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10. Cost Effectiveness Analysis of Type-2 Antidiabetic Drugs in PKU Muhammadiyah Yogyakarta Hospital, Indonesia

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File name: Cost Effectiveness Analayis of DM Plagramme.docx

File checked: 2018-09-17

Report generated: 2018-09-17

Cost Effectiveness Analysis of type-2 antidiabetic drugs in PKU Muhammadiyah Yogyakarta Hospital, (opac.say.ac.id) Indonesia

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Abstract

Introduction Diabetes mellitus (DM) still becomes serious problem in the health perspective. the burden-related DM , particularly DM type 2, are increasing annually.

Method We performed the cost-effectiveness analysis of type 2 DM therapy in PKU Muhammadiyah Yogyakarta hospital, (opac.say.ac.id) Indonesia. patients type 2 DM with or without complication were included in this study. (digital.library.adelaide.edu.au) The data were collected (opac.say.ac.id) from hospital database and the cost effectiveness analysis were performed using health care perspective. ICER were calculated using Biguanide as the reference

Results The proportion of male and female population in this study (digital.library.adelaide.edu.au) was considered equal. Most of the (opac.say.ac.id) patiens were at older age (>45 years old). Furthermore, the most expensive treatment for type 2 DM patients was the combination of Sulfonylurea - Biguanide - Inhibitor DPP-IV. Compared to Biguanide, Sulfonylurea, Long acting Insulin – Biguanide, and mixed insulin generated higher effectiveness in the type 2 DM patients without complication.

Conclusion our study showed that Biguanide is the most favorable option for treating type 2 DM patients in the current setting.

Keywords cost effectiveness analysis, diabetes mellitus, Indonesia

Introduction

Diabetes Mellitus (DM) consistently becomes one of the main health issues worldwide. In 2013, about 382 million people living with DM and almost half of it undiagnosed. According to the current and previous trends, it would be about 592 people living with DM in 2035 (1). In Indonesia, there were substantial increase on the proportion of DM patients as the proportion of DM patients in the population were increase from 1.5-2.3% in 80's into 7.5% in the early 2000 (2). In the local setting such as Yogyakarta, the prevalence of DM is included as the fifth highest in the region.

As the consequences of its increase, the health and social-related burden of DM are also become important concern. In addition, since DM patients prone to experience severe prognoses including

microvascular disease (retinopathy and nephropathy) (3), gangrene, or even stroke, an effective management is important to prevent those future diseases. American Diabetes Association (ADA), as one of the international organization which concern on DM managements, provides various recommendation on DM, particularly DM type 2 patient, based on the best and current evidence (3).

With regards to the management of DM type 2 patients, there are high amount of oral antidiabetic drugs available in the market (4). This high amount of options not only improve the quality of DM managements but also could possibly increase the complexity of the managements itself such as medication error and inefficient use of the medicine (4).

Aside from clinical and also social burden generated by DM in the society, the economic burden associated to DM is also increasing (4). This economic burden covers direct medical cost, such as medicine, hospitalization, health professional fee, etc; indirect cost, such as productivity loss; and also intangible cost. This monetary loss generally affects not only patients but also health care providers such as hospitals and primary health care services. Therefore, both clinical and economic decision making are important in the health care (bmcgeriatr.biomedcentral.com) system (5). the decision making skills have to be possessed by not only the government, in terms of (bmcgeriatr.biomedcentral.com) health-related policy making, but also clinician, such as pharmacists, in order to provide a cost-effective medication for patients (6).

The availability of health economic evidence as the driver on the decision making process (bmcgeriatr.biomedcentral.com) is substantial. Therefore, this study explores and evaluate the cost-effectiveness of type 2 DM medication at PKU Muhammadiyah Yogyakarta Hospital.

Methods

Study design

this study evaluate the cost-effectiveness of type 2 DM treatment using information from the hospital database from January to November 2016 and implemented health care provider perspective. the inclusion criteria for this study were patients who were older than 18 years old, obtained the same oral antidiabetic for at least three moths consecutively. Pregnant patients, patients who obtained or regularly used contraception, and Incomplete records were excluded. An ethical clearance was obtained from ethical committee of Universitas Ahmad Dahlan Yogyakarta, Indonesia before the data collection.

Cost and health parameters

The cost-effectiveness evaluation considering monetary and health outcomes parameters in the analysis. in this study, direct medical cost consists of medicine costs (including OAD and medicine for complication treatment), cost for laboratory test and administration (including professional fee for doctors). The cost presented in this study were the average cost required by the patients every month. Furthermore, the health parameters in this study was Random Blood Sugar (RBS) before and each month up to three

months of medication. The threshold for RBS is 140mg/dL according to the PKU Muhammadiyah Yogyakarta hospital guideline.

