# Adopting Thai Diagnosis Related Group for Vietnam Universal Health Coverage: A Case of Ba Vi District Hospital

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## ABSTRACT

**Objective:** This study aimed to classify all hospital discharges covered by health insurance system into diagnosis related group (DRG) to guide provider payment reforms of universal health coverage roadmap in Vietnam.
**Methods:** Data from Ba Vi hospital from January to December 2012 were grouped into DRGs by Viet-DRG grouper version 1.0 developed based on Thai-DRG version 5 methodologies. The Pearson correlation (r) was used to assess the performance of Viet-DRG grouper as against Thai-DRG grouper. A 5-step trimming of individual inpatient data to achieve the highest correlations was performed.
**Results:** Data of 12,220 inpatient cases were analyzed by both groupers, 84.4% of total cases were classified into 89 DRGs. The five most common DRGs were vaginal delivery without complicating diagnosis (14500); Respiratory infection/inflammation, no complication and comorbidity (04520); Otitis media and URI, no complication and comorbidity (03530); Viral illness except dengue, child, no complication and comorbidity (18610); Bronchitis and asthma, no complication and comorbidity (04590). The performance of Viet-DRG grouper v1.0 compared with Thai-DRG grouper v5.0 for 89 DRGs in terms of relative weights as of 0.4 and length of stay as of 0.5.
**Conclusion:** Validity of the first Viet-DRG was at moderate level compared to Thai-DRG due to the limitation of data availability and quality at the hospital.

**Keywords:** DRG, classification, Viet DRG grouper, Thai DRG grouper

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## INTRODUCTION

Diagnosis related group (DRG) is a patient classification system of hospital product definition for acute inpatient outputs and serves as a tool for budgeting, cost control, and quality control in hospitals.[1] It has been used in both developed and developing countries to help control the cost for caring for inpatients and also sets standard practice for establishing reimbursements for healthcare providers.[2,3]

Provider payment methods are undergoing a profound healthcare reform in Vietnam and many pilots are needed in order to replace the budget deficit fee-for-services payment in the near future. An appropriate reimbursement mechanism to control the global budget was urgently required in order to achieve the universal health coverage (UHC) targeted in 2020 by the Government.[4] The inter-Ministries officially approved the roadmap for DRG system development in Vietnam; hence

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DRG method will be applied for reimbursement for UHC system after 2020 nationwide.

Thailand, a country similar to Vietnam in terms of socio-economic and cultural context, achieved UHC in 2000. DRG system is an important requirement for budgeting, cost control, and quality control in hospitals, besides it is also expected to ensure equity in health for its insured population.[5] The Thai DRG model crossed 5 official version developments and has been applied for acute inpatient service financing since 1999. The latest version is expected to be the most relevant adopted model for Vietnam application.

Ba Vi hospital, a general secondary care district hospital with 305 beds in Hanoi city, was selected for experimental field site of new provider payment scheme trial due to its strong collaboration, active support, available and readily accessible data. Ba Vi Hospital has 39 medical doctors, 5 pharmacists (including assistants), 126 nurses and technicians. There were about 200,000 outpatient visits and 18,000 inpatient admissions per year. The average of daily intake was from 500 to 600 outpatient visits. Bed occupancy rate ranged from 120-130%. In 2012, there were about 70,146 health insurance cards registered to Ba Vi hospital with a total of 106,600 outpatient visits and 12,220 cases admitted (11.5%) for their healthcare treatments.

In order to develop a relevant Vietnam DRG model (Viet-DRG grouper v1.0), the model was firstly generated from Ba Vi General Hospital. This is the first step in the roadmap to develop a comprehensive Vietnam DRG model based on Thai-DRG version 5 with a target of 2,450 DRGs in Viet-DRG. The algorithms and trim points in the Viet-DRG were also applied similar to the Thai-DRG. In addition, outliers by length of stays (LOS) longer than 365 days or less than 1 day would be trimmed which aimed to achieve the homogeneity of the data for evaluation.

