

## Comparative Analysis of Actual Cost and INA CBG Rate in Diabetic Gangrene Inpatients

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### Abstract

**Background:** Diabetic gangrene is a complication of diabetes mellitus that imposes a substantial financial burden on patients and their families as well as the health care system. **Objective:** To determine the total cost of disease, and the difference between real cost and INA CBG rate for diabetic gangrene inpatients from January - December 2017 at Universitas Airlangga Hospital, Surabaya **Methods:** The study was conducted retrospectively by using a total sampling method. The perspective used was the hospital perspective. This study's direct medical costs were laboratory, drug and consumable medical device costs, medical equipment rental, radiology examination, red cross, oxygen, service, and room costs. Data analysis was performed using an independent samples *t*-test. **Results:** The results showed that 148 patients met the inclusion criteria. The total real cost of diabetic gangrene inpatients at Universitas Airlangga Hospital in 2017 was IDR 1,339,949,381, and the total INA CBG rate for inpatients with diabetic gangrene was IDR 1,365,047,500. The difference was ( $p = 0.000$ ) between real cost and INA CBG rate. **Conclusion:** There is a difference between the actual cost and the INA CBG rate for diabetic gangrene inpatients.

**Keywords:** national health insurance, cost analysis, direct cost, diabetic gangrene, diabetes mellitus

### Abstrak

**Pendahuluan:** Gangren diabetik merupakan salah satu komplikasi diabetes melitus yang memberikan beban finansial yang besar bagi pasien dan keluarga serta sistem pelayanan kesehatan. **Tujuan:** mengetahui total biaya penyakit, dan perbedaan antara biaya riil dengan tarif INA CBG pasien gangren diabetik rawat inap periode bulan Januari-Desember 2017 di Rumah Sakit Universitas Airlangga Surabaya. **Metode:** Penelitian dilakukan secara retrospektif dengan cara pengambilan metode *total sampling*. Perspektif menggunakan perspektif rumah sakit. Biaya medis langsung (*direct medical cost*) pada penelitian ini adalah biaya laboratorium, biaya obat dan alat medis habis pakai, biaya persewaan alat medis, biaya pemeriksaan radiologi, biaya PMI, biaya oksigen, biaya jasa pelayanan, dan biaya sewa kamar. Analisis data dilakukan dengan menggunakan uji *independent samples t*-test. **Hasil:** Hasil penelitian menunjukkan terdapat 148 pasien yang memenuhi kriteria inklusi. Total biaya riil pasien gangren diabetik rawat inap di Rumah Sakit Universitas Airlangga Surabaya tahun 2017 adalah Rp 1,339,949,381 dan total tarif INA CBG pasien gangren diabetik rawat inap adalah Rp 1,365,047,500. Diperoleh perbedaan ( $p = 0,000$ ) antara biaya riil dengan tarif INA CBG. **Kesimpulan:** Terdapat perbedaan antara biaya riil dengan tarif INA CBG pasien gangren diabetik rawat inap.

**Kata kunci:** jaminan kesehatan nasional, analisis biaya, biaya langsung, gangren diabetik, diabetes melitus

## INTRODUCTION

Diabetic gangrene is a complication of diabetes. Diabetic gangrene is tissue death or necrosis of the skin and deeper structures, such as muscle, tendon, bone, and joint. Diabetic gangrene occurs in patients, especially in cases of lower limb infection, ulcer formation, and/or tissue damage caused by neuropathy and vascular disease of varying degrees. Diabetic foot condition occurs mainly in patients with the incidence of diabetic ulcer with a long duration and HbA1c value of >7% (Wang *et al.*, 2020).