Data Analysis

Generally, patients were divided into three different categories: type 2 DM without any complication, type 2 DM with hypertension complication and type 2 DM with hyperlipidemia complications. Patient's characteristics, considering age and gender, and drug profile were presented as its proportion. The use of OAD were presented as two different group: single or in combination, while the intensity of its use were also presented by dividing the number of patients whose obtain the prescription and divided by the total patients included in the study. The effectiveness of the treatments was determined if the RBS level at the end of evaluation lies below the recommended threshold.

The Incremental Cost Effectiveness Ratio (ICER) were calculated by dividing the incremental of total cost with the incremental effectiveness between two interventions (7). In this study, we use biguanide as the reference as it is recommended by the guideline as the first line therapy for type 2 DM patients in general (8). This calculation were performed only for the average value. Since the threshold for cost-effectiveness in Indonesia is not available, yet, we describe the ICER generated from this study using their location on the cost effectiveness plane which North East (NE) were considered cost effective, South East (SE) considered cost saving (favorable), South West (SW) considered cost effective, and North West (NW) is cost ineffective (9).

Results

According to the hospital databases, there were 616 type 2 DM patients were treated in the hospital in the (stroke.ahajournals.org) period of January until (www.ukessays.com) November 2016. Furthermore, there 580 were excluded due to inclusion and exclusion criteria, **mainly because patients did not obtain medication** for at least (www.scielo.br) three months consecutively, and finally there 36 patients were included in this study. (www.ukessays.com) This study showed that most of patient who were treated in PKU Muhammadiyah Yogyakarta hospital were type 2 DM patients without any complications (N=19, 52.78%). However, the proportion of (stroke.ahajournals.org) type 2 DM with complication are considerably high as it was almost 50% from the total type 2 DM patients. While mostly patients in without any complication and with hypertension complication groups were female (52.63% and 66.67%), the proportion of **male in the patients with hyperlipidemia group was mostly male (54.54%). Furthermore,** patients in all three (stroke.ahajournals.org) groups of the disease are mostly older than 45 years old (Table 1) with the average age for type 2 DM only, type 2 DM with hypertension, type 2 DM with hyperlipidemia and total population were 51.05 (SD 12.34), 72.33 (SD 10.29), 60.64 (SD 7.62), and 57.53 (SD 13.17) years old, consecutively.

Table 1. patients' characteristics according to its complications

Drug utilization and cost analysis

In order to provide a complete description on how the OAD has been prescribed, we presented the cost information based on the complication groups and the types of OAD that they used (Table 2). Although the patients were divided into (www.scielo.br) three different groups, the OAD that they used were similar which is the combination of Sulfonylurea – Biguanide with 42%, 50% and 44% utility on type 2 DM without complication, type 2 DM with hypertension, and type 2 DM with hypertension and hyperlipidemia complication, respectively.

Type 2 DM with hypertension patients groups spend least money for OAD, followed by type 2 DM without any complication and type 2 DM with hyperlipidemia and hypertension group. Patients using combination of mixed insulin and thiazolidinedione require more money for paying the OAD compared to other treatments especially in type 2 DM without complication and type 2 DM with hypertension and hyperlipidemia. While in the type 2 DM with hypertension group, the most expensive OAD was the combination between long acting insulin and sulfonylurea. In addition, the cost for complication drugs seemingly different between two groups since hypertension complication group spend only one third compared to the total cost for complication in the hypertension with hyperlipidemia group

Table 2. the cost of treatment component for type 2 DM patients

For type 2 DM patients, they generally need a regular checkup for their glucose level, at least monthly. The cost for laboratory check for patients without any complication is lowest, while the laboratory cost for patients with complication of hypertension and hyperlipidemia was the highest since they generally need an additional examination for their lipid level. The registration cost (also include the cost for professional fee for doctors) is generally the same among all patients and it range from IDR67,500 to IDR75,000 depend on the time they register for the treatment.

Cost Effectiveness Analysis

The total of direct medical cost represent the monthly expenses related to type 2 DM treatment every month. According to Table 3, the lowest total cost required by the patients were patients who got biguanide single therapy. This low cost applied for all those three groups. On the other hand, the highest direct medical cost was generated by the combination of mixed insulin-thiazolidinedione, long acting insulin-Sulfonylurea, and Sulfonylurea - Biguanide -Inhibitor DPP-IV at type 2 DM without complication, with hypertension and with hypertension plus hyperlipidemia, respectively.

