Comparison of Cost Effectiveness Analysis (CEA) for Chronic Disease Management Program (Prolanis) Participants and Non Participants (Non Prolanis) on BPJS Kesehatan Diabetes Patients Year 2014 - 2016

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Abstract: An estimated of 5.1 million people in the world aged between 20 and 79 years die of diabetes mellitus in 2013 and the cost of health services for people with diabetes is 2-3 times higher than those who are not (International Diabetes Federation, 2015). In Indonesia National Health Insurance Program (JKN), diabetes mellitus patients are being managed in a Chronic Disease Management Program called PROLANIS. The purpose of this study is to analyze and compare the cost-effectiveness of diabetes mellitus which are managed with PROLANIS from those which are not (NON PROLANIS). The analysis and comparison run for outpatient, inpatient, emergency, and patients with complication. The calculation of cost effectiveness analysis (CEA) is done through the calculation of ACER and ICER. Research methodologies used are descriptive analysis, Kolmogorov Smirnov's normality test, and Mann Whitney non parametric test. The result shows significant differences between costs and cases that are managed under PROLANIS and NON PROLANIS for outpatient, inpatient, and emergencies, while for patients with complications there is no significant difference of cases. PROLANIS is proven to be more cost-effective in managing diabetes mellitus than NON PROLANIS.

Index Terms: Diabetes Mellitus, Prolanis, Non Prolanis, Cost Effective.

I. INTRODUCTION

Diabetes mellitus disease is a group of metabolic diseases that have characteristics of hyperglycemia (high glucose levels in the blood). Diabetes mellitus is the 6th highest cause of death in the world. An estimated 5.1 million people worldwide aged between 20 and 79 years old die of diabetes mellitus by 2013 and 48% of them are under 60 years old and an estimate of 1 in 11 adults have diabetes (International Diabetes Federation, 2015).

In Indonesia, 10 million Indonesians have diabetes mellitus by 2015 or an increase of 9.8% compared to 2014, making Indonesia the sixth largest number of people with diabetes mellitus in the world. It is estimated that in 2040 the number of people with diabetes mellitus in Indonesia can reach to 16.2 million people [1].

Diabetes mellitus and its complications have created a huge economic burden for individuals, families, and the countries. The cost of healthcare of people with diabetes is 2-3 times than non-diabetic people. Costs incurred for diabetes are 10.8% of the world's health spending in 2013 and spend 11.6% of the world's health costs in 2015. As many as 80% of countries report costs incurred for diabetes are between 5% and 20% of total healthcare spending in their country. (International Diabetes Federation, 2015).

The Health System in Indonesia is managed by BPJS Kesehatan through the National Health Insurance Program (JKN). BPJS Kesehatan data Aplication of Business Intelligence, 2017, shows that the financing to be borne by BPJS Kesehatan for diabetes mellitus and its complications in 2016 amounted to 1.98 trillion rupiahs or an increase of 60.44% from health care costs for diabetes mellitus in 2014.

BPJS Kesehatan manages people with diabetes through the Chronic Disease Management Program (Prolanis) with participation based on willingness, consequently, not all people with diabetes join Prolanis (Non Prolanis). Prolanis for diabetes mellitus aims to improve the quality of life of people with diabetes (diabetics) who have joined the program. In the long term it is expected that Prolanis can control the cost of health services of diabetes mellitus effectively and rationally [2].

Prolanis that have been implemented must be evaluated, one of which with health economic evaluation, that is by comparing cost effectiveness analysis between Prolanis and Non Prolanis. A cost effective comparison is performed using the An Average Cost Effectiveness Ratio (ACER) and Incremental Cost Effectiveness Ratio (ICER). The study was conducted with the following objectives:

1. To know which is more cost effective between Prolanis and Non Prolanis viewed from the value of ACER generated through the comparison of costs in the case of Advanced Outpatient (RJTL)
2. To know which is more cost effective between Prolanis and Non Prolanis viewed from the

value of ACER generated through the comparison of costs in the case of Advanced Inpatient (RITL)

3. To know which is more cost effective between Prolanis and Non Prolanis viewed from the value of ACER generated through the comparison of costs in the case of Emergency (ER)
4. To know which is more cost effective between Prolanis and Non Prolanis viewed from the value of ACER generated through the comparison of costs in the case of Complications
5. To determine the required additional cost per 1 person to achieve the same effectiveness as the programs that are considered more cost effective (ICER) in RJTL, RITL, ER and Complications

The research design is quantitative comparative that is by comparing case average and cost of RJTL, RITL, ER, and Complication between Prolanis and Non Prolanis sample. And then calculate ACER and ICER to know which is more cost effective between Prolanis and Non Prolanis. The sample of Prolanis participants was 164 people and Non Prolanis was 996 people. The results of the study are expected to show significant differences in case average and costs of RJTL, RITL, ER and complications between Prolanis and Non Prolanis, and Prolanis is more cost effective than Non Prolanis.