The total average cost of diabetic gangrene patients in China has increased yearly, especially from 2017 to 2020. In 2014, the total average cost of inpatient care for diabetic ulcer patients was ¥15,535.58. The average total cost of care has been increasing until 2020 as it is recorded that the average total cost is ¥42,040.60. The total cost of treatment and length of treatment increases in relation to amputation ( $P < 0.05$ ) (Lu *et al.*, 2020). In some cases of diabetic gangrene, amputation is performed. Amputation in diabetic patients is 10 to 20 times more frequent than in non-diabetic patients (WHO, 2016). Chun *et al.* (2019) research data shows that the direct cost of amputation in diabetic ulcer patients in Korea increased from \$17,578,520 in 2011 to \$25,254,676 in 2016. The average cost of amputation per diabetic ulcer patient increased from \$6,055 in 2011 to \$7,329 in 2016.

The high cost of treating diabetic gangrene can be burdensome for the sufferers and their families. Therefore, the Indonesian government is setting up comprehensive health insurance known as the National Health Insurance (JKN), and diabetic gangrene is one of the diseases included in health insurance financing.

In the era of national health insurance, the payment of benefits at advanced level referral health facilities is in *Indonesia Case Base Groups* (INA CBG) package. The INA CBG rate has been determined based on the classification of disease diagnoses and procedures/actions associated with treatment cost. The rate is fixed or constant, regardless of the action taken.

The INA CBG rate payment method is prospective. A prospective payment method is a payment method determined and agreed upon before the service is provided. Meanwhile, hospital rate or what is called actual cost, uses a retrospective method. This method is a payment method for health services provided to patients based on each service activity provided. The more the number of service activities provided, the greater the cost to be paid. Some research data with various cases such as coronary heart disease

(Lilissuriani *et al.*, 2017), hemorrhagic stroke (Hudayani, 2016), neonatal (Mufarrihah, 2016), ischemic stroke (Putri, 2016; Muslimah *et al.*, 2017), and so on indicate that there is a difference between actual cost and INA CBG rate. However, this study is different from previous studies because it examines the actual cost and analyzes the difference between actual cost and diabetic gangrene by involving all cases of diabetic gangrene at Universitas Airlangga Hospital.

This research is conducted at Universitas Airlangga Hospital, Surabaya. Universitas Airlangga Hospital Surabaya is a type B hospital, one of the referral hospitals in Surabaya. This hospital has collaborated with Healthcare and Social Security Agency (BPJS Kesehatan) to treat patients with BPJS Health membership. As an Advanced Level Referral Health Facility (FKRTL), Universitas Airlangga Hospital accepts referral patients from health service providers (PPK) 1 and health service providers (PPK) 2, so this hospital treats patients with diabetic gangrene cases with actions and procedures in which the previous health facilities cannot handle (PPK 1 and PPK 2) at great expense.

Based on the background explained above, thus a study was conducted to analyze the average actual cost of diabetic gangrene cases and the difference between the actual cost and INA CBG rate for diabetic gangrene patients hospitalized at Universitas Airlangga Hospital Surabaya using a hospital perspective.

## MATERIALS AND METHODS

The research data was taken from the period of January - December 2017. The samples of this study were inpatients of diabetic gangrene who were JKN participants at Universitas Airlangga Hospital, Surabaya. The inclusion criteria of this study were 1) patients with a diagnosis of diabetic gangrene based on the INA CBG claim with ICD code of 10 E11.52 with a *Non-Insulin Dependent Diabetes Mellitus with Peripheral Circulatory Complications* diagnosis, 2) patients were BPJS Class 1, 2, and 3 participants, 3) complete patient data listed in medical record data, detailed data on inpatient care cost, and claim data from January to December 2017. On the other hand, the exclusion criteria for this study were 1) the patients died, 2) the patients discharged from the hospital by their request.

The sampling technique was carried out using the total sampling method. Data analysis was performed using the independent samples t-test examination.

**RESULTS AND DISCUSSION**

**Patient characteristics**

Based on the from January to December 2017, there were 148 cases of diabetic gangrene inpatients who were JKN participants at Universitas Airlangga Hospital, Surabaya. Table 1 shows the data on the characteristics of diabetic gangrene inpatients.

