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## ANALYSIS OF FUTURE HEALTH INSURANCE PREMIUM RESERVE CALCULATIONS USING THE COMMISSIONERS METHOD WITH WOOLHOUSE FORMULA

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### Article Info

Article history:

Received : June 13, 2024

Revised : July 26, 2024

Accepted : July 29, 2024

Available online : July 31, 2024

<https://doi.org/10.33541/edumatsains.v9i1.5933>

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### Abstract

This study employs a quantitative approach and literature review to compare premium reserve methods in term life insurance. Utilizing secondary data from the Indonesian Mortality Table (TMI) IV 2019 by the Indonesian Life Insurance Association (AAJI), the research aims to determine the premium reserve for life insurance using the Commissioners method and the WOOLHOUSE mortality law. The primary data collection methods include secondary data and literature review. Secondary data, such as the TMI IV, financial reports of insurance companies, academic journals, actuarial textbooks, and other relevant sources, provide the foundation for mortality law and premium reserve calculations. Literature review facilitates the understanding and development of theories and methodologies pertinent to these calculations. The instruments for data collection encompass documents and literature, actuarial software, and relevant financial reports. The TMI IV from AAJI and texts on the WOOLHOUSE mortality law and Commissioners method serve as key resources. Actuarial software aids in complex mathematical simulations and calculations. The objectives of data collection are to determine survival probabilities using the WOOLHOUSE mortality law, calculate insurance and annuity values, establish annual premiums, and compute modified premium reserves based on the Commissioners method at the end of the liability period. The study evaluates the insurance company's readiness to meet its obligations to policyholders based on these reserves. This research specifically focuses on a 35-year-old men enrolled in a dual-purpose life insurance program with a 35-year liability period and a 5-year premium payment period at a 2,25% interest rate, with a liability of Rs. 20,000,000. The analysis reveals that the premium reserves calculated using the Commissioners method and the WOOLHOUSE mortality law align with the predetermined reserve values, ensuring the insurance company's preparedness to fulfill its promised obligations to the policyholder.

**Keyword:** life insurance; quantitative premiums; methods commissioners

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### 1. Introduction

Determining the premiums is crucial in future health insurance. It is closely related to the operational sustainability of the insurance company and the financial fairness of the participants. Proper premium reserves ensure that companies can meet their obligations to participant claims,

thereby building confidence and stability within the health insurance industry. The calculation of the premiums involves an assessment of the level of risk of each participant, which may be influenced by age, gender, health history, and other risk factors. The global health insurance market, according to [globoNewsWire.com](https://www.globenewswire.com), will grow from \$1.465.8 billion in 2019 to \$2.210.62 billion in 2027. This is due to the rise in the elderly population, the high cost of medical examinations, government initiatives to improve surgical replacement policies, and efforts to improve health insurance services, in the payment of claims. According to the information, health insurance is one of the alternative financing of health care that will continue to grow for the next five years. Health insurance can act as one of the funding instruments that can the goal of universal health coverage. The World Health Organization (WHO) has encouraged countries around the world to provide health insurance to their people in the form of either commercial or social health insurance. Even since 2001, the WHO has advocated health insurance programmes as an alternative funding for successful immunization programmes. Nowadays the insurance industry is developing in line with the development of the business world in general. Many people in Indonesia have already realised the importance of insurance, although compared to other countries, Indonesia is still far behind. Most people take life insurance because they want to reduce the risk of financial losses. On the other hand, the insurance company could have suffered losses when there was a deceased policyholder and at that time the company did not have funds, while the company had to issue some funds for bail. Therefore, to anticipate the loss of the company, then part of the premiums received by the company must be presented to the company as a premium reserve so that if in the future there is a claim then the company does not have difficulty paying it. This study aims to determine the size of the reserves obtained using the reserve method which is an extension of the prospective reserve, the Commissioners reserve. Health insurance is a measure of protection granted by the insured party to a liable person in the event of a disaster or loss such as death, accident, or loss of ability to earn income (Laili et al., 2022). There are three types of health insurance: long-term life insurance, lifetime life insurance and *dwiguna* (endowment). In addition, future health insurance can also have a variety of additional options, such as the option to add family members, adjustment of the benefit level, and the option of extending the policy after a certain period. Future health insurance can provide a sense of security and financial security for participants, ensuring that they can receive the necessary health care without being burdened by high costs. Health Insurance at P.T. Bumida General Insurance 1967 Cab.Medan may face a number of problems that require special attention in the analysis of the calculation of premiums reserves. One of the problems that may arise is fluctuations in the level of health claims in the region. Medan as a developing city can experience variations in disease prevalence, patterns of use of health services, and treatment costs. Therefore, the calculation of the premium reserve needs to be adapted to local public health characteristics in order to accommodate the dynamics of claims that may change over time. According to (Yumna, 2021) it is explained that health insurance is insurance that provides two benefits, first as protection for life and second as a savings. Assistance shall be granted as agreed upon if the insured party dies during the period of liability or is alive until the end of the period. Health insurance aims to secure a fixed fund up to a certain period without pointing to the amount of income with a life insurance bonus. In health insurance, it's not