The trial conducted in Ba Vi hospital was aimed to classify all hospital discharges covered by health insurance system into DRG adopting Thai-DRG version 5 methodologies to facilitate pace of change. The experiences from this one hospital will provide significant evidence and learning to set-up a comprehensive Vietnam DRG model (Viet-DRG grouper v1.0) for the imminent provider payment reforms.

## MATERIALS AND METHODS

All individual data audited both electronically and by printed data inspection related to health services, medical and non-medical bills of each insured inpatient were subjects for this study. A retrospective design was used to collect full electronic dataset files from Ba Vi district hospital in Hanoi city from 1 January to 31 December 2012.

Data was firstly extracted from the hospital's electronic information system. If e-file data was lacking information, e.g. without principal diagnosis (PDx), or inadequate secondary diagnosis (SDx), the corresponding printed medical records would be simultaneously checked to complete missing data by manually entering into Excel software. In Ba Vi hospital, ICD-10 (WHO) was used with 3 digit coding only. In order to group the diseases, data with three digits were modified by adding the 4$^{th}$ digit because the Thai DRG's ICD10 library adopted for this classification mostly employed 4 digits coding. This modification was done for principal diagnosis (PDx) and secondary diagnosis (SDx).

Additional data collected included breakdown of itemized fees and total fees to reflect health resource use in hospital. In each medical record, the information regarding age, sex, admission and discharge date, principal diagnosis, co-morbidities and complications were coded with WHO ICD-10, and main surgical procedures coded with Vietnam procedure codes. The local procedure codes were mapped into ICD-9-CM before passing individual inpatient data through the Viet-DRG grouper v1.0.

Viet-DRG grouper v1.0 was an open-source PostgreSQL-based software (written by Dr. Vu Thanh Nam). The logics and ICD-10/ICD-9-CM libraries for classification of Viet-DRG were the same as of Thai-DRG version 5. The verification of Viet-DRG grouper v1.0 as against the Thai-DRG grouper version 5 (written by Dr. Chairoj Zungsontiporn) was done by passing individual inpatient data through both DRG groupers.[6]

Viet-DRG grouper assigned each patient into Viet-DRG with Vietnam relative weight (Viet-RW) while Thai-DRG grouper assigned patients into Thai-DRG with Thai-RW and average length of stay (LOS).

In order to compare DRG assignments of both groupers, the Pearson correlation of RW Viet-DRG and RW-Thai-DRG, and correlation of LOS and Thai-DRG LOS were studied. The results would provide evidence of appropriateness and validity of Viet-DRG compared to Thai-DRG grouping. The strong correlation (Rho=1) indicated that Viet-DRG would be perfectly identical to Thai-DRG. The correlations were calculated after 5-step trimming of individual inpatient data that had been used by Thai-DRG. First, inpatients assigned into MDC26 (mostly ungroupable DRGs) were dropped. Second, cases with total fee lower than 100.000 Vietnam Dong (VND) or higher than 10 million VND of the total cost were dropped. Third, outliers by LOS longer than 365 days were trimmed. Fourth, DRGs with number of patients lower than 9 were excluded. Fifth, cases having different DRGs by Viet-DRG grouper and Thai-DRG grouper were finally excluded because they might be misclassified by Viet-DRG.

Calibration of relative weight of Viet-DRG was as follows. First, the average fee (A, as we assumed that medical fee in Ba Vi hospital proportionately reflected hospital cost because of limitation on costing data) for all trimmed inpatient cases was calculated as a total fee divided by number of cases. After grouping to different DRGs, average fee for each DRG (B) was measured. Finally, the relative weight for each Viet-DRG was calculated as the ratio of two averages (B/A).