Patient characteristics data in Table 1 shows that 84 (56.8%) respondents were women. These results were consistent with Fitria *et al.* (2017), indicating that patients who experienced diabetic foot ulcers at Zainal Abidin Hospital and Meuraxa Hospital in Banda Aceh

were primarily women, as many as 31 patients (54.5%). Hormonal changes in menopausal women can increase the risk of diabetes mellitus. The research by Li *et al.* (2019) showed that the incidence of type 2 diabetes mellitus was mostly found in postmenopausal women than in premenopausal women ( $p < 0.01$ ). Research shows that menopause increases the risk of metabolic disease and system function decreases with decreasing levels of estrogen and progesterone. Other risk factors that influence are obesity, hyperlipidemia, and hypertension.

**Table 1.** Characteristics of diabetic gangrene inpatients of JKN participants

| Characteristics of Diabetic Gangrene Patients | Number of Patients<br>(N = 148)<br>n (%) |
|---|--|
| <b>Gender</b>                                 |  |
| - Female                                      | 84 (56.8)                                |
| - Male  | 64 (43.2)                                |
| <b>Age</b>                                    |  |
| - 30 - > 40 years old                         | 1 (0.68)                                 |
| - 40 - > 50 years old                         | 25 (16.89)                               |
| - 50 - > 60 years old                         | 65 (43.92)                               |
| - 60 - > 70 years old                         | 45 (30.40)                               |
| - ≥ 70 years old                              | 12 (8.11)                                |
| <b>Insurance Type</b>                         |  |
| - BPJS Mandiri                                | 146 (95.9)                               |
| - BPJS PBI                                    | 6 (4.1)                                  |
| <b>Treatment Class</b>                        |  |
| - 1   | 45 (30.4)                                |
| - 2   | 34 (23.6)                                |
| - 3   | 68 (45.9)                                |
| <b>Severity Level</b>                         |  |
| - Mild  | 39 (26.35)                               |
| - Moderate                                    | 17 (11.49)                               |
| - Severe                                      | 92 (62.16)                               |
| <b>Returning Condition</b>                    |  |
| - Healed                                      | 4 (2.7)                                  |
| - Control                                     | 140 (94.6)                               |
| - Referred to                                 | 4 (2.7)                                  |

According to the study's findings (Table 1), the age range for most diabetic gangrene patients was between 50 and 60 years old. The research results by Rahmawati & Hargono (2018) showed that the age group of diabetes mellitus patients with neuropathy complications in the range of 50 - 59 years old was the largest age group (52.78%) compared to other age groups. With increasing age, many underlying physiological changes occur. Decreased physiological function with age, such as reduced secretion or insulin resistance, results in suboptimal control of high blood glucose. Uncontrolled sugar levels will lead to long-term chronic complications, one of which is diabetic gangrene.

Data (Table 1) shows that 146 patients (95.9%) were patients who used BPJS Mandiri. BPJS data shows that the most significant composition is BPJS PBI, with 86.4 million people (67%) followed by BPJS Mandiri.

This study shows that the most class of care was in class 3 (Table 1). This research aligns with Rahayuningrum *et al.* (2017) that the care for JKN participants is mostly in grade 3.

Based on Table 1, it can be seen that the most severe level was severe level with a total of 92 patients (62.16%). These results indicate that the Airlangga University Hospital Surabaya as a FKRTL treats more patients with severe severity.

Based on data on the condition of the patients with diabetic gangrene, it is divided into three, namely recovery, control, and referral. The data show that the control condition was the most discharged condition with 140 patients (94.6%) followed by a cured condition and four patients (2.7%) each referred condition. Control discharge condition is when the patients are required to return to health control through outpatient care. Control conditions are needed to determine clinical improvement, especially in areas infected with diabetic gangrene.

**Secondary diagnosis and action**

According to INA CBG claim data, there were 12 types of secondary diagnoses from January to December

2017 (Table 2). A secondary diagnosis is a diagnosis that accompanies the primary diagnosis at the time of admission or occurs during an episode of care. Secondary diagnosis represents comorbidities and/or complications (Kementerian Kesehatan RI, 2016).

Based on Table 2, the most secondary diagnosis in diabetic gangrene patients was sepsis, with a total of 89 patients (39%). This result is in line with the research of Fortuna (2016), showing that the most complication in diabetes patients with ulcers/gangrene is sepsis (38.30%).