off with what's called a premium reserve. (Laili et al., 2022) stated that the reserve is the amount of money available to the company during the period of suspension. It's not uncommon for health insurance companies to suffer losses due to inaccuracies in arranging their premiums. However, it is not a problem if the health insurance company has a premiums reserve fund that has been prepared with proper calculation. The calculation of self-reserve value is divided into two types, retrospective and prospective. For the calculation of prospective reserves can use a variety of methods, among others: commissioners and canadian methods. According to (Keisler-Starkey & Bunch, 2022) the commissioner method states the net premium and the modified premium relationship which constitutes the difference between the modifications  $\beta$  and  $\alpha$  of any given policy and the age at the time of issuance. Then on the results of the study (Putri, 2020) it was concluded that the commissioners method produced smaller premiums than the Canadian method with annual calculations so that the profits the company would earn would also be small. In a previous study by (Hasnah, 2019) it was mentioned that the commissioners method was a method of high cost modification in the first year. In addition to the commissioners method with the woolhouse formula, there are several methods used in research or calculation in insurance, one of which is the Canadian method, and the Illionic method. Where the Canadian method is one of the methods of calculation by balancing between Canadian initial modified premium and net premium with the difference between net premium for life insurance policy with natural premium. According canadian method can be used if and only if the policy condition has a net premium and flat greater than the flat net premium of life insurance with large deposit or claims and the same period of liability. In his research (Winarto, 2019) he compared the calculation of premiums using the commisioners and Canadian methods to find out which methods are more effective to use in calculating the size of the premiums on dwiguna life insurance. The results of the study say that of the two methods the commissioners method is more effectively used to determine the size of the premiums reserves, because at the beginning of the year the premium reserves generated by the Commissioners method are larger than the Canadian method as a result of which the increasing profits are also obtained by the company.

While the Illinois Reserve is an expansion of the prospective reserve in which the costs charged to the insured are limited by the company with a 20-year limit of payment which contains some net premium values namely net premium for the first year, net premiums for the next 19 years, and annual net premium (Manurung et al., 2023). The results of the study indicate that at the end of the period the value of the reserve in the first year will increase year by year so that the resulting reserve value will be the same as the deposit received by the assured at the time of the expiry period. In situations like this can be overcome if the insurance company has a reserve fund that has been prepared. However, to determine the reserve fund is not easy, insurance companies must be wise in taking into account their premiums. Previous research conducted by (Hasnah, 2019) stated that the Commissioners method was a modified method that would reduce high costs in the first year and in his journal, which discussed the method of Commissioners with the result was that Commissioners' reserves with the Woolhouse formula produced larger reserves than Commissioners' reserves with annual payments, because influenced by the size of the premiums,