## RESULTS

A total of 70,146 insured people were registered in Ba Vi hospital in 2012. There were 12,220 inpatient cases admitted to the hospital from 1 January to 31 December 2012, which accounted for 17.4% admission rate. (The total of 12,220 insured inpatients were among 17,329 inpatients admitted to the hospital in 2012 with both insured, and non-insured, which accounted for 70.5%). Two groups of insurance beneficiaries reported the highest admission rates, e.g. volunteer (group 6) 28.5%, and children under 6 years old (group 4) 25.5% (Table 1).

Female dominated the inpatient populations rather than male (53.9% vs. 46.1%), although it differed by groups. In children (group 4), male accounted for the majority (61.8%), and then the retired (group 2) and students (group 5, both 59.7%), but much less in formal sector (group 1, 10.9%) and volunteer (group 6, 14.9%) (Table 2).

Among inpatients in Ba Vi hospital in 2012, the mean of total fee was 854,414 VND (±6,436). The highest fee was 1,281,592 VND (±17,790) in the retired and the lowest was 459,276 VND (±4,814) in children under 6. The mean of LOS was 6.1 days (±0.04). The longest average LOS was 8.1 days (±0.1) in the retired and the shortest was 4.6 days (±0.09) in the formal sector. Overall average age was 27.9 years old (±0.24), but it varied across the insured groups. Mean age in children under 6 was 2.7 years old (±0.08) and the retired was 65.8 years old (±0.29) (Table 3).

For the first criteria of trimming process, 631 inpatients assigned into MDC26, were dropped. Trimming by the second criteria including the

**TABLE 1.** Admission rates of beneficiaries to Ba Vi hospital by insured group, 2012.

| Insured group | Persons | Number of inpatients | Rate (%) |
|---|---|---|---|
| Group 1 formal sector | 8,583 | 1,429 | 16.6 |
| Group 2 retired | 18,381 | 2,617 | 14.2 |
| Group 3 poor & near poor | 4,367 | 1,007 | 23.1 |
| Group 4 children <6 years | 18,059 | 4,609 | 25,5 |
| Group 5 students | 14,592 | 801 | 5.5 |
| Group 6 volunteer | 6,164 | 1,757 | 28.5 |
| Total | 70,146 | 12,220 | 17.4 |

**TABLE 2.** Distribution of gender by inpatient groups in Ba Vi hospital, 2012.

| Insured group | Number of inpatients | Percent of male (%) |
|---|---|---|
| Group 1 formal sector | 1,429 | 10.9 |
| Group 2 retired | 2,617 | 59.7 |
| Group 3 poor & near poor | 1,007 | 32.9 |
| Group 4 children <6 years | 4,609 | 61.8 |
| Group 5 students | 801 | 59.7 |
| Group 6 volunteer | 1,757 | 14.9 |
| Total | 12,220 | 46.1 |

**TABLE 3.** Total fee, relative weight, length of stay and age by insured group.

| Insured group | Total fee | | | RW | LOS | | Age | |
|---|---|---|---|---|---|---|---|---|
| | Mean | Median | S.D. | | Mean | S.D. | Mean | S.D. |
| Group 1 | 985,804.5 | 876,000 | 15,627.32 | 1.15 | 4.6 | 0.09 | 30.4 | 0.24 |
| Group 2 | 1,281,592.0 | 1,060,869 | 17,790.34 | 1.50 | 8.1 | 0.10 | 65.8 | 0.29 |
| Group 3 | 1,041,422.0 | 876,000 | 22,998.83 | 1.22 | 6.1 | 0.13 | 38.9 | 0.65 |
| Group 4 | 459,275.6 | 382,855 | 4,814.47 | 0.54 | 5.6 | 0.05 | 2.7 | 0.08 |
| Group 5 | 818,224.2 | 668,284 | 23,987.11 | 0.96 | 5.9 | 0.12 | 11.8 | 0.20 |
| Group 6 | 1,057,139.0 | 876,000 | 16,020.96 | 1.24 | 5.4 | 0.09 | 36.9 | 0.38 |
| Total | 854,414.3 | 805,408 | 6,435.57 | 1.00 | 6.1 | 0.04 | 27.9 | 0.24 |