II. THEORITICAL REVIEW

American Diabetes Association (ADA), 2005, defines diabetes mellitus as a group of metabolic diseases with characteristics of hyperglycemia that occurs due to defects in insulin secretion, insulin action, or both. Hyperglycemia is one of the signs of diabetes mellitus. Hyperglycemia is a condition in which the increase in blood glucose levels exceeds the normal limit.

Diabetes mellitus can cause complications. The chronic complications of diabetes mellitus are rampant throughout the body. In addition to hair loss, ears ringing or deafness, frequent changes of eyeglasses (in a year), cataracts at an early age, and developing glaucoma (elevated eyebrow pressure, and may end with blindness), blindness due to retinopathy, nerve palsy occurs after 10-15 years. Coronary heart attack, nephropathy, paralyzed nerves, or gangrene appears in the legs and feet, as well as stroke. Diabetes Mellitus is a 48.3% cause of Chronic Renal Failure (GGK) which further requires dialysis action. [6][7][8].

Definition from Diseases Management Association of America, 2003, Diseases Management Program (DMP) is a system that combines the management of health services and communication for a group of participants with certain disease conditions through the efforts of handling the disease independently. Another goal of DMP implementation is to reduce the incidence of hospitalization and complications for people with chronic diseases. Good DMP requires the integration of both primary and advanced health care services and the role of health workers (doctors, nurses, nutritionists, etc.).

DMP in Indonesia is organized by BPJS Kesehatan and is known by the name of Chronic Disease Management

Program (Prolanis). Prolanis is defined as a system that combines health and communication service to populations that have conditions in which self-reliance is the main thing. The difference between Prolanis and Non Prolanis is that participants who join Prolanis are managed more comprehensively through routine activities such as education, physical activity, and monitoring the supporting examinations [3][4]. In Prolanis there is also more intensive contact between the doctor and the patient. It is hoped that Prolanis can achieve a more optimal quality of life with health financing that is more rational than Non Prolanis. In other words, Prolanis is expected to be more cost effective than Non Prolanis.

III. RESEARCH METHODOLOGY

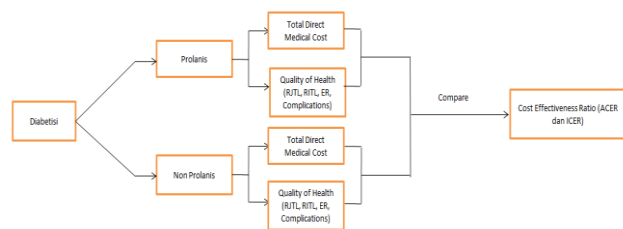Based on literature review and previous research (Drummond, 2005), the research framework can be described as follows:

Fig. 1. Research Framework

Based on the framework can be proposed research hypothesis as follows:

H1	Prolanis is more cost effective than Non Prolanis when calculated using the ACER cost formula in Advanced Outpatient (RJTL)
H2	Prolanis is more cost effective than Non Prolanis when calculated using the ACER cost formula in Advanced Inpatient (RITL)
H3	Prolanis is more cost effective than Non Prolanis when calculated using the ACER cost formula in the case of Emergency (ER)
H4	Prolanis is more cost effective than Non Prolanis when calculated using the ACER cost formula in the case of complications
H5	Prolanis is more cost effective than Non Prolanis where it takes an additional cost for 1 Non-Prolanist participant to achieve the effectiveness as high as ProLine in the cases of RJTL, RITL, ER and Complications

A. Data Analysis Technique

Data were analyzed with descriptive analysis, data feasibility analysis with Kolmogorov - Smirnov normality test, if the data were normally distributed then the next analysis used was independent parametric test samples t-test. However, since the data is not normally distributed, the parametric test changes to Mann Whitneyy Non parametric test[12].