**Table 2.** Distribution of secondary diagnosis of diabetic gangrene inpatients of JKN participants

| Secondary distribution   | Number of Patients<br>(N = 148)<br>n (%) |
|--|--|
| <i>Anaemia, unspecified</i>  | 3 (1.3)                                  |
| <i>Congenital mitral insufficiency</i>                             | 1 (0.4)                                  |
| <i>Disorders of magnesium metabolism</i>                           | 1 (0.4)                                  |
| <i>Hyperkalaemia</i>   | 2 (0.9)                                  |
| <i>Hypertensive heart disease with congestive heart failure</i>    | 1 (0.4)                                  |
| <i>Hypertensive heart disease without congestive heart failure</i> | 1 (0.4)                                  |
| <i>Hypo-osmolality and hyponatraemia</i>                           | 6 (2.7)                                  |
| <i>Hypokalaemia</i>  | 2 (0.9)                                  |
| <i>Mild protein-energy malnutrition</i>                            | 1 (0.4)                                  |
| <i>Pleural effusion, not elsewhere classified</i>                  | 1 (0.4)                                  |
| <i>Septicemia, unspecified</i>                                     | 89 (39.4)                                |
| <i>Tb lung without mention of bact or histological confirm</i>     | 1 (0.4)                                  |
| <i>No Secondary Diagnosis</i>                                      | 39 (17.3)                                |

Based on Table 3, there were eight types of actions carried out in treating diabetic gangrene patients in the period of January - December 2017. The least number of activities was no action, with the highest number of 54 patients, followed by non-excisional debridement of

wound, infection, or burn action. Nonexcisional debridement of wound, infection, or burn action is surgical intervention. Surgical operations of the skin and subcutaneous tissue excise and remove necrotic lesions of skin and subcutaneous tissue.

**Table 3.** Distribution of actions for diabetic gangrene inpatients of JKN participants

| Actions  | Number of Patients (N = 148) n (%) |
|--|------------------------------------|
| <i>Amputation above knee</i>   | 1 (0.4)                            |
| <i>Amputation of toe</i>   | 18 (8.0)                           |
| <i>Excisional debridement of wound, infection, or burn</i>           | 1 (0.4)                            |
| <i>Nonexcisional debridement of wound, infection, or burn</i>        | 52 (23.0)                          |
| <i>Other amputation below the knee</i>                               | 4 (1.8)                            |
| <i>Other incisions with drainage of skin and subcutaneous tissue</i> | 17 (7.5)                           |
| <i>Other skin graft to other sites</i>                               | 1 (0.4)                            |
| <i>No Action</i>   | 54 (23.9)                          |

According to research at Semarang Hospital (Pemayun & Naibaho, 2017), debridement (44%) and abscess incision or drainage (31%) are most often performed primarily in patients with grades 3 and 4 based on the Wagner classification. Diagnostic data and  
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data on actions and procedures obtained from medical record data files affect the grouper results in the INA CBG application.

This period was obtained based on Table 4, 10 kinds of INA CBG codes in diabetic gangrene patients. The

most diabetic gangrene patients were in the code group of I-4-15-III, namely blood vessel disease and others, with a total of 78 patients (52.7%). The main diagnosis in this code is *Non-Insulin Dependent Diabetes Mellitus with Peripheral Circulatory Complications* with the

second most frequent diagnosis was *septicemia, unspecified*, namely as many as 73 (94.80%) patients from 78 patients. The most frequent action in this code was *Nonexcisional debridement of wound, infection, or burn* action with a total of 35 patients (44.87%).

