative	Original source	The PCL formulas are nearly identical, showing the strong technology diffusion.
Procedure coding	ICD-9-CM	ACHI (Australian Classification of Health Interventions)	Australia’s ACHI is more modern. Thailand’s reliance on ICD-9-CM is a legacy constraint.
Mental health	Limited specific groups	Specialized mental health classification	Australia has moved towards a more advanced mental health case-mix; Thailand still relies largely on basic DRGs for psychiatry.
Updates	Irregular (every 4-5 years)	Biennial/Annual	Australia updates weights and grouper logic more frequently, keeping pace with technology better.

6. **Specificity in Action: Tropical Diseases and Local Context**

A key "**idea**" behind the Thai algorithm is that it must reflect Thai reality. A Western grouper would fail in Thailand because it lacks the resolution for tropical infectious diseases.

6.1 Dengue Hemorrhagic Fever (DHF)

In the US or Europe, dengue is a rare travel disease, often grouped into a generic "**viral illness**" DRG. In Thailand, it is a high-volume, high-variance condition.

- **Granularity:** The Thai Grouper (MDC 18: Infectious Diseases) contains specific logic for dengue hemorrhagic fever. It differentiates between:
  - Dengue fever (classic).
  - DHF Grade I/II (warning signs).
  - DHF Grade III/IV (dengue shock syndrome).
- **Impact:** A case of dengue shock syndrome (A91 with shock) triggers a high complexity score (DCL 3 or 4) or maps to a specific high-weight DC. This ensures that hospitals are paid for the intensive fluid management and ICU monitoring required, which differs vastly from simple dengue fever.[9]
- **Research integration:** Research on biomarkers (like monocyte distribution width, MDW) and clinical risk scores in Thailand directly informs these groupings, ensuring the DRG definitions match clinical guidelines.[23]

7. **Systemic Challenges: Vulnerabilities in the Model**

Despite its sophistication, the TDRG system is not without flaws. These challenges represent the "**unfinished business**" of the algorithm.

7.1 The Cost-Charge Disconnect

The single biggest weakness is the data source for relative weights.

- **The Problem:** Thailand relies heavily on cost-to-charge ratios (CCR) derived from hospital charges, rather than true micro-costing.[1]
- **The Distortion:** Public hospitals often set charges based on policy rather than economics. Departments like pharmacy and labs typically have high profit margins (charges > cost) to cross-subsidize underpriced nursing and room services.
- **The Result:** The DRG weights likely overvalue drug-intensive/diagnostic-intensive cases (medical oncology, cardiology) and undervalue labor-intensive cases (geriatrics, psychiatry). This biases the system towards technology rather than care.[24]

7.2 Coding Quality and "DRG Creep"

The algorithm is only as good as the coder.

- **Upcoding:** Hospitals have learned that adding certain codes (e.g., "**respiratory failure,**" "**hypokalemia,**" "**sepsis**") boosts the PCL from 0 to 2 or 3, significantly increasing payment. This phenomenon, known as "**DRG Creep,**" was rampant in early versions.
- **Error rates:** Audits in the early years showed error rates as high as 64%. While this has improved, random audits still find significant discrepancies, often due to a lack of trained professional coders. In many hospitals, nurses or clerks do the coding as a secondary task.[1]

7.3 The "Ungroupable" Void

Transition periods between versions (e.g., v5 to v6) create chaos.

- **Issue:** Changes in the **"map"** (ICD-10 to DRG) can leave valid clinical cases as **"ungroupable"** (DRG 26509). If a new disease code is introduced (e.g., a new COVID strain) but the Grouper hasn't been updated, the case hits an error wall.
- **Impact:** Hospitals must appeal these cases or force-code them into incorrect categories to get paid, degrading data quality.[5]

8. Recommendations: Improving the TDRG System

Based on the analysis of the snippets and international best practices, the following strategic improvements are recommended:

8.1 Strategic Move to Micro-Costing (PLICS)

Thailand must transition from charge-based weights to cost-based weights.

