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# Effectiveness of Diabetes Mellitus Type 2 Management in Prolanis Participants at the BPJS Kesehatan Sibolga

**Ester Maria Suzanne Sitompul[1*], Firdaus Hafidz As Shidieq [2]**

[1-2] Gajdah Mada University, *e-mail*: estermsuzannesitompul@mail.ugm.ac.id

**Abstract:** BPJS Kesehatan aims to improve the health of participants suffering from Type 2 DM through the Chronic Disease Management Program "Prolanis" (Program Pengelolaan Penyakit Kronis) strategy implemented at Primary Health Care (PHC). Program success is measured by the outcomes of controlled Fasting Blood Sugar status and the cost-effectiveness of Prolanis. This research was conducted to determine the cost-effectiveness of Prolanis in treating Type 2 DM. Analytical cross-sectional research using secondary data from BPJS Kesehatan in the Sibolga Branch Office work area in 2020-2022 on Type 2 DM participants who took Prolanis and Non-Prolanis. The analysis used univariate, bivariate, multiple logistic regression, and ICER cost analysis. Characteristics of Prolanis participants, age, number of visits, and Body Mass Index showed a significant relationship with the achievement of controlled fasting blood sugar. The average fasting blood sugar of Prolanis and Non-Prolanis participants in 2021-2022 did not significantly differ. Still, the proportion of controlled fasting blood sugar of Prolanis participants was greater than that of Non-Prolanis participants. The total cost of Prolanis in a row for 2020-2022 is IDR 1,437,411,273, IDR 2,706,895,281, and IDR 2,751,510,452. The total cost of Non Prolanis for 2020-2022 is IDR 5,861,773,361; IDR 7,807,455,547,- ; IDR 10,291,812,544,-. The ICER for each controlled fasting blood sugar proportion varies from 2020-2022 IDR 462,489; IDR 201,473; IDR 362,856. Prolanis expenditure at the Sibolga Branch Office is higher, but the clinical effectiveness of the proportion of controlled fasting blood sugar participants is better than that of non-Prolanis participants.

***Keywords:*** Disease Management Program, Prolanis, Fasting Blood Sugar, Cost-effectiveness, Incremental Cost Effectiveness Ratio

## INTRODUCTION

Non-communicable diseases are the world's biggest threat to health and development. There are four (4) major non-communicable diseases: cardiovascular disease, cancer, chronic respiratory disease, and diabetes. These four diseases kill nearly 41 million people globally every year, and more than a third of them are in their productive years. Globally, it is estimated that 100 million people fall into extreme poverty every year, mainly due to out-of-pocket health expenditures and treatment costs (WHO, 2022).

The Health Social Security Administering Body, hereinafter referred to as BPJS Kesehatan, is tasked and responsible for managing the National Social Security System by Law Number 40 of 2004. Its position is strengthened by Law Number 24 of 2011. The total population of Indonesia registered as JKN participants as of November 2022 was 246,947,033 people, with a coverage of 91.10%. Indonesia faces various health challenges, including health financing. The most significant proportion of funding from JKN services in 2022 will be in Secondary Health Care, namely IDR. 87.72 trillion (85.35%), followed by Primary Health Care amounting to Rp. 14.63 Trillion (14.23%). Based on national data, the five most prominent diagnoses for the Referral Program in November 2022 were diabetes mellitus (927,009 people), hypertension (827,976 people), heart disease (377,690 people), stroke (81,536 people) and asthma (80,020 people). (DJSN, 2022).

Based on data on Outpatient patient visits at Secondary Health Care at the Sibolga Branch Office, there were 27,698 cases of diabetes mellitus in 2020, which will increase to 33,750 cases (121%) in 2021. The increase in diabetes mellitus cases in Secondary Health Care will increase JKN financing, especially for chronic diseases, which threaten JKN's sustainability. BPJS Kesehatan implemented the Prolanis strategy (Chronic Disease Management Program) to anticipate this.

Prolanis is a form of the Disease Management Program. This health service is implemented in an integrated manner involving participants, health facilities, and BPJS Kesehatan to maintain the health of participants suffering from chronic diseases and achieve optimal quality of life with cost-effective and efficient health services. Prolanis Management Health Facilities are primary health care facilities, pharmacies, and laboratories collaborating with BPJS Kesehatan. The Prolanis program was created for participants with chronic diseases, especially diabetes mellitus type 2 and Hypertension, to actively maintain their health independently. The general aim of Prolanis is to encourage participants with chronic diseases to achieve optimal quality of life and prevent disease complications through comprehensive and integrated health services with effective and efficient cost utilization. Prolanis has five pillars of program management: a Plan of Care, clinical guidelines, supporting examinations, drug services, and health monitoring. Screening for Prolanis DM Type 2 participants is carried out at Primary Health Care through education on the benefits of Prolanis. For participants who are willing to become Prolanis participants, FKTP will make a registration entry in the P-Care application. Participants registered with Prolanis are entitled to Prolanis services, including health consultation services, drug services, supporting examination services, and group activities consisting of health education and physical activity (Kesehatan. BPJS, 2019).

Prolanis' success indicators consist of Input, Process, and Outcome Indicators. Input Indicator is the ratio of Prolanis DM Type 2 participants divided by participants with a history of Type 2 DM diagnosis. The Process Indicator is the ratio of Prolanis DM Type 2 participants checked for Fasting Blood Sugar (FBS) divided by the number of Prolanis DM Type 2 participants who visited Primary

Health Care. The outcome indicator is the ratio of the number of Prolanis DM Type 2 participants whose health status is under control divided by the number of registered Prolanis participants (Kesehatan. BPJS, 2019).

By taking Prolanis, JKN participants who suffer from chronic diseases, especially Type 2 Diabetes Mellitus, can maintain their health independently. The more regularly participants participate in Prolanis activities, the lower the number of visits and the lower the cost burden on primary and secondary health care. By strengthening Prolanis, we will maintain the financial sustainability of JKN KIS implementation.