**Table 4.** Distribution of INA CBG codes for diabetic gangrene inpatients of JKN participants

| INA CBG Code | Description                             | Total (N = 148) n (%) |
|--------------|---|-----------------------|
| I-4-15-I     | Vascular Diseases and Others (Mild)     | 29 (19.6)             |
| I-4-15-II    | Vascular Diseases and Others (Moderate) | 15 (10.1)             |
| I-4-15-III   | Vascular Diseases and Others (Severe)   | 78 (52.7)             |
| L-1-30-I     | Skin Transfer Without Burns (Mild)      | 1 (0.7)               |
| M-1-02-I     | Amputation (Mild)                       | 1 (0.7)               |
| M-1-02-III   | Amputation (Severe)                     | 4 (2.7)               |
| M-1-30-I     | Foot Procedure (Mild)                   | 8 (5.4)               |
| M-1-30-II    | Foot Procedure (Moderate)               | 1 (0.7)               |
| I-4-15-I     | Foot Procedure (Severe)                 | 10 (6.8)              |
| I-4-15-II    | Soft Tissue Procedure (Moderate)        | 1 (0.7)               |

**INA CBG rate and the actual cost of diabetic gangrene patients**

INA CBG rate is a package rate that covers all components of hospital resources used in both medical and non-medical services (Kementerian Kesehatan RI, 2016). INA CBG rate in diabetic gangrene patients is varied. The highest INA CBG rate is at code of M-1-02-

III class 1, namely amputation with a severe severity of IDR 34,942,100. Research data from Ozan *et al.* (2019) show that the incidence of amputation occurs due to the influence of risk factors such as age, Wagner’s classification, long duration of diabetes mellitus, long duration of having diabetic ulcer, and level of C-reactive protein.

**Table 5.** INA CBG rate for diabetic gangrene inpatients of JKN participants

| INA CBG Grouping | Class | Number of Patients (N = 148) | INA CBG Rate (IDR)     |
|------------------|-------|------------------------------|------------------------|
| I-4-15-I         | 1     | 9                            | 6,092,500              |
|                  | 2     | 5                            | 5,222,100              |
|                  | 3     | 15                           | 4,351,800              |
| I-4-15-II        | 1     | 3                            | 8,288,400              |
|                  | 2     | 7                            | 7,104,400              |
|                  | 3     | 5                            | 5,920,300              |
| I-4-15-III       | 1     | 29                           | 9,946,100              |
|                  | 2     | 15                           | 8,525,200              |
|                  | 3     | 34                           | 7,104,400              |
| L-1-30-I         | 1     | 1                            | 12,074,600             |
| M-1-02-I         | 2     | 1                            | 18,173,700             |
| M-1-02-III       | 1     | 1                            | 34,942,100             |
|                  | 3     | 3                            | 24,958,600             |
| M-1-30-I         | 1     | 2                            | 11,879,900             |
|                  | 2     | 6                            | 10,182,800             |
| M-1-30-II        | 3     | 1                            | 13,750,200             |
| M-1-30-III       | 1     | 1                            | 27,526,100             |
|                  | 2     | 2                            | 23,593,800             |
|                  | 3     | 7                            | 19,661,500             |
| M-1-50-II        | 3     | 1                            | 8,590,000              |
| <b>Total</b>     |       | <b>148</b>                   | <b>1,365,047,500 *</b> |

Note: \*: Total of INA CBG rates from 148 patients

Based on Table 5, the total INA CBG rate was IDR 1,365,047,500 with an average of 9,233,293.92 ± 5,108,117,888. The actual cost of diabetic gangrene patients for January - December 2017 varied from the P-ISSN: 2406-9388 E-ISSN: 2580-8303

smallest IDR 1,377,796 and the highest IDR 28,670,452. Real cost under IDR 5,000,000 was occupied by 37 patients, and then 67 patients ranged from IDR 6,000,000 to IDR 10,000,000.00. In the range

of IDR 11,000,000 - IDR 15,000,000.00, there were 31 patients, and in the range of IDR 16,000,000 - IDR 20,000,000.00 was with 8 patients and the remaining 5 patients were at cost above IDR 20,000,000.00.

The research data from Tables 5 and 6 show nine groups of INA CBG rates based on treatment class in which the average actual cost was greater than the INA CBG rate. Moreover, 11 code groups with a lower average actual cost than the INA CBG rate were obtained.