*Note: Group 1: formal sector (government and private sector), Group 2: retired, Group 3: children <6 years old, Group 4: poor and near poor, Group 5: students, Group 6: volunteer*

cases with total fee lower than 100,000 VND or higher than 10 million VND of the total cost, 334 additional inpatients were not included in the next step. The third step found no inpatient cases with LOS more than 365 days in the dataset. Besides, 130 inpatients were found to be same day cases, with the same admission and discharge date. In this case, all of them were included in the final dataset because information was not available to determine the duration of admission in hours with a cut off at 6 hours (Thai-DRG version 5 requires time of admission and discharge to determine hours of hospitalization in same day cases). The fourth step was to exclude DRGs with fewer than 10 cases to increase stability of RW calibration, so 459 cases were further dropped. Therefore, final cases for grouping were 10,818 inpatients with a remainder of 89 DRGs. The fifth step was to exclude cases assigned to different DRGs by Viet-DRG grouper and Thai-DRG grouper, so 520 cases were further excluded, so the remaining cases for final analysis were 10,298 inpatients with 89 DRGs. Thus, the data analysis was 84.4% of the original data. It indicated the high validity and reality of collected data from Ba Vi hospital (Fig 1).

Among 10,298 cases, the most frequent diseases by ICD10 in Ba Vi hospital, 2012 have been listed in Appendix 1 [single spontaneous delivery (21.2%) and spontaneous vertex delivery (17.3%), bronchopneumonia, unspecified (13.1%) and unspecified arthropod-borne viral fever (9.2%)]. In addition, the three most common DRGs in Ba Vi hospital, in 2012 have been listed in Appendix 2 in which vaginal delivery without complicating Dx (16.7%), respiratory infection or inflammation, no CC (13.7%) and otitis media and URI, no CC (8.6%) were the most frequent.

The relevance of Viet DRG grouper v1.0 software with Thai DRG grouper v5.0 was measured with their correlations in terms of LOS and relative weight (RW). The means of Viet LOS was 6.28 (95% confidence interval 6.23-6.33) days and of Viet RW was 1.00 (95% CI 0.99-1.01) while means of Thai LOS was 2.78 (95% CI 2.76-2.79) days and of Thai RW was 0.425 (95% CI 0.421-0.428).

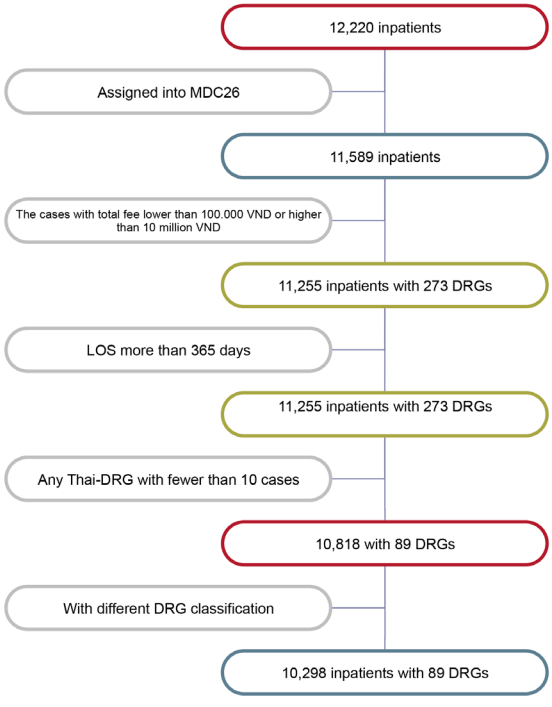


**Fig 1.** Flow chart of trimming and exclusion criteria

In order to measure the correlation between Viet RW and Thai RW, the scatter plot was done and the results indicated that two were significantly correlated with rho equal to 0.49 ($p<0.01$) (Fig 2).