The effectiveness of the medication was evaluated by measuring the level of (www.scielo.br) RBS and compare it with the standard of 140mg/dL. If the patients showed consecutive higher results during the first (stroke.ahajournals.org) three months of therapy, they were included as failed or not effective. In this study, (www.ukessays.com) the effectiveness of the treatment were substantially low since it were only 42.1%, 0%, and 54% for type 2 DM without complication, with hypertension and with hypertension and hyperlipidemia, respectively.

Table 3. the cost effectiveness analysis of type 2 DM patients

Using biguanide as the reference, the use of another types of antidiabetes generated higher cost and various incremental effectiveness including better than biguanide (sulfonylurea, Long acting Insulin – Biguanide, and mixed insulin for non-complication group), equal effectiveness (sulfonylurea, biguanide combination, and mixed insulin for patients with hypertension and hyperlipidemia complication), and worse effectiveness for the other types of antidiabetic.

In the group of patients without any complication, there were three options, Sulfonylurea, Long acting Insulin – Biguanide, and mixed insulin, which were located in the North East (NE) quadrant, while the other options were located in North-West (NW) quadrant which were considered less favorable than biguanide. Furthermore, in the patients with hypertension complication, all other options were more expensive but the effectiveness are equal to Biguanide. Finally, in the patients with hypertension and hyperlipidemia complication, all of them were more expensive but none of them produced a better effectiveness compared to Biguanide.

Discussion

The cost effectiveness analysis potentially helps decision maker in order to **choose the best medication for patients.** In this study, (www.ukessays.com) we consider not only the clinical aspect, which is effectiveness of the medication, but also the economics, which is also important in the clinical practice. Our study found that monotherapy, particularly biguanide, is still the best option to manage either type

2 DM patients regardless its complications. This finding is equal to current recommendation that Biguanide is the first line therapy for type 2 DM patients (10).

In this study, (www.ukessays.com) there were apparently no differences on patients' gender. Hence, this issue is seemingly debatable as some studies showed that there were (www.ukessays.com) no correlation between gender and type 2 DM while the others showed the opposite way. However, our findings showed comparable results with previous studies in other region of Indonesia. Furthermore, according to ADA, gender is not one of the risk factor of type 2 DM since DM generally linked with genetics, obesity, environmental factors, lifestyle and pregnancy.

Most of the patients obtained Sulfonylurea – Biguanide prescription for their treatment regardless their whether they have complication of hypertension, hyperlipidemia or none of them. This combination possesses a complementary action since sulfonylurea increase the release of insulin while biguanide increase the sensitivity of the body to insulin. Therefore, the reduction of blood glucose level achieved efficiently. This combination has been evidenced as an efficient combination from both trials and clinical practice.

The highest cost mainly generated from the combination use of several types antidiabetic either oral or injection. In this study, we found that the total cost of treatment are mainly driven by the cost of drugs as it is also identified by several studies elsewhere. Therefore, the choice of the drugs has to be considered very well as this treatment could be lifetime. In addition, our study also found that more complication resulted more cost of treatment as it showed in the type 2 DM with complication of hypertension and hyperlipidemia. This finding can be predicted previously as the more complication on a patient, the more treatment that they need to obtain.

Several limitations are identified in this study. First, in this study, the effectiveness indicator was using RBS instead of Haemoglobin A1c (HbA1C) (11). HbA1C occurs when the haemoglobin join with glucose as the result of high glucose level in the blood stream. This parameter showed the severity of diabetes and recently also becomes the indicator whether the DM treatment has achieved. This parameter could not be completely obtained in this study is the record on this examination is mostly incomplete. Furthermore, the cost for this examination is also considerably high.

The direct correlation between treatment and its effectiveness frequently difficult to achieve since there may be some confounding factors, for example adherence, which influence the correlation (12). In this study, we did not evaluate the adherence due to the limitation of the data from hospital database. Adherence could be evaluated using pill count methods or directly ask the patients about the treatment history. Another confounding factor, for example the severity of the disease sometimes influences the treatment outcome significantly. In this study, we could not differentiate the severity of the patients since one of the main indicator to evaluate this issues, which is HbA1c, was lacking.

Perspective in health economic evaluation is important issue. most of the international guideline suggest societal perspective for economic evaluation. This study implemented health care provider perspective due to accessibility issue. Since societal perspective provides comprehensive pictures of health economic aspects in the society, it will help decision maker considering the best option which is available. Indirect

cost, which is usually be considered in this perspective, was not collected in this study due to technical issue.

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