The code L-1-30-I shows a big difference between actual cost and INA CBG rate based on these data. The real cost is 21,750,822.00 while the INA CBG rate is 12,074,600.00. The research data showed that the code L-1-30-I contained one patient without a secondary diagnosis with other skin graft to other sites procedures with four days of treatment. According to ICD-9-CM other skin grafts to other sites include skin and subcutaneous tissue operations, including skin excision for autogenous grafts. Research data Santema *et.al.* (2017) showed an increase in the healing rate of foot ulcers in diabetic patients compared to standard care (Risk Ratio (RR) 1.55, Confidence Interval (CI) 1.30 to 1.85). However, the study states that cost-effectiveness is uncertain. As is the case in the study, although the

treatment duration is according to the standard, the cost of skin grafts is quite high.

Table 6 shows actual cost variations in one code that contains three different types of classes. Code I-4-15-III indicates that a high actual cost does not always accompany high class. The actual cost of class 1 is higher than that of class 2 and class 3. However, the actual cost of class 2 is lower than class 3. The results show that the highest number of secondary diagnoses in code I-4-15-III is Septicemia, Unspecified with 73 of 78 patients (93.58%), accompanied by the most actions, namely 43 of 78 patients (55.12%). The length of treatment for patients with code I-4-15-III ranged from 1 to 13 days, with the most length of treatment being four days (28.2 %). This situation is a sign of actual cost variation in this code.

Actual cost variations can be reduced by standardizing inputs and processes. Drugs and AMHP are the input standards in question. The Hospital Formulary is created by considering hospital drug procurement standards and prescription writing standards based on procurement acquisition. Clinical practice guidelines and clinical pathways are examples of process standards. The establishment of process standards impacts the decision-making process for sick input standards (Kementerian Kesehatan RI, 2014).

**Table 6.** The average real cost for diabetic gangrene inpatients of JKN participants

| INA CBG Grouping | Class | Total | Average Real Cost (IDR) |
|------------------|-------|-------|-------------------------|
| I-4-15-I         | 1     | 9     | 8,505,972 ± 3,380,116   |
|                  | 2     | 5     | 7,936,194 ± 2,985,572   |
|                  | 3     | 15    | 4,059,528 ± 2,659,078   |
| I-4-15-II        | 1     | 3     | 8,436,399 ± 4,263,234   |
|                  | 2     | 7     | 8,296,446 ± 2,633,580   |
|                  | 3     | 5     | 9,160,104 ± 1,455,251   |
| I-4-15-III       | 1     | 29    | 12,098,043 ± 5,587,691  |
|                  | 2     | 15    | 6,828,472 ± 4,043,572   |
|                  | 3     | 34    | 7,750,157 ± 3,369,101   |
| L-1-30-I         | 1     | 1     | 21,750,822              |
| M-1-02-I         | 2     | 1     | 13,122,850              |
| M-1-02-III       | 1     | 1     | 20,146,329              |
|                  | 3     | 3     | 19,307,217 ± 8,128,131  |
| M-1-30-I         | 1     | 2     | 9,344,510 ± 448,426     |
|                  | 2     | 6     | 11,134,614 ± 1,271,618  |
| M-1-30-II        | 3     | 1     | 6,621,607               |
| M-1-30-III       | 1     | 1     | 8,919,956               |
|                  | 2     | 2     | 11,949,258 ± 2,911,015  |
|                  | 3     | 7     | 11,014,274 ± 2,107,367  |
| M-1-50-II        | 3     | 1     | 7,340,602               |
| Total            |       | 148   | 1,339,949,381 *         |

Note: \*: Total of INA CBG rate from 148 patients

The real cost components consist of laboratory examination cost, radiology examination cost, drug and consumable medical equipment (AMHP) costs, medical equipment rental cost, PMI cost, oxygen cost, medical

service cost, and room rental cost. The real cost components of diabetic gangrene inpatients are shown in Table 7.