Meanwhile, the correlation between Viet LOS and Thai LOS generated by the scatter plot indicated that the Viet LOS and Thai LOS were significantly correlated with rho equal to 0.45 ($p<0.01$) (Fig 3).

## DISCUSSION

Similar to another study,7 DRG grouping in this study was carried out based on both medical records and database information. The most frequent errors in the data base for the DRG grouping variables were principal diagnosis, secondary diagnosis, complications, procedures, age and discharge status of death and length of stay.[7] Besides, other factors associated with data quality are roles of key hospital staff and other related internal dynamics in hospitals.[8] This

**Appendix 1.** Percentage of 20 most common diseases in Ba Vi hospital, 2012 (n=10,298).

| Diseases | ICD-10 WHO 2012 | Number of inpatients | Percent |
|---|---|---|---|
| Single spontaneous delivery | O80 | 2180 | 21.2% |
| Spontaneous vertex delivery | O800 | 1780 | 17.3% |
| Delivery by elective Caesarean section | O820 | 425 | 4.1% |
| Single delivery by Caesarean section | O82 | 310 | 3.0% |
| Dyspepsia | K30 | 434 | 4.2% |
| Predominantly allergic asthma | J450 | 182 | 1.8% |
| Chronic obstructive pulmonary disease with acute lower respiratory infection | J440 | 155 | 1.5% |
| Acute bronchitis due to Mycoplasma pneumoniae | J200 | 321 | 3.1% |
| Bronchopneumonia, unspecified | J180 | 1348 | 13.1% |
| Pneumonia, organism unspecified | J18 | 230 | 2.2% |
| Acute laryngopharyngitis | J060 | 265 | 2.6% |
| Stroke, not specified as haemorrhage or infarction | I64 | 188 | 1.8% |
| Essential (primary) hypertension | I10 | 313 | 3.0% |
| Menieres disease | H810 | 263 | 2.6% |
| Acute suppurative otitis media | H660 | 165 | 1.6% |
| Mucopurulent conjunctivitis | H100 | 206 | 2.0% |
| Mumps orchitis (N51.1*) | B260 | 183 | 1.8% |
| Mumps | B26 | 196 | 1.9% |
| Unspecified arthropod-borne viral fever | A94 | 948 | 9.2% |
| Diarrhoea and gastroenteritis of presumed infectious origin | A09 | 453 | 4.4% |

**Appendix 2.** List of 20 most common DRG with 3 digits coded into 4 digit codes in Ba Vi hospital, 2012.

| DRG | DRG code | Number of inpatients | Percent |
|---|---|---|---|
| Vaginal delivery wo complicating Dx | 14500 | 1721 | 16.7% |
| Respiratory infection/inflammation, no CC | 04520 | 1409 | 13.7% |
| Otitis media and URI, no CC | 03530 | 888 | 8.6% |
| Viral illness except dengue, child, no CC | 18610 | 616 | 6.0% |
| Bronchitis and asthma, no CC | 04590 | 448 | 4.4% |
| Gastroenteritis age <10, no CC | 06580 | 281 | 2.7% |
| Other digestive system diagnoses, not transferred, no CC | 06600 | 274 | 2.7% |
| Other disorders of the eye, no CC | 02540 | 268 | 2.6% |
| Dysequilibrium, no CC | 03510 | 254 | 2.5% |
| Minor skin disorders, no CC | 09530 | 249 | 2.4% |
| Oesophagitis, gastritis and dyspepsia age <10, no CC | 06650 | 223 | 2.2% |
| Hypertension, no CC | 05600 | 221 | 2.1% |
| Tendonitis, myositis and bursitis, no CC | 08610 | 194 | 1.9% |
| Inflammation of the male reproductive system, no CC | 12520 | 194 | 1.9% |
| G.I.hemorrhage, age <65, no CC | 06520 | 156 | 1.5% |
| Chronic obstructive pulmonary disease, no CC | 04550 | 145 | 1.4% |
| Moderate skin disorders, no CC | 09520 | 142 | 1.4% |
| Dental & oral disorders, no CC | 03570 | 129 | 1.3% |
| Medical back problems, no CC | 08570 | 123 | 1.2% |
| Viral illness except dengue, adult, no CC | 18600 | 121 | 1.2% |