and in the last major year the reserves were equal to the amount of money owed. The main difference between the two categories is that personal insurance is usually given to individuals/families with a maximum of five members, parents, and three children. The premiums are usually higher than the joint health insurance, whereas in integrated health insurance the community that participates and the premiums paid are usually lower. This is because the risk of a claim being shared equally among all individuals in the group. The Commissioners' Method with the Woolhouse Formula, as a tool for calculating premiums in futures health insurance, has advantages and disadvantages that need to be noted. One of the main advantages of this method is its ability to accommodate variability in insurance claims data by considering risk factors and risk variability directly. The Woolhouse formula provides a relatively simple method and can be easily implemented by insurance companies. However, a number of shortcomings also need to be noted. First, this method can be complex when dealing with highly fluctuative data, and requires a thorough understanding of the statistical parameters used. Besides, the Woolhouse Formula may be less flexible in responding to changes in the business environment and evolving risk structures. Another advantage is that this method gives special attention to individual risk factors, which can provide a more accurate picture of the level of risk of participants. Furthermore, the use of mathematical formulas in this method can improve the accuracy of the calculation of the premiums. However, the main weakness may lie in the need for complete and accurate data to produce reliable calculation results. If the data used is incomplete or less accurate, it can lead to uncertainty in the outcome of premiums calculation. The researchers identified the Commissioners method that is a modified method that can minimize the high costs in the first year that occurred on the previous method due to the value of its reserves equal to zero which only sufficiently covers the operating costs of the first one year. The Commissioners' method with the Woolhouse formula has more reserves than the Commissioner's method with annual payments which would be better if the reserves were more so that it could reduce the risk of the company if at some point it could not return the amount agreed with the insured, and further the authors chose to use futures health insurance because there has not been any research that uses the Futures Health Insurance for Commissioners's methods with the formula.

Based on the results of some of the studies that have been described, it can be concluded that comparisons of the result of the calculation of the health insurance premiums reserves using several methods that have already been shown result in different levels of effectiveness. Since there are still some methods of calculating premiums that have not been compared, the researchers are interested in comparing premiums by using the commissioners method with the woolhouse formula on health insurance. Moreover, because in previous studies using the calculation of annual premiums, the calculations seem less realistic, so in this study the author will use the calculating of premiums. Reviewed from some of the aspects that have been described then the author took the title on “Analysis of Calculation of Provisional Health Insurance Prices Using Commissioners Method with Woolhouse Formula”.

## 2. Methods

The type of research used in this research is applied research. The approach used in writing this research is a quantitative approach, i.e. an approach that uses a lot of numbers, ranging from data collection, data calculation, interpretation of the data, as well as the appearance of the results. The theory in comparing it is based on the size of the small value of the premium reserves. The larger the value of a premium reserve using a method, the more effective the method is being used because the greater the cost of the reserves prepared by the company to anticipate the occurrence of unexpected claims.

### Variables and Definitions of Operational Variables

The variables and operational definitions of these variables are as follows:

- a.  $x$ , is the age of the policy holder or insured at the time of registering insurance,
- b.  $n$ , is the insurance participation period carried out by the policy holder which has been approved at the beginning of insurance,
- c.  $h$ , is the premium payment period that will be used in calculating the annuity,
- d.  $t$ , is the time to calculate the premium reserve payment,
- e.  $m$ , is the number of payments insured makes in one year.

### Research Procedures

This research has several steps in the research procedure which can be explained as follows:

1. Knowing the age of the policy holder ( $x$ ), the period of time for taking insurance ( $n$ ), the period of premium payments ( $h$ ) and the number of payments made in one year ( $m$ ).
2. Determine the interest rate and type of mortality table used.
3. Find out a person's chance of survival and chance of death which can be seen in the mortality table.
4. Calculating term life annuity using the Woolhouse formula using equation.

$$\ddot{a}_{x+t:\overline{n-t}|}^{(m)} = \frac{N_{x+t}-N_{x+h}}{D_{x+t}} - \frac{m-1}{2m} (1 - v^{h-t} {}_{h-t}p_{x+t}) - \frac{m^2-1}{12m^2} (\delta + \mu_{x+t} - v^{h-t} {}_{h-t}p_{x+t} (\delta + \mu_{x+h}))$$

5. Calculating a single health insurance premium using the Woolhouse formula using equation.

$$A_{x+t:\overline{n-t}|}^{(m)} = 1 - d^{(m)} \left( \frac{N_{x+t}-N_{x+h}}{D_{x+t}} - \frac{m-1}{2m} (1 - v^{h-t} {}_{h-t}p_{x+t}) - \frac{m^2-1}{12m^2} (\delta + \mu_{x+t} - v^{h-t} {}_{h-t}p_{x+t} (\delta + \mu_{x+h})) \right) - v^{n-t} {}_{n-t}p_{x+t}$$