**Table 7.** Components of real cost of diabetic gangrene inpatients of JKN participants

| Cost components                    | Total (IDR)   | Percentage | Average (IDR)                |
|------------------------------------|---------------|------------|------------------------------|
| Laboratory Examination Cost        |               |            |                              |
| Clinical Pathology Laboratory Cost | 71,123,700    | 5 - 30     | 500,871.13 ± 358,499.932     |
| PA Laboratory Cost                 | 1,668,000     | 0.12       | 417,000.00 ± 70,800.000      |
| Microbiology Laboratory Cost       | 5,545,000     | 41         | 616,133.33 ± 210,914.390     |
| Parasitology Laboratory Cost       | -             |            | -                            |
| Radiology Examination Cost         | 18,742,000    | 1.39       | 208,244.44 ± 141,068.978     |
| Drug and AMHP Costs                |               |            |                              |
| Drug and AMPHP IRNA Costs          | 162,158,591   | 12.10      | 1,095,666.16 ± 917,526.481   |
| Drug and Surgical AMPHP Costs      | 116,140,585   | 8.66       | 784,733.68 ± 858,167.496     |
| Medical Equipment Rental Cost      | 43,669,567    | 3.25       | 432,371.95 ± 316,988.217     |
| PMI Cost                           | 20,365,000    | 1.51       | 565,694.44 ± 533,206.142     |
| Oxygen Cost                        | 18,645,000    | 1.37       | 810,652.17 ± 514,081.936     |
| Medical Service Cost               | 817,671,353   | 61.02      | 5,524,806.44 ± 3,529,927.843 |
| Room Rental Cost                   | 184,800,000   | 13.79      | 1,248,648 ± 852,785.471      |
|                                    | 1,339,949,381 |            | 9,053,712.03 ± 4,825,753.168 |

Based on Table 7, the most significant component that made up the real cost component was the cost component for medical services with an average cost of 5,524,806.44 ± 3,529,927,843 for a total of IDR 817,671,353 (61.02%). Mufarrihah (2016) research on the neonatal case at Dr Sardjito Yogyakarta shows that the most significant cost component is the cost of medical services with the cost of examining doctor,

consultant, and visite with 27.3% of the total cost of patient care and cost of action or procedures of 17.27%.

Comparing the actual total cost and the total INA CBG rate in diabetic gangrene patients showed a p-value of 0.000 (Table 8). This result illustrates a statistically significant difference between actual cost and the INA CBG rate.

**Table 8.** Difference between real cost and INA CBG rate for diabetic gangrene inpatients of JKN participants

| Total Real Cost (IDR) | Total INA CBG Rate (IDR) | p*    |
|-----------------------|--------------------------|-------|
| 1,339,949,381         | 1,365,047,500            | 0.000 |

Note: \* Independent samples t-test

Normality test, normally distributed data

The total actual cost was IDR 1,339,949,381, and the total INA CBG rate was IDR 1,365,047,500. Some of the previous studies are researches on inpatients in Solo, Boyolali, and Karanganyar (Rahayuningrum *et al.*, 2016) and ischemic stroke patients at RSUD Dr Soetomo Surabaya (Putri, 2016), showing that the INA CBG rate is higher than the actual cost. Presidential Regulation Number 12 of 2013 concerning Health Insurance as amended by Presidential Regulation Number 111 of 2013 INA CBG rates is reviewed at least every two years. Efforts to review rates aim to make rates more in line with the actual costs of services provided by hospitals (Kementerian Kesehatan RI, 2014). The calculation of the total actual cost is based on the cross-subsidy process in the research year. It is hoped that there will be a tariff review, especially on

codes with a large range of actual cost and INA CBG rate differences.

The results of this study are expected to provide input for more efficient cost control aspects while still providing better service quality. Research It is necessary to take a sample at the research site with a larger number of samples so that it is expected to obtain more varied data on codes and classes regarding the cost analysis of inpatient diabetic gangrene.

**CONCLUSION**

The results showed that the cost of medical services was the highest actual cost component for diabetic gangrene inpatients in Universitas Airlangga Hospital in 2017. The cost comparison results show that there was a difference between the actual cost and the INA CBG rate

for inpatients with diabetic gangrene in Universitas Airlangga Hospital in 2017.

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