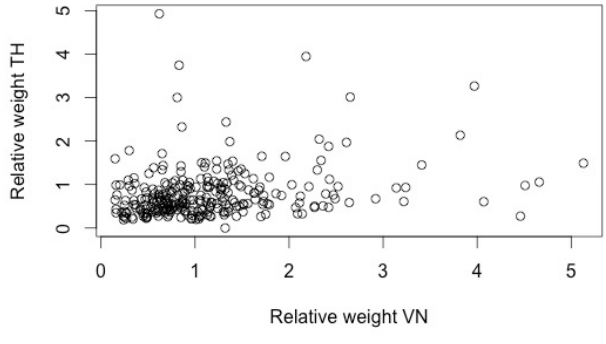


**Fig 2.** Scatter plot of Viet RW and Thai RW (n=10,298)

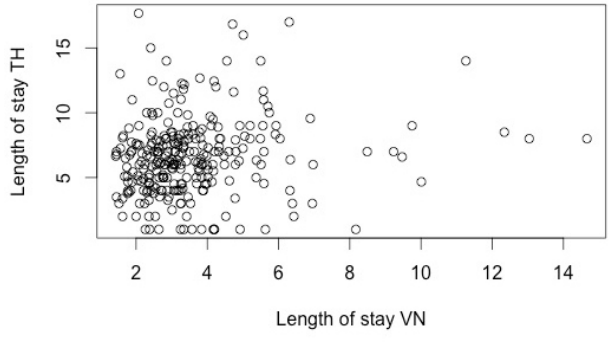


**Fig 3.** Scatter plot of Viet LOS and Thai LOS (n=10,298)

problem was also found in another research since the healthcare providers were often incapable of producing high quality DRG codes, especially in resource-limited settings.[9] This suggested an alternative that an internet technology application with available and easy accessible software may be a platform to achieve quality of data as a basis for DRG development.[10]

Main causes for incorrect grouping observed in research in Germany in 2001 included incomplete mapping, not enough reference to multi-disciplinary treatments, and system construction problems.[11] In addition, other factors associated with the difference of DRG groupers would be the level of medical complexity that differed across the countries.[11] The distinction of DRG systems are also from the classification of patients who had similar clinical characteristics and comparable costs such as Europe versus United State Medicare DRG systems.[12] Besides, the DRG systems also varied due to certain requirements in terms of coding standardization, data availability and health information system in each country.[13]

For this adoption phase of DRG development in Vietnam, 2011 inpatient data of Ba Vi hospital was used. Among 12,220 insured population, three main groups with highest hospital admission rates were voluntary insured group, children <6 years old and the poor and near poor, but the lowest rate was found among students which absolutely reflected the high adverse selection in voluntary insurance group.

The study faced various levels of challenges in the adoption phase. The reasons why Thai-DRG was selected were contextual and technical challenges. Thai-DRGs since version 3 were adapted from the Australian Refined-DRG; which need as many diagnoses data as possible to classify into different severity DRGs (different levels of comorbidities and complications). The fifth version is more advanced that requires time of admission and discharge to determine hours of hospitalization for same day cases. Data from Ba Vi hospital could not identify the duration for same day cases, so retaining these cases in the comparison might distort the DRG classification and correlation statistics. More important, data from a district hospital like Ba Vi hospital often lacked detailed information regarding principal diagnosis and secondary diagnoses, age, admission weight for neonate, etcetera. that may lead to bias in DRG classification. This led to a 5% drop of cases to ungroupable DRGs (MDC26) and assignment to 273 DRGs as compared to 2,450 DRGs of Thai-DRG version 5. Since the data for the present study were from only one secondary care hospital (Ba Vi hospital), it represented only 11% of the possible 2,450 groups of Thai-DRG grouper. Before Vietnam could reach the stage of pooling electronic data from all hospital levels, crucial findings from the present study will facilitate faster moving into better quality data at data entry point and grouper development. As examples, only 3 digit-ICD10 data for diagnosis and local code for procedure data from Ba Vi hospital required data modification step to make DRG grouping feasible, such as, single spontaneous (O80) was modified to the spontaneous vertex delivery (O800). However, single delivery by caesarean section (O82) mapped into the delivery by elective caesarean section (O820), but was not categorized to caesarean section DRG because of problems of procedure code and Viet-DRG grouper engine.