Research conducted by Aryani et al. (2016) conducted a cost-effectiveness analysis of cost-effectiveness analysis between the Chronic Disease Management Program (PROLANIS) and Non-Prolanis in Type 2 Diabetes Mellitus patients at RSUD Dr. Drajat Prawira Serang Banten found that the quality of life of Prolanis participants was better than Non-Prolanis participants. The cost of care for Prolanis patients is smaller than Non Prolanis. Prolanis is more cost-effective than Non Prolanis.

Based on this, this study was conducted to determine the cost-effectiveness of implementing the Chronic Disease Management Program (Prolanis) as an intervention in the management of type 2 diabetes mellitus in Health Facilities in the working area of the Sibolga BPJS Kesehatan Branch Office.

## METHOD

This research design is a quantitative study, conducted as an analytic cross-sectional study for JKN participants with a diagnosis of Diabetes Mellitus Type 2 who are registered as Prolanis and Non-Prolanis participants for the 2020-2022 period in the Sibolga Branch Office work area.

The JKN membership segment is divided into PBI JK and Non-PBI JK. PBI JK is the BPJS Kesehatan membership segment for poor and vulnerable people who cannot afford to pay contributions. The Central Government pays the PBI JK monthly contribution. Non-PBI-JK are all membership segments outside PBI JK registered as JKN participants.

The components to be analyzed are the health status of Prolanis and Non-Prolanis Diabetes Mellitus Type 2 participants, including the Fasting Blood Sugar component and the total medical costs of participants. Descriptive analysis was conducted to evaluate variations in demographic characteristics on fasting blood sugar outcomes. Then, it continued with the Mann-Whitney U test to test the difference in the mean of fasting blood sugar and the Wald test to test the difference in the proportion of controlled fasting blood sugar for Prolanis and Non-Prolanis participants. Total cost analysis was calculated from the total cost of preventive promotions, drug costs, and the cost of treating Type 2 DM and its complications with INA-CBGS. Incremental Cost Effectiveness Ratio (ICER) analysis was conducted by comparing the total cost of Prolanis and the total cost of non-

Prolanis for one year, which was then compared with the dimensions of fasting blood sugar achievement of Prolanis patients and non-Prolanis patients in the same year.

The data used were secondary data from the BPJS Kesehatan Masterfile. Sample data (n) for analysis were 589 participants in 2020, 664 participants in 2021, and 604 participants in 2022. Inclusion criteria are JKN participants diagnosed with Diabetes Mellitus Type 2, registered at the Primary Health Care in the working area of the Sibolga BPJS Kesehatan Branch Office, and having fasting blood sugar data. Exclusion criteria are missing data and errors; participants do not have fasting blood sugar data.

## RESULT

### Descriptive Analysis

The study's samples were Diabetes Mellitus Type 2 participants registered as Prolanis and non-Prolanis participants observed in 2020, 2021, and 2022.

**Table 1. Distribution of samples based on participant characteristics**

| No | Participant Characteristics | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| | | n (%) | n (%) | n (%) |
| 1 | **Prolanis Membership** | | | |
| | Prolanis | 367 (62,3) | 372 (56) | 368 (55,8) |
| | Non Prolanis | 222 (37,7) | 292 (44) | 236 (35,8) |
| 2 | **Fasting Blood Sugar** | | | |
| | Uncontrollable | 321 (54,5) | 197 (29,7) | 98 (14,8) |
| | Controllable | 268 (45,5) | 467 (70,3) | 506 (76,7) |
| 3 | **Age** | | | |
| | <45 years old | 73 (12,4) | 71 (10,7) | 58 (8,8) |
| | 45-55 years old | 216 (36,7) | 248 (37,3) | 224 (33,9) |
| | 56-65 years old | 210 (35,7) | 240 (36,1) | 239 (36,2) |
| | >65 years old | 90 (15,3) | 105 (15,8) | 83 (12,6) |
| 4 | **Sex** | | | |
| | Male | 211 (35,8) | 235 (35,4) | 200 (30,3) |
| | Female | 378 (64,2) | 429 (64,6) | 404 (61,2) |
| 5 | **Membership Segment** | | | |
| | PBI JKN | 185 (31,4) | 240 (36,1) | 218 (33) |
| | Non- PBI JKN | 404 (68,6) | 424 (63,9) | 386 (58,5) |
| 6 | **Number of Visits** | | | |
| | 1-6 times | 439 (74,5) | 426 (64,2) | 318 (48,2) |
| | >6 times | 150 (25,5) | 238 (35,8) | 286 (43,3) |
| 7 | **Body Mass Index** | | | |
| | Not Ideal | 136 (23,1) | 187 (28,2) | 218 (33) |
| | Ideal | 453 (76,9) | 477 (71,8) | 386 (58,5) |

## Bivariate Analysis

The table below shows the results of the bivariate test using the Chi-Square Test.

