ABSTRACT

Objective: The purpose of this study was to compare the cost-effectiveness of T2DM patients in community health centers (Puskesmas) of Rancaekek, Linggar, and Nanjungmekar. The medicine was a combination of metformin and glimepiride; the outcome parameter was fasting glucose level, cost components were fee of BPS class III and transportation cost with the patient's perspective. Pharmacoeconomic method was cost-effectiveness analysis. Respondents were given counseling about the importance of medicine consumption.

Results: There were 60 respondents, which met the inclusion criteria, then grouped by gender (male (15%) and female (85%)) and age (the highest incidence was the range from 56 to 65 y old, 36.67%). The average cost-effectiveness ratio of Prolanis in the Puskesmas of Rancaekek, Linggar, and Nanjungmekar was 1,073, 956 and 1,885 IDR per decreased glucose level, respectively. The statistical analysis of decreased blood glucose was 0.341 and the Prolanis cost was 0.399, which no difference between decreased blood glucose and Prolanis costs in the three Puskesmas.

Conclusions: The Prolanis of Linggar Puskesmas was the most cost-effective compared to the Rancaekek and Nanjungmekar Puskesmas.

Keywords: Puskesmas, Fasting glucose level, Cost component, Pharmacoeconomic analysis

INTRODUCTION

Diabetes is associated with a significant clinical and economic burden in the world, including Indonesia. The global projection for diabetes was 438 million in 2025 [1]. Diabetes mellitus (DM) is a clinical syndrome with signs of hyperglycemia due to absolute and relative insulin deficiency. Deficiency of insulin, which release by pancreas β-cells, significantly interferes with carbohydrate, protein, and fat metabolism [2, 3]. Blood glucose levels are regulated by insulin as the main regulator of metabolic intermediaries [2]. Type 2 diabetes (T2DM), known as adult-onset diabetes, is characterized by high blood glucose levels, insulin resistance, and a relative lack of insulin [3].

The community health center (Puskesmas) is a health service facility, which organizes first-level public and private health efforts, with preventive and promotive priorities to achieve the highest degree of public health. The Health Social Security Administering Agency (Badan Penyelenggara Jaminan Sosial, BPS) implements a Disease Management Program (Program Pengelolaan Penyakit Kronis, Prolanis) to control T2DM. The Prolanis goal is to encourage diabetes patients to achieve optimal quality of life at an effective and rational cost [4]. Regulation No. 40 of 2004 article 24 mandates Health BPS to control of quality and costs, which implemented by Prolanis [5].

The DM economic burden and its impact on a patient’s life can be measured by economic analysis, which calculates the most cost-effective therapeutic option [1]. Pharmacoeconomic study using the Cost-Effectiveness Analysis (CEA) method was conducted to control cost-effectiveness [6, 7]. The purpose of this study was to determine the decreased fasting glucose levels and the cost-effectiveness of T2DM patients in the Puskesmas of Rancaekek, Linggar, and Nanjungmekar. This study compared the implementation of Prolanis in three Puskesmas.

MATERIALS AND METHODS

Subjects

The study was approved by the Health Research Ethics Committee of Dr. Hasan Sadikin Hospital, Indonesia, and was conducted accordingly to an approved method. The patients were undertaken for observation only after their informed consent. This study was a prospective observational study. T2DM patients were enrolled in the study for 3 mo from May to July 2019. The population in this study was 109 patients, but only 60 patients who willing to participating in the study.

The sampling technique was total sampling [8]. This study compared the cost-effectiveness of Prolanis patients in the Rancaekek, Linggar, and Nanjungmekar Puskesmas. The inclusion criteria were:

a. Patients participate in Prolanis activities and check-up routinely.

b. Patients younger than 18 y old.

c. Patients receiving a combination of 500 mg metformin (three tablets per day) and 1 mg glimepiride (one tablet per day) [9].

d. Patients over 18 y old.

The exclusion criteria were:

a. The patient was not a Prolanis participant.

b. The patient less than 18 y old.

c. The T2DM Prolanis participant who did not want to participate in the study.

d. Patients with co-morbid conditions such as hypertension, hypothyroidism, dyslipidemia, coronary artery disease, and myocardial infarction.

Methods

Determination of outcome

The outcome as an indication of medication successful was fasting glucose level for 3 mo.