Apart from the above-mentioned contextual and technical challenges, the cost of reliance on any well-developed DRG grouper is foreseeable. This study based self-reliance on developing own Viet-DRG grouper on the logic of Thai-DRG, and the study also attempted the calibration of Vietnam relative weight based on charges of 12,220 cases. The case mix index based on the Viet-RW showed internal validity where children had the lowest and the retired had the highest severity by the average RW. However, the average lengths of stay by insurance groups did not reflect the severity of insurance group by the average RW.

Comparing the results of Viet-DRG grouper with Thai-DRG grouper, about 84.4% of original data remained in the study after 5-step trimming process that illustrated the accuracy and relevance of collected data for DRG grouping. In addition, the data was not categorized with surgical admissions versus emergency cases or frequency of admission that might distort the DRG grouping consequences. In this study, correlations between Viet and Thai-DRG grouper were 0.49 and 0.45 for RW and LOS respectively; these correlations were at moderate level, despite a highly significant level ($p<0.01$). The lower correlation for Viet-LOS and Thai-LOS was consistent with the inconsistency between Viet-RW and LOS as discussed in the previous paragraph. At the beginning of Viet-DRG development, the validity of Viet-DRG grouper version 1.0 remained low in comparison with Thai-DRG version 5 due to limitations of sample size and data representation. Besides, a large number of DRGs were removed from final data analysis due to lack of data quality assurance or categorized as outliers. Therefore, it is suggested to take into account more data from all representative regions at national scale aimed to achieve comprehensive DRGs in Vietnam.

In fact, the DRG system in each country will vary according to its different needs and context. For instance, European DRG systems are very heterogeneous due to the different designs of the main building blocks, even if the DRG

grouping approach was similar across countries.[2] In completion of Viet DRG grouper in comparison to Thai DRG grouper v5.0 required a larger dataset aimed to generate the strong correlation between two groupers. Data from one district hospital was not able to represent for all types of DRGs in the country. Data from different hospital levels as well as regional aspects will be useful sources to adjust the Viet DRG grouper and extent its application in various circumstances and possible adaptation.

## CONCLUSION

The 2012 data from one pilot Ba Vi hospital, which underwent 5-step trimming criteria was 84.4%, was highly valid for DRG grouping. The four most frequent diseases were single spontaneous delivery (O80), spontaneous vertex delivery (O800), bronchopneumonia, unspecified (J180) and unspecified arthropod-borne viral fever (A94). Three most common DRGs in Ba Vi hospital were vaginal delivery without complicating Dx (14500), respiratory infection or inflammation, no CC (04520) and otitis media and URI, no CC (03530). The Health Information System in hospitals should be improved to classify by the 4 digit code of diseases instead of 3 digit code applying at district hospital currently. The study provided significant evidence that Viet DRG grouper v1.0 and Thai DRG grouper v5.0 software were positively correlated at moderate level. The application of Thai DRG grouper v5.0 is appropriate to measure LOS and RW aimed to group the diseases into different DRGs in Vietnam context. In other words, Viet DRG grouper v1.0 likely will play a crucial role to extend the use of disease grouping to another level in which Thai DRG grouper v5.0 is recommended as a base to develop DRG system in Vietnam. The adjustment of Viet DRGs in order to improve the correlation of two groupers requires additional data inputs from various Vietnam healthcare provider levels.

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