IV. FINDINGS

A. Characteristic Samples

The sample is a participant of

BPJS Health with Diabetes who have joined in Prolanis and not yet joined (Non Prolanis). The method used is Purposive sampling with inclusion criteria of participants who have experienced outpatient, inpatient, emergency and at least 2 time of complication. The number of Prolanis sample is 196 people and Non Prolanis sample is 996 people. Characteristic Samples is describes in the matriks:

Table I. Characteristic Samples Prolanis and Non Prolanis

Keterangan	Prolanis		Non Prolanis		Total	
	Jumlah	%	Jumlah	%	Jumlah	%
Jenis Kelamin						
Laki-laki	76	46.34%	475	47.69%	551	47.50%
Perempuan	88	53.66%	521	52.31%	609	52.50%
Usia						
< 45	2	1.22%	10	1.00%	12	1.03%
45 – 55	23	14.02%	152	15.26%	175	15.09%
≥ 55	139	84.76%	834	83.73%	973	83.88%
Status Pernikahan						
Belum Menikah	6	3.66%	32	3.21%	38	3.28%
Menikah	143	87.20%	858	86.14%	1001	86.29%
Bercerai	15	9.15%	106	10.64%	121	10.43%
Segmen Peserta						
Pekerja Penerima Upah	60	36.59%	350	35.14%	410	35.34%
Bukan Pekerja	104	63.41%	645	64.76%	749	64.57%
Pekerja Bukan Penerima Upah	0	0.00%	1	0.10%	1	0.09%
Kelas Rawat						
1 (satu)	128	78.05%	774	77.71%	902	77.76%
2 (dua)	36	21.95%	222	22.29%	258	22.24%
3 (tiga)	0	0.00%	0	0.00%	0	0.00%

Source: sample data is processed

B. Descriptive Analysis

Prolanis and Non Prolanis sample data processing is done using SPSS version 21, with the following recapitulation:

Table I. Recapitulation Matrix of Statistical Descriptive Results

Variable		Prolanis (n = 164)			Non Prolanis (n = 996)		
		Min.	Max.	Mean	Min.	Max.	Mean
RJTL	Case	1	32	6.65	1	88	8.46
	Cost	144,900	12,270,185	1,501,117.38	135,900	46,394,157	1,732,689.32
RITL	Case	1	7	1.41	1	26	1.75
	Cost	1,573,500	52,015,800	7,550,562.84	1,422,500	206,737,357	10,017,319.18
ER	Case	1	19	1.49	1	31	1.84
	Cost	131,700	14,504,100	466,556.34	129,500	14,786,000	504,057.64
Complications	Case	2	144	16.59	2	289	20.29
	Cost	304,831	292,123,013	27,009,745.64	314,400	539,303,056	34,151,681.77
Total Medical Cost		4,470,772	300,410,788	42,060,754.82	4,369,490	572,187,606	53,777,923.13

Source: sample data is processed

C. Data Feasibility Analysis

From the test result with Kolmogorov Smirnov method that the value of Asymp.Sig. (2-tailed) is less than 0.05 this means that all tested data is not normally distributed so it is not feasible to test Parametrik independent samples t-test so that the test is changed into a Mann Whitneyy Non Parametric test.

D. Uji Non Parametrik Mann Whitneyy

Mann Whitney Non Parametric Test Results as follows:

Table II. Mann Whitney Test recapitulation matrix (Value of Asymp. Sig. (2 tailed))

Variable		Asymp.Sig. (2 tailed)	Interpretation
RJTL	Case	0.033	There are significant differences
	Cost	0.005	There are significant differences
RITL	Case	0.014	There are significant differences
	Cost	0.017	There are significant differences

Variable		Value	Interpretation
ER	Case	0.036	There are significant differences
	Cost	0.012	There are significant differences
Complications	Case	0.233	There are not significant differences
	Cost	0.009	There are significant differences
Total Medical Cost		0.001	There are significant differences

Source: sample data is processed

E. ACER and ICER Calculations

Calculation of Cost Effectiveness Analysis (CEA) is done using the formula of An Average Cost Effectiveness Ratio (ACER) and Incremental Cost Effectiveness Ratio (ICER) with the following results:

Table III. Comparison Matrix of ACER Comparison and ICER Value

Variable	ACER		Interpretation	ICER	Interpretation
	Prolanis	Non Prolanis			
RJTL	6,324,925	6,356,728	ACER Prolanis is lower. Prolanis is more cost effective	127,940.30	It takes Rp 127.940 for Non Prolanis to achieve effectiveness as high as Prolanis
RITL	29,830,322	30,730,241	ACER Prolanis is lower. Prolanis is more cost effective	7,254,636.29	It takes Rp 7,254,636 for Non Prolanis to achieve effectiveness as high as Prolanis
ER	28,228,694	29,227,132	ACER Prolanis is lower. Prolanis is more cost effective	107,146.58	It takes Rp 107,146 for Non Prolanis to achieve effectiveness as high as Prolanis
Complications	2,535,308	2,650,464	ACER Prolanis is lower. Prolanis is more cost effective	1,930,253.00	It takes Rp 1,930,253 for Non Prolanis to achieve effectiveness as high as Prolanis