**Table 2. Relationship between Participant Characteristics and Fasting Blood Sugar**

| NO | Participant Characteristic | 2020 | | | | | 2021 | | | | | 2022 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Controlled Fasting Blood | | Uncontrolled Fasting Blood | | *p-value* | Controlled Fasting Blood | | Uncontrolled Fasting Blood | | *p-value* | Controlled Fasting Blood | | Uncontrolled Fasting Blood | | *p-value* |
| | | n | % | n | % | | n | % | n | % | | n | % | n | % | |
| 1 | **Prolanis Membership** | | | | | | | | | | | | | | | |
| | Prolanis | 174 | 8,6 | 193 | 9,6 | 0,231 | 279 | 13,8 | 93 | 4,6 | 0,003 | 322 | 15,9 | 46 | 2,3 | 0,002 |
| | Non Prolanis | 128 | 6,3 | 128 | 6,3 | | 188 | 9,3 | 104 | 5,1 | | 184 | 9,1 | 52 | 2,6 | |
| 2 | **Age** | | | | | | | | | | | | | | | |
| | <45 years old | 42 | 2,1 | 31 | 1,5 | | 49 | 2,4 | 22 | 1,1 | | 52 | 2,6 | 6 | 0,3 | |
| | 45-55 years o | 98 | 4,9 | 118 | 5,8 | 0,113 | 179 | 8,9 | 69 | 3,4 | 0,718 | 191 | 9,4 | 33 | 1,6 | 0,039 |
| | 56-65 years o | 92 | 4,6 | 118 | 5,8 | | 163 | 8,1 | 77 | 3,8 | | 194 | 9,6 | 45 | 2,2 | |
| | >65 years old | 36 | 1,8 | 54 | 2,7 | | 76 | 3,8 | 29 | 1,4 | | 69 | 3,4 | 14 | 0,7 | |
| 3 | **Sex** | | | | | | | | | | | | | | | |
| | Male | 93 | 4,6 | 118 | 5,8 | 0,604 | 159 | 7,9 | 76 | 3,8 | 0,265 | 164 | 8,1 | 36 | 1,8 | 0,405 |
| | Female | 175 | 8,7 | 203 | 10,0 | | 308 | 15,2 | 121 | 6,0 | | 342 | 16,9 | 62 | 3,1 | |
| 4 | **Membership Segment** | | | | | | | | | | | | | | | |
| | PBI JKN | 78 | 3,9 | 107 | 5,3 | 0,271 | 168 | 8,3 | 72 | 3,6 | 0,888 | 188 | 9,3 | 30 | 1,5 | 0,217 |
| | Non PBI JKN | 190 | 9,4 | 214 | 10,6 | | 299 | 14,8 | 125 | 6,2 | | 318 | 15,7 | 68 | 3,4 | |
| 5 | **Number of Visit** | | | | | | | | | | | | | | | |
| | 1-6 times | 169 | 8,4 | 270 | 13,4 | <0,001 | 248 | 12,3 | 178 | 8,8 | <0,001 | 232 | 11,5 | 86 | 4,3 | <0,001 |
| | >6 times | 99 | 4,9 | 51 | 2,5 | | 219 | 10,8 | 19 | 0,9 | | 274 | 13,6 | 12 | 0,6 | |
| 6 | **Body Mass Index** | | | | | | | | | | | | | | | |
| | Not Ideal | 45 | 2,2 | 91 | 4,5 | <0,001 | 159 | 7,9 | 28 | 1,4 | <0,001 | 165 | 8,2 | 53 | 2,6 | <0,001 |
| | Ideal | 223 | 11,0 | 230 | 11,4 | | 308 | 15,2 | 169 | 8,4 | | 341 | 16,9 | 45 | 2,2 | |

## Fasting Blood Sugar Outcome Picture

Overall, the Fasting Blood Sugar of Prolanis participants is more controlled than that of non-Prolanis participants. Table 3 shows the data.

**Table 3. Fasting Blood Sugar Picture of Prolanis and Non-Prolanis Participants**

| Year | Prolanis | | Non Prolanis | |
|---|---|---|---|---|
| | Controlled Fasting Blood Sugar (%) | Uncontrolled Fasting Blood Sugar (%) | Controlled Fasting Blood Sugar (%) | Uncontrolled Fasting Blood Sugar (%) |
| 2020 | 174 (47,4%) | 193 (52,6) | 94 (42,3%) | 128 (57,7%) |
| 2021 | 279 (75%) | 93 (25%) | 187 (64%) | 105 (36%) |
| 2022 | 322 (87,5%) | 46 (12,5%) | 184 (78%) | 52 (22%) |

**Table 4. Distribution of Fasting Blood Sugar Test Results of Prolanis and Non-Prolanis Participants**

| PROLANIS DOMAIN | Year | Minimum | Maximum | Mean | Median | SD |
|---|---|---|---|---|---|---|
| Fasting Blood Sugar | 2020 | 74,00 | 409,00 | 141,21 | 129,00 | 50,45 |
| | 2021 | 74,00 | 301,00 | 120,70 | 114,32 | 37,09 |
| | 2022 | 92,33 | 366,00 | 121,28 | 115,10 | 33,79 |
| **NON-PROLANIS DOMAIN** | **Year** | **Minimum** | **Maximum** | **Mean** | **Median** | **SD** |
| Fasted Blood Sugar | 2020 | 76,00 | 408,50 | 158,13 | 139,40 | 66,78 |
| | 2021 | 74,00 | 398,67 | 129,74 | 113,56 | 52,98 |
| | 2022 | 73,00 | 361,00 | 127,71 | 108,87 | 50,02 |

**Fasting Blood Sugar Mean Test.**

In 2020, the Mann-Whitney U test results showed a p-value <0.05, so with a significance level of five percent, the null hypothesis was rejected, or there was a real difference between the Fasting Blood Sugar of Prolanis and non-Planis participants.

**Table 5. Fasting Blood Sugar Mean Test**

| Year | Mann-Whitney U | Asymp. Sig. (2-tailed) |
|---|---|---|
| 2020 | 35529,5 | 0,009 |
| 2021 | 52575 | 0,479 |
| 2022 | 41533 | 0,366 |

**Test of the Proportion of Fasting Blood Sugar Checks**

In 2021 and 2022, the Wald test results show a p-value <0.05, meaning that the null hypothesis is rejected with a five percent significance level. This means there is a difference in the proportion of patients with controlled Fasting Blood Sugar in Prolanis and Non-Prolanis participants.

**Table 6. Fasting Blood Sugar Proportion Test Results**

| Year | Membership | Controlled Proportion | The Wald Test | Two-way significance |
|---|---|---|---|---|
| **2020** | Prolanis | 0.474 | 0,051 | 0,231 |
| | Non-Prolanis | 0.423 | | |
| **2021** | Prolanis | 0.750 | 0,110 | 0,002 |
| | Non-Prolanis | 0.640 | | |
| **2022** | Prolanis | 0.760 | 0,095 | 0,002 |
| | Non-Prolanis | 0.780 | | |

## Multivariable Analysis

The results of the multivariable analysis test from 2020-2022 showed that the variables of Prolanis membership, age, number of visits, and Body Mass Index (BMI) significantly affected Fasting Blood Sugar (GDP).