Determine the cost component

a) Determination of perspective. The perspective of this study was the patient’s perspective.
b) Determination of cost components. The cost components were fee of BPJS class III (25,500 IDR) [10] and transportation cost for every month. Transportation costs were obtained from interviews.

c) Pharmacoeconomic analysis. Cost-effectiveness analysis was evaluated in follow-up cases, which achieved glycemic control, i.e. fasting blood glucose <130 mg/dl [11]. The cost of health interventions was measured in monetary units (Indonesian Rupiah, IDR) and the intervention results were health indicators, both clinical and non-clinical (non-monetary). Data analysis was performed by calculating the Cost-Effectiveness Ratio (CER) with formula 1 and the cost-effectiveness table [12].

\[
CER = \frac{\text{Cost}}{\text{Effectiveness}} = \frac{\text{cost of treatment}}{\text{fasting glucose level}} - (1)
\]

Statistical analysis

Data were presented as the mean±standard deviation (SD). Data were conducted to statistical analysis using the Kolmogorov-Smirnov test, followed by ANOVA for parametric analysis or Kruskal Wallis Test for non-parametric analysis.

RESULTS AND DISCUSSION

The Prolanis goal is to encourage participants with chronic diseases to achieve optimal quality of life with an indicator of 75% of registered participants visiting first-level health facilities having "good" results of specific tests for T2DM and hypertension according to the relevant clinical guidelines to prevent disease complications. The forms of Prolanis implementation include medical or educational consultation activities, home visit, reminder, club activities and health status monitoring [4]. The T2DM patients, which Prolanis participant at Rancaekek, Linggar, and Nanjungmekar Puskesmas were 49, 24, and 36 patients, respectively. Patients who met the inclusion criteria were 20 patients in each Puskesmas, then filled in the informed consent and given counseling about the importance of medicine consumption. The decrease of fasting glucose levels in the three Puskesmas were 49-76 mg/dL, with an average of 43.26 ±22.36 mg/dL (table 2).

| Variable | Puskesmas | Patients | % | Patients | % | Patients | % |
|----------|-----------|----------|---|----------|---|----------|---|
| Gender   |           |          |   |          |   |          |   |
| Male     | 3         | 15       | 4 | 20       | 2 | 10       | 90|
| Female   | 17        | 85       | 16| 80       | 18| 90       |   |
| Age (years) |   |       |   |          |   |          |   |
| <45      | 0         | 0        | 0 | 0        | 0 | 0        | 0 |
| 46-55    | 3         | 15       | 8 | 40       | 10| 50       |   |
| 56-65    | 9         | 45       | 7 | 35       | 6 | 30       |   |
| ≥ 65     | 8         | 40       | 5 | 25       | 4 | 20       |   |

BPJS fee cover health services, medicines, laboratory examinations, and administration. All the Prolanis patients (60 people) were given a combination of 500 mg metformin and 1 mg glimepiride [9, 19]. Metformin belongs to the biguanides group, suppresses hepatic glucose production, increases insulin sensitivity, increases glucose uptake, increases fatty acid oxidation, and decreases glucose absorption [20]. Glimepiride belongs to sulfonylurea group, stimulates the release of insulin from pancreatic β-cells [21]. The decrease of T2DM treatment was assessed by a decreased fasting glucose level. All patients were shown decreased fasting glucose levels, in the range of 21-36 mg/dl, with an average of 29.65±22.86 mg/dl (table 2).

The average decrease in Rancaekek Puskesmas Nanjungmekar was higher than other Puskesmas, with a difference of 5,750±750 and 6,350±900 IDR (table 3). This was because of higher transportation cost, due to the distance between the patient’s home and the Nanjungmekar Puskesmas was in the range of 6 to 8 km. The best CER was the Linggar Puskesmas (table 4). Cost analysis statistically assessed the overall cost in detail based on data with the normality test. The total cost normality test resulted in p value<0.05, which showed a significant difference. The data were not normally distributed and not homogeneous, so it is included in the non-parametric statistical analysis. In the non-parametric analysis, a Kruskal-Wallis test is performed. Asymptotic significance value of 0.339 showed there was no difference between the costs in the three Puskesmas.