- **Action:** Expand the **"patient level information and costing system"** (PLICS) pilot. Currently, only a few sentinel hospitals perform detailed micro-costing (tracking every syringe and minute of nursing time).
- **Benefit:** This would correct the undervaluation of nursing services and ICU care. It would align the payment with the actual consumption of resources rather than the billing habits of hospitals.[32]

8.2 Automated Artificial Intelligence Auditing

To combat **"DRG Creep"** without hiring an army of auditors:

- **Action:** Implement AI/machine learning algorithms in the claims processing pipeline.
- **Mechanism:** The AI looks for patterns: **"why does this hospital have 50% of pneumonia cases coded with 'Sepsis' when the national average is 10%?"** or **"Why was this 'respiratory failure' patient discharged home in 2 days?"**
- **Benefit:** Targeted audits focus resources on high-probability fraud/error, increasing the deterrence effectd[26]

8.3 Dynamic Recalibration

The 4-5 year gap between versions (v5 in 2012, v6.2 in 2017) is too long.

- **Action:** Adopt a biennial update cycle for relative weights, even if the Grouper structure remains stable.
- **Benefit:** This prevents the **"technological lag"** where new, expensive treatments (e.g., new stroke thrombectomy devices) are underpaid for years until a new version is released.[15]

8.4 Preparing for ICD-11

The world is moving to ICD-11, which introduces **"post-coordination"** (combining two codes into a single string).

- **Challenge:** The current Thai Grouper logic (parsing static 5-character strings) will break under ICD-11.
- **Action:** The TCMC must begin

"dual coding" studies immediately, mapping ICD-11 clusters to current DRGs to test the impact on PCL scores. As a WHO collaborating center, Thailand is well-positioned to lead this research for the region.35

8.5 Integrating Quality (Value-Based Payment)

The DRG pays for quantity (discharges). It should also pay for quality.

- **Action:** Overlay a "**pay-for-performance**" (P4P) matrix on the DRG payment.
- **Example:** For "**acute myocardial infarction**" (MDC 05), the full DRG payment is conditional on the prescription of beta-blockers at discharge or the timeliness of thrombolysis. This counters the incentive to "**skimp**" on care to save costs.[37]

Conclusion

The TDRG system stands as a testament to the capacity of a middle-income country to implement sophisticated health financing mechanisms. It is not merely a payment tool but the "**operating system**" of the UHC. Its "**idea**"—the pursuit of fairness through the statistical balancing of clinical complexity—has allowed Thailand to achieve universal health coverage without the runaway inflation seen in fee-for-service systems.

However, the system is maturing, and with maturity comes the need for refinement. The reliance on charge data, the vulnerability to coding manipulation, and the looming obsolescence of ICD-9-CM procedures are significant hurdles. By embracing micro-costing data, leveraging AI for auditing, and preparing for the digital leap to ICD-11, Thailand can ensure its DRG system remains a robust foundation for health equity in the decades to come. The Thai model proves that one does not need to be a wealthy nation to have a smart health system; one simply needs the political will to let data drive decision-making.

Table 3 Summary of Strategic Divergence between Thai and US Models.[1]

Metric	TDRG (v6.2)	US MS-DRG (v38)
Philosophy	Equity & access (tropicalized)	Efficiency (elderly/chronic)
Complexity engine	PCL (recursive, 0-9)	CC/MCC (ategorical)
Data basis	Adjusted charges	Cost reports
Updates	Irregular (4-5 years)	Annual (Oct 1)
Key strength	Adaptability to local disease burden	Data richness & regularity
Key weakness	Cost data quality (CCR bias)	Complexity & admin cost

Declaration of Generative Artificial Intelligence and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used Gemini AI to generate an initial draft based on prompts created by Dr. Prapat Suriyaphol. Following the use of this tool, the manuscript was reviewed, revised, and edited for accuracy through the editorial process of the HISPA Compendium (January to April 2026). The authors take full responsibility for the content of the published article. A representative prompt used in the AI-assisted drafting process focused on "Information about Thai DRG focusing on the algorithm, and what is the idea behind the algorithm and where Thai DRG is based on? And what can we do to improve?"

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