**Table 7. Results of Multivariable Analysis of Fasting Blood Sugar.**

| No | Dependent Variable | 2020 | | | | 2021 | | | | 2022 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | β | OR | 95% CI | *P-Value* | β | OR | 95% CI | *P-Value* | β | OR | 95% CI |
| 1 | **Prolanis Membership** | | | | | | | | | | | |
| | Prolanis | -0,264 | 0,768 | 0.540-1.093 | 0,142 | -0,167 | 0,846 | 0.585-1.225 | 0,376 | -0,515 | 0,598 | 0.370-0.965 |
| | Non Prolanis (*Reference)* | | | | | | | | | | | |
| 2 | **Age** | | | | | | | | | | | |
| | <45 years old | -0,363 | 0,696 | 0.398-1.217 | 0,204 | 0,276 | 1,318 | 0.697-2.491 | 0,396 | -0,519 | 0,595 | 0.224-1.578 |
| | 45-55 years old | -0,412 | 0,663 | 0.378-1.162 | 0,151 | 0,057 | 1,058 | 0.561-1.997 | 0,861 | -0,923 | 0,397 | 0.152-1.038 |
| | 56-65 years old | -0,682 | 0,506 | 0.263-0.873 | 0,041 | 0,248 | 1,282 | 0.619-2.654 | 0,504 | -0,870 | 0,419 | 0.140-1.254 |
| | >65 years old *(Reference)* | | | | | | | | | | | |
| 3 | **Sex** | | | | | | | | | | | |
| | Male | 0,045 | 1,046 | 0.729-1.500 | 0,808 | 0,198 | 1,219 | 0.836-1.778 | 0,304 | 0,099 | 1,104 | 0.669-1.822 |
| | Female *(Reference)* | | | | | | | | | | | |
| 4 | **Membership Segment** | | | | | | | | | | | |
| | PBI JKN | -0,001 | 0,999 | 0.685-1.457 | 0,994 | -0,056 | 0,945 | 0.664-1.388 | 0,774 | -0,436 | 0,647 | 0.383-1.093 |
| | Non PBI JKN *(Reference)* | | | | | | | | | | | |
| 5 | **Number of Visit** | | | | | | | | | | | |
| | 1-6 times | 1,116 | 3,051 | 2.038-4.568 | 0,000 | 1,974 | 7,201 | 4.259-12.174 | 0,000 | 2,115 | 8,288 | 4.368-15.725 |
| | >6 times *(Reference)* | | | | | | | | | | | |
| 6 | **Body Mass Index** | | | | | | | | | | | |
| | Not Ideal *(Reference)* | | | | | | | | | | | |
| | Ideal | 0,636 | 1,889 | 1.246-2.863 | 0,003 | -0,774 | 0,461 | 0286-0.743 | 0,001 | 0,759 | 2,136 | 1.324-3.445 |

## Cost Analysis

Total costs are the sum of preventive promotion costs, Outpatient costs (RJTL), Inpatient costs (RITL), drug costs for Referral Participants (PRB), and chronic drug costs. The difference in the total cost of Prolanis and Non-Prolanis Participants is in the preventive promotive cost component. The preventive promotion cost component was not present in the total cost of Non-Prolanis. The total cost of non-Prolanis participants is greater than that of Prolanis and has increased yearly.

In 2020, the total cost of Prolanis was IDR 1,437,411,273, which is smaller than Non-Prolanis's IDR 5,861,773,361. In 2021, the total cost of Prolanis was IDR 2,706,895,281, which is smaller than Non-Prolanis's IDR 7,807,455,547. In 2022, the total cost of Prolanis was IDR 2,751,510,452, which is smaller than Non-Prolanis's IDR 10,291,812,544.

The largest proportion of Prolanis participants' costs each year is the cost of preventive promotion. The smallest proportion of costs for Prolanis participants each year is the cost of PRB drugs. The largest proportion of Non-Prolanis participants' costs each year is the cost of Outpatient Care (RJTL). The smallest proportion of costs for non-Planis participants each year is the cost of

PRB drugs. The total cost of Prolanis and Non-Prolanis both increased every year. Cost details can be seen in Table 8.

**Table 8. Details of Prolanis and Non-Prolanis Costs per Year**

| Costs | Total Cost of Prolanis per Year (IDR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | % | 2021 | % | 2022 | % |
| Preventif Promotion Costs | 802.677.000,00 | 55,84 | 1.798.802.000,00 | 66,45 | 1.669.379.688,00 | 60,67 |
| Outpatient Costs | 214.702.600,00 | 14,94 | 301.906.900,00 | 11,15 | 356.633.600,00 | 12,96 |
| Inpatient Costs | 110.291.930,00 | 7,67 | 94.260.460,00 | 3,48 | 111.343.980,00 | 4,05 |
| Referral Participant Drug Costs (PRB) | 92.679.067,00 | 6,45 | 94.205.249,00 | 3,48 | 86.044.040,00 | 3,13 |
| Chronic Drug Costs | 217.060.676,00 | 15,10 | 417.720.672,00 | 15,43 | 528.109.144,00 | 19,19 |
| **TOTAL** | **1.437.411.273,00** | | **2.706.895.281,00** | | **2.751.510.452,00** | |

| Costs | Total Cost of Prolanis per Year (IDR) | | | | | |
|---|---|---|---|---|---|---|
| | 2020 | % | 2021 | % | 2022 | % |
| Preventif Promotion Costs | - | - | - | - | - | - |
| Outpatient Costs | 2.410.879.200,00 | 41,13 | 3.196.520.600,00 | 40,94 | 4.210.857.400,00 | 40,91 |
| Inpatient Costs | 1.550.412.970,00 | 26,45 | 1.349.785.870,00 | 17,29 | 2.049.781.320,00 | 19,92 |
| Referral Participant Drug Costs (PRB) | 80.788.058,00 | 1,38 | 102.913.072,00 | 1,32 | 89.599.740,00 | 0,87 |
| Chronic Drug Costs | 1.819.693.133,00 | 31,04 | 3.158.236.005,00 | 40,45 | 3.941.574.084,00 | 38,30 |
| **TOTAL** | **5.861.773.361,00** | | **7.807.455.547,00** | | **10.291.812.544,00** | |