Source: sample data is processed

F. Discussion

Based on the results of the analysis, the results of research will be discussed and interpreted as follows:

1) Comparison of Average Direct Medical Cost (TBM) to Average Case of RJTL (Hypothesis 1 is accepted)

In the comparison of ACER Cost to RJTL Cases it is found that Prolanis is more cost effective than Non Prolanis shown through ACER Prolanis value is lower than ACER Non Prolanis and the difference is significant in the Mann Whitneyy Non Parametric Test with α 5%.

These results are in line with research conducted by Stock, et. al (2011) in Disease Management Programs can improve quality of care for the chronically ill, even in a weak Primary Care System: a Case Study from Germany, they had conducted a survey using PACIC and EQ-5D instruments that showed that DMP has a positive impact on quality of life (more structured care, reduced costly complications, controlled HbA1C, and integrated health services). The economic evaluation also shows the cost effectiveness through the decreasing of the utilization of the hospital.

The analysis on the cause that Prolanis can be more cost effective, among others is that in Prolanis, first level health service is given more comprehensively. The Prolanis participants are given routine education, health monitoring/supporting laboratory that can be done in the first level and service of referral medicines. This caused Prolanis participants do not have to make frequent visits to RJTL compared to non-Prolanis participants because the first level service was already sufficient. Non-Prolanis participants should visit RJTL regularly to RS to obtain chronic drugs or supporting laboratory services. This is why the number of cases and

costs of Non-Prolanis Participant RJTL is higher than that of Prolanis participants.

Policy of fare system at BPJS Kesehatan for health service insurance is divided into 2 (two), first level and advanced level. At first level service, financing is done through capitation mechanism. Capitation fare, which is the monthly fee paid in advance by BPJS Kesehatan to the First Level Health Facility based on the number of registered participants without taking into account the type and amount of health services provided.

Especially for chronic services and supporting laboratories, in accordance with applicable regulations set a special fare excluding Capitation budget.

While financing at hospital service level, using Indonesian-Case Based Group fare system here in after called INA-CBG Rate is the amount of claim payment by BPJS Kesehatan to FKRTL for service package based on grouping of disease diagnosis and procedure. Advanced financing is more expensive than the first level[11].

2) Comparison of Average Direct Medical Cost (TBM) to Average Case of RITL (Hypothesis 2 is accepted)

In the comparison of ACER Costs to RITL Cases it was found that Prolanis is more cost effective than Non Prolanis shown through the ACER Prolanis value that is lower than ACER Non Prolanis and the difference is significant in the Mann Whitneyy Non Parametric Test with α 5%.

It is because Non-Prolanis participants are more likely to be hospitalized than Prolanis participants. Inpatient Financing due to DM and its Complications is a large financing burden for BPJS Kesehatan as the provider of health insurance for registered participants. BPJS Kesehatan needs to think through and look for appropriate strategies to increase the number of Prolanis membership as well as methods to monitor the health improvement outcomes of participants who have joined Prolanis since the large number of Prolanis participants will be meaningless without the effective health monitoring control for Prolanis registered participants.

The result of this study is in accordance with previous research conducted by Stock, et. al (2010) in the German Diabetes Management Programs Improve Quality Of Care And Curb Costs concluded that Complications of the disease (myocardial infarction, leg amputation, stroke, chronic renal failure) in diabetic patients incorporated in DMP is lower than non-DMP patients. In addition, DMP patients have lower medication and hospital costs, lower length of hospital stay, and lower fares of hospitalization.

3) Comparison of Average Direct Medical Cost (TBM) to Average Case of ER (Hypothesis 3 is accepted)

In the ACER cost comparison to ER Cases it was found that Prolanis was more cost effective than Non Prolanis shown through the lower ACER Prolanis score compared to ACER Non Prolanis and the difference was significant in the Mann Whitneyy Non Parametric Test with α 5%.

It is because the DM that is not well controlled will cause acute complications so that DM participants experience emergency due to illness[10].