| Table 1: Distribution of type 2 diabetes mellitus patients |
|-------------|-------------|-------------|
| Variable    | Rancaekek   | Linggar     | Nanjungmekar |
| Gender      | Patients    | %           | Patients    | %           | Patients    | %           |
| Male        | 3           | 15          | 4           | 20          | 2           | 10          |
| Female      | 17          | 85          | 16          | 80          | 18          | 90          |
| Age (years) | <45         | 0           | 0           | 0           | 0           | 0           |
|            | 46-55       | 3           | 15          | 8           | 40          | 10          |
|            | 56-65       | 9           | 45          | 7           | 35          | 6           |
|            | ≥ 65        | 8           | 40          | 5           | 25          | 4           |

| Table 2: The decreased fasting glucose levels |
|---------------------------------------------|
| Decreased fasting glucose levels (mg/dl) at the puskesmas |
| Rancaekek | Linggar | Nanjungmekar |
|-----------|---------|--------------|
| 32.15±2.603 | 21.35±1.720 | 35.45±2.76 |

The average cost at Puskesmas Nanjungmekar was higher than other Puskesmas, with a difference of 5,750±750 and 6,350±900 IDR (table 3). This was because of higher transportation cost, due to the distance between the patient’s home and the Nanjungmekar Puskesmas was in the range of 6 to 8 km. The best CER was the Linggar Puskesmas (table 4). Cost analysis statistically assessed the overall cost in detail based on data with the normality test. The total cost normality test resulted in p value<0.05, which showed a significant difference. The data were not normally distributed and not homogeneous, so it is included in the non-parametric statistical analysis. In the non-parametric analysis, a Kruskal-Wallis test is performed. Asymptotic significance value of 0.339 showed there was no difference between the costs in the three Puskesmas.
All patients were educated that the T2DM can be maintained compared to the Rancaekek and Nanjungmekar Puskesmas (table 5). Prolanis in the Linggar Puskesmas was the most cost-effective interventions relative to other health interventions [22]. The Prolanis of Linggar Puskesmas was the most cost-effective compared to the Rancaekek and Nanjungmekar Puskesmas (table 5). All patients were educated that the T2DM can be maintained through lifestyle modification, diet control, and control of overweight and obesity. The community education was needed for diabetes control, and disease management was needed to improve the quality of life of T2DM patients. The data of the quality of life of T2DM Prolanis patients who participated in the study could not be processed, because they were only obedient in laboratory examinations and medicines. The patients were not adherent in education, which was observed from the attendance data on Prolanis activities.

Table 3: Patient cost expended

| Average costs (IDR) | Patient cost expended (IDR) at the puskesmas | Nanjungmekar |
|---------------------|---------------------------------------------|--------------|
| BPJS fee            | 25,500                                      | 25,500       |
| Transportation      | 9,000±2,876                                 | 8,400±1,765  |
| Total               | 34,500±3,574                                | 33,900±2,583 |
|                     |                                             | 40,250±4,575 |

The cost-effectiveness table was used to determine health interventions relative to other health interventions [22]. The Prolanis in the Linggar Puskesmas was the most cost-effective compared to the Rancaekek and Nanjungmekar Puskesmas. All patients were educated that the T2DM can be maintained through lifestyle modification, diet control, and control of overweight and obesity. The community education was needed for diabetes control, and disease management was needed to improve the quality of life of T2DM patients. The data of the quality of life of T2DM Prolanis patients who participated in the study could not be processed, because they were only obedient in laboratory examinations and medicines. The patients were not adherent in education, which was observed from the attendance data on Prolanis activities.

Table 4: Calculation of cost-effectiveness ratios

| Prolanis at the puskesmas | Average cost (IDR) | Outcome (mg/dl) | CER |
|---------------------------|--------------------|-----------------|-----|
| Rancaekek                 | 34,500±3,574       | 32.15±26.03     | 1,073±213 |
| Linggar                   | 33,900±2,583       | 21.35±17.20     | 1,587±138 |
| Nanjungmekar              | 40,250±4,575       | 35.45±22.76     | 1,173±187 |

CONCLUSION
The Prolanis of Linggar Puskesmas was the most cost-effective compared to the Rancaekek and Nanjungmekar Puskesmas.

FUNDING
Nil

AUTHORS CONTRIBUTIONS
All the authors contributed equally.

CONFLICT OF INTERESTS
Declared none

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