Source: BPJS Kesehatan data

**Table 9. Frequency distribution of average costs in 2020**

| Participants | Number of Participants | Minimum (Rp) | Maximum (Rp) | Mean (Rp) | Total (Rp) |
|---|---|---|---|---|---|
| **Prolanis** | | | | | |
| Preventif Promotion Costs | 721 | - | - | 1.113.283 | 802.677.000 |
| Outpatient Costs | 234 | 140.000 | 969.200 | 917.532 | 214.702.600 |
| Inpatient Costs | 14 | 3.441.500 | 13.915.200 | 7.877.995 | 110.291.930 |
| Referral Participants drug costs (PRB) | 240 | 3.610 | 1.431.604 | 386.163 | 92.679.067 |
| Chronic drug costs | 207 | 4.004 | 2.828.258 | 1.048.602 | 217.060.676 |
| **Total** | | **3.589.114** | **19.144.262** | **11.343.575** | **1.437.411.273** |
| | | | | | |
| **Non Prolanis** | | | | | |
| Preventif Promotion Costs | 3.259 | 108.700 | 4.010.900 | 739.760 | 2.410.879.200 |
| Inpatient Costs | 219 | 2.246.130 | 35.361.400 | 7.079.511 | 1.550.412.970 |
| Referral Participants drug costs (PRB) | 269 | 1.805 | 1.464.014 | 300.327 | 80.788.058 |
| Chronic drug costs | 2.103 | 1.492 | 2.271.666 | 865.284 | 1.819.693.133 |
| **Total** | | **2.358.127** | **43.107.980** | **8.984.883** | **5.861.773.361** |

*Source : BPJS Kesehatan data*

Table 9 shows that the total cost of non-Prolanis participants is greater than that of Prolanis participants. Still, the total average financing was greater for Prolanis participants than non-Prolanis

participants in 2020. The total cost of Prolanis participants was IDR 11,343,575, while the total cost of non-Prolanis participants was IDR 8,984,883.

**Table 10. Frequency distribution of average cost in 2021**

| Participants | Number of Participants | Minimum (Rp) | Maximum (Rp) | Mean (Rp) | Total (Rp) |
|---|---|---|---|---|---|
| **Prolanis** | | | | | |
| Preventif Promotion Costs | 747 | - | - | 2.408.035 | 1.798.802.000 |
| Outpatient Costs | 239 | 140.000 | 1.264.300 | 1.263.209 | 301.906.900 |
| Inpatient Costs | 17 | 2.968.290 | 12.254.300 | 5.544.733 | 94.260.460 |
| Referral Participants drug costs (PRB) | 186 | 2.035 | 983.577 | 256.730 | 94.205.249 |
| Chronic drug costs | 309 | 1.659 | 1.859.869 | 1.347.486 | 417.720.672 |
| **Total** | | **3.111.984** | **16.362.046** | **10.820.193** | **2.706.895.281** |
| | | | | | |
| **Non Prolanis** | | | | | |
| Outpatient Costs | 3.822 | 114.400 | 4.057.100 | 836.348 | 3.196.520.600 |
| Inpatient Costs | 214 | 2.246.130 | 27.856.500 | 6.307.411 | 1.349.785.870 |
| Referral Participants drug costs (PRB) | 234 | 2.957 | 1.520.673 | 439.799 | 102.913.072 |
| Chronic drug costs | 3.095 | 591 | 1.916.991 | 1.020.432 | 3.158.236.005 |
| **Total** | | **2.364.078** | **35.351.264** | **8.603.989** | **7.807.455.547** |

*Source : BPJS Kesehatan data*

Table 10 shows that the total cost of non-Prolanis participants is greater than that of Prolanis participants. Still, the total average financing was greater for Prolanis participants than for non-Prolanis participants in 2021. The total funding for Prolanis participants is IDR 10,820,193, while the total financing for non-Prolanis participants is IDR 8,603,989.

**Table 11 Frequency distribution of average cost in 2022**

| Participants | Number of Participants | Minimum (Rp) | Maximum (Rp) | Mean (Rp) | Total (Rp) |
|---|---|---|---|---|---|
| **Prolanis** | | | | | |
| Preventif Promotion Costs | 982 | - | - | 1.699.979 | 1.669.379.688 |
| Outpatient Costs | 286 | 140.000 | 1.334.300 | 1.246.971 | 356.633.600 |
| Inpatient Costs | 17 | 2.968.290 | 13.915.200 | 6.549.646 | 111.343.980 |
| Referral Participants drug costs (PRB) | 176 | 1.018 | 934.217 | 488.887 | 86.044.040 |
| Chronic drug costs | 369 | 1.659 | 1.605.001 | 1.431.190 | 528.109.144 |
| **Total** | | **3.110.967** | **17.788.718** | **11.416.673** | **2.751.510.452** |
| | | | | | |
| **Non Prolanis** | | | | | |
| Outpatient Costs | 4.690 | 140.000 | 1.519.800 | 897.837 | 4.210.857.400 |
| Inpatient Costs | 324 | 2.860.800 | 35.361.400 | 5.806.815 | 2.049.781.320 |
| Referral Participants drug costs (PRB) | 240 | 1.690 | 1.052.004 | 260.917 | 89.599.740 |
| Chronic drug costs | 3.886 | 407 | 2.676.843 | 1.003.967 | 3.941.574.084 |
| **Total** | | **3.002.897** | **40.610.047** | **7.969.536** | **10.291.812.544** |

*Source : BPJS Kesehatan data*

The total cost of Non Prolanis participants is greater than that of Prolanis participants, but the total average cost is greater for Prolanis participants than for Non Prolanis participants in 2021. The average total financing of Prolanis participants was IDR 11,416,673, - while the total average funding of Non-Prolanis participants was IDR 7,969,536, - (Table 11).