Prolanis participants receive comprehensive services at the first level so that it will decrease the incidence of acute complications. Laboratory monitoring is done routinely including monitoring of blood glucose every month, HbA1C every 3-6 months. HbA1C is the best indicator in performing monitoring for people with DM. The UKPDS study results show that a 1% decrease in HbA1C levels decreases the risk of death by 21%, heart attack by 14%, microvascular complications by 37%, and peripheral vascular disorders (amputation) by 43% (UKPDS in Stratton IM, et al 2000).

The results are in line with previous studies conducted by Lorig, et.al (2001) that had conducted a study on the Effect of a Self-Management Program on Patients with Chronic Diseases through a 1-year cohort study. They found that participants experienced improved improvement in health behaviors (sports, cognitive and communication with physicians) as well as improvements in health status (decrease shortness of breath, fatigue, and visits to the emergency room).

4) Comparison of Average Direct Medical Cost (TBM) to Average Case of Complications (Hypothesis 4 is accepted)

In the comparison of ACER Cost to Complication Case it is found that Prolanis is more cost effective than Non Prolanis shown through ACER Prolanis value is lower than ACER Non Prolanis but the difference is not significant in Mann Whitneyy Non Parametric Test with α 5% for Complication cases but significant on cost difference.

DM incidence rate is very difficult to detect because the

general signs and clinical symptoms of DM are not too visible so someone that diagnosed DM often already has some chronic complications. It also happens with Prolanis participants, when registered as Prolanis participants, participants have a history of 1, or more, comorbidities (complications519). If it is not managed properly then complications will be more severe, consequently participants are forced to get hospitalization services due to these complications.

Al Maskari, et. al in 2010 had conducted Assessment of the direct medical costs of diabetes mellitus and its complications in the United Arab Emirates with the results showed that indirect costs continue to increase and are directly proportional to the progression of diabetes and its complications. Integrated disease management is needed to deal with diabetes and its complications in order to save costs in the future.

In Prolanis, health quality management is undertaken to prevent the severity of complications that have been experienced and to reduce the incidence of hospitalization due to these complications, so that although the cases of complications do not have significant differences between Prolanis versus Non Prolanis, but in terms of cost, Prolanis is able to control the expenditure to handle such complications more efficiently[9].

5) Calculation of the additional cost required to achieve higher effectiveness (Hypothesis 5 is accepted)

In the ICER calculation, the number of costs required by Non Prolanis participants to achieve the effectiveness of Prolanis in both RJTL, RITL, ER and Complications cases is acquired. The results are in line with research conducted by Aryani (2016) even though the quality domain used is different. Aryani had conducted research on Cost Effectiveness Analysis (CEA) Prolanis Diabetes Mellitus Type 2 Participant of JKN in Serang city of Banten with PROLANIS result that is more cost effective than Non PROLANIS with ICER value of Rp.625.155, - for every better extra domain of social relation and Rp 969.369, - for every better extra domain environment as well as dominant for cost and quality of life on CE Plane.

V. CONCLUSIONS

Based on the results of research and discussion in the previous chapters can be put forward some conclusions as follows:

1. Prolanis is more cost effective than Non Prolanis when viewed from the value of ACER generated through cost comparison to RJTL cases. A program is said to be more cost effective if it has a smaller ACER value. There were also significant differences in case variables and RJTL costs between Prolanis versus Non Prolanis.

2. Prolanis is more cost effective than Non Prolanis when viewed from the value of ACER generated through cost comparison to RITL cases. A program is said to be more cost effective if it has a smaller ACER value. There were also significant differences in case variables and RITL costs between Prolanis versus Non Prolanis.

3. Prolanis is more cost effective than Non Prolanis when viewed from the value of ACER generated through cost comparison to Emergency cases. A program is said to be more cost effective if it has a smaller ACER value. There were also significant differences in case variables and Emergency costs between Prolanis versus Non Prolanis.

4. Prolanis is more cost effective than Non Prolanis when viewed from the value of ACER generated through cost comparison to complications cases. A program is said to be more cost effective if it has a smaller ACER value. There were also significant differences in case variables and Complications costs between Prolanis versus Non Prolanis, while in case of complications there is no significant difference. This is because the symptoms of a person with diabetes mellitus are often not known before, and only recently diagnosed when the disease has experienced complications to 1 - 2 other diseases.

5. It takes a certain amount of cost per Non Prolanis participant to achieve the same effectiveness as Prolanis which is Rp 127.940 for RJTL case, Rp 7,254,636 for RITL case, Rp 107,146 for ER case and Rp 1,930,253 for complication case.

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