***Incremental Cost Effectiveness Analysis (ICER)***

Incremental Cost Effectiveness Analysis (ICER) is calculated using cost and clinical effectiveness parameters by dividing the difference in cost per patient by the difference in total clinical effectiveness. The cost parameter is the average cost per patient (Table 9, Table 10, and Table 11). Clinical effectiveness is the proportion of controlled fasting blood sugar for both Prolanis and Non-Prolanis participants (Table 5). The results of the ICER calculation in the comparison of Prolanis and Non-Prolanis participants in 2020 showed that Non-Prolanis participants needed a cost of IDR 462,489, - to get one percent of the same proportion of controlled fasting blood sugar in Prolanis participants. In 2021, the results obtained by Non-Prolanis participants cost IDR 201,473, - to get one percent of the same proportion of controlled fasting blood sugar in Prolanis participants. In 2022, the results obtained by Non-Prolanis participants cost 362,856 - to get one percent of the same proportion of controlled fasting blood sugar in Prolanis participants. The additional costs increased from 2020 to 2021 and then decreased in 2022.

**Table 12. *Incremental Cost Effectiveness Ratio* (ICER) Values**

| Prolanis | Year | Cost Per Patient (IDR) | Effectiveness of Controlled Fasting Blood Sugar Proportions (%) | ΔC (Prolanis Cost - Non Prolanis Cost) | ΔE (Effectiveness Prolanis - Non Prolanis) | ICER (ΔC/ΔE) |
|---|---|---|---|---|---|---|
| Prolanis | 2020 | 11.343.575 | 47,40 | 2.358.692 | 5 | 462.489 |
| Non Prolanis | | 8.984.883 | 42,30 | | | |
| Prolanis | 2021 | 10.820.193 | 75,00 | 2.216.203 | 11 | 201.473 |
| Non Prolanis | | 8.603.989 | 64,00 | | | |
| Prolanis | 2022 | 11.416.673 | 87,50 | 3.447.137 | 10 | 362.856 |
| Non Prolanis | | 7.969.536 | 78,00 | | | |

## DISCUSSION

Disease Management Programmes (DMPs) aim to reduce costs by improving the quality of health care for people with chronic diseases, especially diabetes mellitus. Reducing health expenditure covers the DMP program's cost, which has challenges (Simcoe et al., 2019). Prolanis is a Disease Management Program (DMP) for managing chronic diseases, especially diabetes mellitus, at the primary level.

### Prolanis

The number of National Health Insurance participants diagnosed with Type 2 DM grows yearly along with the increase in participants diagnosed with Type 2 DM. Still, the growth rate of Type 2 DM Prolanis participants is lower than that of Type 2 DM diagnosis participants.

The achievement of input and outcome indicators from 2020 to 2022 did not reach the predetermined targets, so the program success criteria were unmet. Considering the failure of the Type 2 DM Prolanis program, there is the influence of the COVID-19 pandemic, which was established on 31 March 2020 through Presidential Decree Number 11 of 2020 concerning the determination of the 2019 Coronavirus Disease Public Health Emergency in Indonesia with the implementation of social distancing. This finding highlights that the COVID-19 pandemic hurt the clinical outcomes of Prolanis participants (Salamah et al., 2023).

### Factors affecting fasting blood sugar levels

This study showed a relationship between age and fasting blood sugar achievement in 2020. Most Prolanis participants were in the age range of 45-65 in 2020, with the majority being female, with a proportion of 64.86%-70.11%. Previous research on populations in West African countries supports this, proving a significant relationship between age and type 2 diabetes mellitus (Issaka et al., 2022). Research on the effect of age on type 2 diabetes mellitus in America shows that age will significantly impact after 40 years through pathophysiological mechanisms (Fazeli et al., 2020).

The results of research from 2020 to 2022 show that the variable that consistently has a significant effect on fasting blood sugar achievement is participant activeness. Prolanis participant compliance is measured by monthly attendance at the Health Facility. Program activities for program participants consisted of health consultations, supporting examinations, group activities, home visits, and reminders. The main emphasis of program activities is on supporting examinations to determine the health status of program participants as an assessment of program success (BPJS Kesehatan, 2019). A retrospective study conducted in Japan from January 2005 to June 2013 on patients newly diagnosed with type 2 diabetes mellitus showed a significant association of non-

adherence with microvascular complications of diabetes. Non-compliance was measured by patients' non-attendance at health facilities every month to receive health care (Fukuda & Mizobe, 2017).

The 2020 to 2022 study results showed that the variable that consistently significantly affected fasting blood sugar achievement was Body Mass Index. This study shows that the proportion of Prolanis participants with ideal Body Mass Index (BMI) is higher than that of non-ideal BMI. This finding implicitly shows that Prolanis participants comply with treatment and commit to achieving glycemic targets. High BMI is a major risk factor for type 2 diabetes. The association between high BMI and type 2 diabetes mellitus has been increasing in the last decade. Research conducted at the Primary Health Care in Malang showed that patients with type 2 diabetes mellitus have an estimated adherence rate of 50% due to the difficulty of regulating their diet (Rahmadhanie, 2019). prospective cohort study 'The Nurses' Health Study' in 74,419 women found that increasing BMI was associated with a greater risk of diabetes mellitus. The Diabetes Prevention Program (DPP) conducted a study on individuals with an average BMI of 34.0 kg/m2; the results showed that the intervention group experienced a significant reduction in the incidence of diabetes mellitus by 58% compared to the control group (Carbone et al., 2019).

Tests conducted on 2022 data showed that the Prolanis membership variable significantly affected the fasting blood sugar of Type 2 DM participants. Based on these results, Type 2 DM participants who follow the prolanis program tend to have controlled fasting blood sugar 1.673 times compared to the fasting blood sugar of non-prolanis Type 2 DM patients. Similar research conducted by Aryani et al. showed that participation as a Prolanis participant significantly correlates with the patient's quality of life. The longer type 2 DM patients follow prolanis, the better their quality of life (Aryani et al., 2016).

Diabetes is a complex disease with many barriers to its management. Barriers to diabetes management are patient, provider, and self-management factors. Knowing the barriers to diabetes management is very useful in improving the quality of diabetes care, including metabolic control and diabetes management. The results of Prolanis research vary between regions; research conducted by Alkaf et al. in the Wates area, East Java, in 2021 found that implementing Prolanis was ineffective because metabolic control parameters and kidney function did not improve within 18 months. Only serum triglyceride levels experienced significant improvement (Alkaff et al., 2021). According to research at the Bandung City Health Centre, 68.1% of Prolanis participants felt complexity in following the program, such as a lack of health worker collaboration and family support. So, there is a need to integrate care for DM participants in Prolanis. Diabetes patients with appropriate consultation and education services show better compliance behavior (Sari et al., 2022). Research conducted by Sekhar, R.V for patient inhibiting factors on 24 HIV diabetes patients by intervening by providing ABCDE (Analogy-Based Comprehensive Diabetes Education) education,

which is a basic concept regarding diabetes care with a clinical approach arranged in a simple language consisting of HbA1C recognition, avoiding sweet foods and healthy diet compliance, to achieve optimal glycemic control of HbA1c and fasting blood sugar. Lack of health literacy hinders adherence to diabetes care, including lifestyle and pharmacotherapy (Sekhar, 2022).

**Fasting Blood Sugar Outcome**

One of the principles in implementing Prolanis is continuity. Chronic disease management services are carried out continuously between the Primary Health Care (PHC) and participants. Chronic participants must regularly visit the PHC to conduct health checks and consultations. Participants who visit periodically can monitor their health status and development (BPJS Kesehatan, 2019).

In 2020, the average fasting blood sugar significantly differed between Prolanis and Non-Prolanis participants. Still, the average was higher than the target for controlled fasting blood sugar (80-130 mg/dl). The proportion of Prolanis participants with controlled fasting blood sugar was lower (47.4%) compared to uncontrolled fasting blood sugar (52.6%). In 2021 and 2022, there was no significant difference in the mean fasting blood sugar of Prolanis and Non Prolanis participants. Still, the proportion of controlled fasting blood sugar was greater in Prolanis participants than in Prolanis. Based on the research of Talavera et al. in a group of participants with type 2 diabetes mellitus at the Federally Qualified Community Health Center San Diego, it shows that the average HbA1c between the intervention group and the usual care group has no difference due to some participants not doing laboratory tests, so there is missing data and the amount is quite large. Incomplete data can weaken the results of assessing the effectiveness of the intervention. Health facilities need to document data appropriately as a basis for outcome assessment. The study's results using HbA1c as a glycaemic control showed that the Chronic Care Model significantly improved HbA1c in the intervention group. This study proved that integrated team-based diabetes care is more effective in reducing HbA1c than usual care. The health care team comprised certified nurse diabetes educators, dietitians, and community health workers. To increase clinical effectiveness, it is still necessary to improve patient compliance (Talavera et al., 2021).

**Prolanis Financing**

This study uses the BPJS Kesehatan payer perspective. Direct medical costs that BPJS Kesehatan bears are costs billed by health facilities after serving BPJS Kesehatan patients (Aryani et al., 2016). The largest proportion of the costs of Prolanis participants each year is the cost of preventive promotion, while non-Prolanis is the cost of Outpatient Care. The smallest proportion of costs for Prolanis and Non-Prolanis participants each year is the cost of PRB drugs. The total costs

incurred by BPJS Kesehatan for Non Prolanis participants are higher when compared to the total costs of Prolanis from 2021 to 2022. Research conducted on Austrian Disease Management Program 'Therapie aktiv' diabetes participants with a large population, using a cohort design and followed for 4 years since being registered as a participant, showed a decrease in total DMP costs when compared to the total costs of non-program participants (Riedl et al., 2016). Research by Aryani et al. showed that the total cost of Prolanis participants with type 2 diabetes mellitus for treatment and complications for one year, both direct and indirect medical costs, was lower than Non-Prolanis. The average total cost of care for Type 2 DM Non PROLANIS patients was 99.5% greater than that of PROLANIS patients (Aryani et al., 2016).

***Incremental Cost Effectiveness Ratio* (ICER)**

*Incremental Cost Effectiveness Ratio (ICER)* for every additional one percent of controlled fasting blood sugar in Non Prolanis participants varies annually with consecutive values in 2020, namely IDR 462,489, - then decreased to IDR 201,473, - in 2021 and 2022 increased again to IDR 362,856, - The existence of differences in costs and quality of life of Prolanis and Non-Prolanis can be seen in the Cost-effectiveness (CE) Plane diagram. The difference in costs between Prolanis and Non-Prolanis gives positive results, indicating that Prolanis is not cost-effective compared to Non-Prolanis from 2020 to 2022. The high cost of Prolanis is due to the Preventive Promotive cost component not found in Non-Prolanis participants. The effectiveness of Prolanis is better than that of Non-Prolanis. CE Plane analysis shows that Prolanis in 2020, 2021, and 2022 is in quadrant 1 'Trade-Off,' namely, the effectiveness of the proportion of controlled fasting blood sugar Prolanis is superior to Non-Prolanis, but the cost is also higher. In conclusion, Prolanis succeeded in improving the effectiveness of clinical outcomes of controlled fasting blood sugar in diabetic participants (Arnold, 2021).

A cost-effectiveness analysis was conducted on diabetes participants who participated in an integrated diabetes program (MMC Programme) and non-program in Yuhuan City, China, using 'societal perspective' cost parameters, including direct medical, direct non-medical, indirect, and operational costs. The cost data showed that the total cost of diabetes participants in the MMC program was higher than that of non-program participants. However, the unit cost for every 1% increase in controlled fasting blood sugar in the intervention group was lower than the control group. The Cost Effectiveness Ratio of the intervention group was lower than that of the control group. The higher total cost in the intervention group compared to the control group was due to the MMC program providing high-quality outpatient care that reduced cost-related hospitalizations. The MMC program is an integrated service that involves primary health care in China. Integrated services include patient education and self-management support, strengthening the primary care system, and

coordination of primary and specialized services. Intensive therapies and examinations require additional costs, but the MMC program improves patients' clinical conditions, and QALYs and economic analysis show that these extra costs are realistic. Additional costs in primary care contributed to the high total costs for MMC program participants. Still, the results showed that the MPP program was cost-effective, with increased clinical improvement of MPP program diabetes participants (Liang et al., 2023).

This differs from the results of Aryani et al., who calculated the ICER value of Prolanis and Non-Prolanis participants. The cost components included direct medical costs, indirect medical costs, and non-medical costs. However, direct medical costs did not include the cost of preventive promotion. Output Cost-effectiveness analysis with the ratio of additional expenses (ICER) using the outcome of the quality of life of the social relationship domain obtained a value of IDR 625,155, - and for the quality of life of the environmental domain obtained an ICER value of IDR 969,369, -

This study concluded that Prolanis is more cost-effective. Prolanis research in Serang City Banten showed that the cost-effectiveness analysis of Type 2 DM treatment with Prolanis was proven effective. Namely, the costs incurred for Prolanis were lower, and the outcomes provided were a better quality of life. CE Plane Prolanis occupies quadrant 2, which means that both price and quality of life outcomes are dominant, with lower costs and better quality of life (Aryani et al., 2016).

The strength of this study is that it uses secondary data from BPJS Kesehatan in the implementation of Prolanis in type 2 diabetes mellitus patients, factors that affect fasting blood sugar, and cost analysis includes participant cost data from Primary Health Care, Secondary Health Care, and Pharmacies. In addition, the cost analysis also separated the cost data of preventive promotion, outpatient care, inpatient care, and medication. This study showed a significant association between age, BMI, participant activeness, and Prolanis membership with fasting blood sugar. Cost analysis calculated the incremental cost-effectiveness ratio (ICER) over three years and showed that Prolanis financing was higher than non-Planis and occupied quadrant 1 ‘Trade-Off.’ This study can also serve as a foundation for other studies to explore the factors that influence the improvement of fasting blood sugar control and the factors that can affect the high cost of Prolanis.

However, this study has several limitations. Firstly, the study used BPJS Kesehatan secondary data, which had limitations on the information provided. The number of type 2 diabetes mellitus Prolanis participants who participated in this study was relatively small compared to the total number of Prolanis participants because they did not have fasting blood sugar data, so they were excluded during the selection process. The analysis also used the fasting blood sugar variable as a glycaemic control in type 2 diabetes mellitus participants. Still, the HbA1c test is more sensitive to establish type 2 diabetes mellitus and indicate the severity or complications of diabetes. It is necessary to

conduct large-scale cohort studies to produce more concrete scientific evidence for decision-making in effective diabetes management.

This study only calculates the cost of treating type 2 diabetes mellitus participants in the Sibolga Branch Office area hospital. The cost of preventive promotion is an aggregate cost paid by BPJS Kesehatan to health facilities, so calculating the cost per Prolanis participant can cause bias. Future research should explore the factors that cause the low participation of Prolanis Diabetes Mellitus type 2 in Primary Health Care. Research needs to add components of direct and non-medical costs to calculate total costs so that the Incremental Cost Effectiveness Ratio value is more accurate.

## CONCLUSION

The characteristics of Prolanis membership, age, number of visits, and Body Mass Index significantly affect fasting blood sugar achievement.

In 2021 and 2022, there was no difference in mean fasting blood sugar between Prolanis and non-Prolanis participants, and the mean fasting blood sugar of Prolanis DM Type 2 participants was lower than That of non-Prolanis participants. However, the proportion test of controlled fasting blood sugar in 2021-2022 showed a difference between Prolanis and non-Prolanis participants.

The total health service cost of Prolanis DM Type 2 is lower than Non-Prolanis from 2021, 2022, and 2023. Preventive promotive costs accounted for the largest proportion of the expenses for Prolanis participants. Outpatient costs accounted for the largest proportion of costs for Non-Prolanis participants.

The incremental Cost-Effectiveness Ratio of Prolanis DM Type 2 and Non-Prolanis participants in 2020 to 2022 is IDR 462,489,-; IDR 201,473, Ffisrt-; and IDR 362,856,—to achieve a 1% proportion of controlled fasting blood sugar. The cost of Prolanis is higher, but the clinical effectiveness of Prolanis' controlled fasting blood sugar achievement is better. CE Plane analysis shows that Prolanis is in quadrant 1, '*Trade-Off.'*

The first recommendation for implementing Prolanis is strengthening the Prolanis data information system in the P-Care application through the obligation to input fasting blood glucose checks for Prolanis participants every month for the needs of monitoring the health of Prolanis participants as well as monitoring and evaluating policymakers; secondly, Prolanis activities are not separate from physical activities in supporting controlled fasting blood sugar outcomes so they are part of what must be done; third, namely prolanis involves a multidisciplinary community with uniform competencies consisting of certified doctors, certified nurses, certified pharmacists and certified nutritionists for the management of diabetes mellitus. The multidisciplinary certification program includes diabetes knowledge, diet counseling, pharmacotherapy management, physical exercise, and integration of interdisciplinary team care at Primary Health Care.

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