6. Calculate the annual premium for term health insurance using the Woolhouse formula using equation.

$${}^hP_{\dot{x}:\overline{n}|}^{(m)} = \frac{1 - d^{(m)} \left( \frac{N_x - N_{x+n}}{D_x} \right) v^n {}_n p_x}{\frac{N_x - N_{x+h}}{D_x} - \frac{m-1}{2m} (1 - v^h) {}_h p_x - \frac{m^2-1}{12m^2} (\delta + \mu_x - v^h) {}_h p_x (\delta + \mu_{x+h})}$$

7. Calculating the modification premium using the Commissioner's method using equation.

$$\beta^{com(m)} = {}^hP_{\dot{x}:\overline{n}|}^{(m)} + \frac{{}^{h-1}P_{x+1}^{(m)} - C_x^{(m)}}{\ddot{a}_{x:\overline{h}|}^{(m)}}$$

8. Calculating the reserve value of term health insurance premiums using the Commissioners method with the Woolhouse formula using equation for  $t < h$ , namely:

$${}^hV_{\dot{x}:\overline{n}|}^{com(m)} = A_{\dot{x}+t:\overline{n-t}|}^{(m)} - \beta^{com(m)} \ddot{a}_{x+t:\overline{n-t}|}^{(m)}$$

And equation  $t \geq h$

$${}^hV_{\dot{x}:\overline{n}|}^{com(m)} = A_{\dot{x}+t:\overline{n-t}|}^{(m)}$$

9. Obtaining the reserve value of term health insurance premiums using the Commissioner's method with the Woolhouse formula.

### 3. Result and Discussion

#### A. Result

The results of this study are as follows:

1. Knowing the age or policyholder ( $x$ ), the duration of the insurance ( $n$ ), the period of payment of premiums ( $h$ ) and the number of payments made in a year ( $m$ ). In this study the age of the policyholder is 35 years up to 40 years. In the calculation of this study, it is assumed that a Bumida General Insurance company issued a health insurance product with a 35-year liability period. The product provides a penalty of Rs.20,000,000 in the amount of payments made 3 months once in a year if the customer died while still in the liability term or remained alive until the liabilities period ended. A client is a 35-year-old male.
2. Set the interest rate, mortality rate and mortality table to be used.

##### a) Interest rate

The applicable interest rate is the rate of interest provided by the Bank of Indonesia at the time of conducting the research, which is 6.75% per annum so that for  $m = 3$  the rate is 2.25%.

##### b) Large assembly

The amount of the assumption is Rs. 20,000,000.

c) Type of Mortality Table

In this study, the type of mortality table applied as a reference to calculate premiums and premiums reserves is the Indonesian Mortality Table of 2019 Special Men – Men.

1. Knowing the chances of life and the odds of death

The chances of survival and death of a person can be seen on the Indonesian mortality table as follows:

Table 1 Mortality Indonesia 2019

x	qx (laki-laki)	px	lx	sx	dx	ex
0	0.00524	0.99476	100000	1	524	78.39904
1	0.00053	0.99947	99476	0.99947	576.72228	77.81201
2	0.00042	0.99958	99423.27772	0.99958	94.48006	76.85328
3	0.00034	0.99966	99381.51994	0.99966	75.54749	75.88557
4	0.00029	0.99971	99347.78023	0.99971	62.60056	74.91138
5	0.00026	0.99974	99318.91938	0.99974	54.63376	73.93311
6	0.00023	0.99977	99293.09647	0.99977	48.66033	72.95234
7	0.00021	0.99979	99270.25905	0.99979	43.68417	71.96912
8	0.0002	0.9998	99249.41230	0.9998	40.69664	70.98424
9	0.0002	0.9998	99229.56242	0.9998	39.69579	69.98844
10	0.00019	0.99981	99209.71050	0.99981	38.69576	69.01244
11	0.00019	0.99981	99190.86666	0.99981	37.69611	68.02555
12	0.00019	0.99981	99172.02039	0.99981	37.68895	67.03848
13	0.0002	0.9998	99153.17771	0.9998	38.67332	66.05122
14	0.00023	0.99977	99133.34707	0.99977	42.63131	65.06443
15	0.00027	0.99973	99110.54640	0.99973	49.56052	64.0794
16	0.00031	0.99969	99083.78656	0.99969	57.47582	63.09671
17	0.00037	0.99963	99053.07058	0.99963	67.36561	62.11627
18	0.00043	0.99957	99016.42095	0.99957	79.22670	61.13927
19	0.00047	0.99953	98973.84389	0.99953	89.09477	60.16557
20	0.00049	0.99951	98927.32618	0.99951	94.99210	59.19386
21	0.00049	0.99951	98878.85179	0.99951	96.92503	58.22288
22	0.00049	0.99951	98830.40115	0.99951	96.87753	57.25142
23	0.00049	0.99951	98781.97426	0.99951	96.83006	56.27949
24	0.0005	0.9995	98733.57109	0.9995	97.76995	55.30708
25	0.00052	0.99948	98684.20430	0.99948	100.68257	54.33474
26	0.00055	0.99945	98632.88852	0.99945	105.56387	53.36301
27	0.0006	0.9994	98578.64043	0.9994	113.39527	52.39238
28	0.00065	0.99935	98519.49324	0.99935	123.18485	51.42383
29	0.0007	0.9993	98455.45557	0.9993	132.95649	50.45728
30	0.00075	0.99925	98386.53675	0.99925	142.70872	49.49263
31	0.00081	0.99919	98312.74685	0.99919	153.42323	48.52977
32	0.00087	0.99913	98233.11353	0.99913	165.09613	47.56911
33	0.00093	0.99907	98147.65072	0.99907	176.74012	46.61054
34	0.00099	0.99901	98056.37340	0.99901	188.35312	45.65392
35	0.00107	0.99893	97959.29759	0.99893	201.89226	44.69917
36	0.00116	0.99884	97854.48114	0.99884	218.32765	43.74705
37	0.00127	0.99873	97740.96995	0.99873	237.64223	42.79785
38	0.00139	0.99861	97616.83891	0.99861	259.81844	41.85227
39	0.00155	0.99845	97481.15151	0.99845	286.78319	40.91053
40	0.00173	0.99827	97330.0572	0.99827	319.47678	39.97404
41	0.00193	0.99807	97161.67473	0.99807	355.90303	39.04331
42	0.00216	0.99784	96974.15269	0.99784	396.98620	38.11881
43	0.00241	0.99759	96764.68852	0.99759	442.66707	37.20133

B. Discussion

In this research, insurance premium reserves will be calculated using two methods. Health insurance provides guarantees to the insured to reimburse any medical costs, including medical procedures, surgeries, medications, and dental care costs.

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Table 2 Annuity Calculation Results

$t$	$at^{(m)}_{x+t-1 }$
1	18,94728
2	18,709067
3	18,57142
4	17,999212
5	17,916518
6	17,247593
8	16,857273
9	16,454374
10	15,61718
11	15,23216
12	14,73509
13	14,27873
14	13,81186
15	13,25562
16	12,84673
17	11,89494
18	11,84092
19	11,32122
20	10,78889
21	10,24275
22	10,13824
23	9,101142
24	8,50301
25	7,88332
26	7,24073
27	6,57299
28	5,87857
29	5,09011
30	4,39969
31	3,94038
32	2,52373
33	1,906843
34	0,966709
35	0

In this research, a case example is provided as a simulation to calculate premium reserves for term health insurance using the Commissioner's method with the Woolhouse formula. Before performing the calculation, it is essential to determine the age of the policyholder, the annuity, the premium, the number of payments, the interest rate, and the compensation provided by the insurance company. In the simulation, a 35-year-old person participates in term health insurance for five years, with insurance payments made over 35 years and payments made every three months. The interest rate is 2.25% or 0.00225, with compensation worth IDR 20,000,000, the mortality table used is the Indonesian Mortality Table of 2019, specifically for men. This table provides data needed to calculate premium reserves, such as the age of the insured (symbolized as  $x$ ), the probability of survival for a person aged  $x$  years ( $p_x$ ), and the number of people living to the age of  $x$  years ( $l_x$ ).

After obtaining the required data, the next step is to calculate the annuity value. Before this calculation, the commutation symbol values are determined to simplify the insurance calculations. To determine the commutation symbol values, the cash value of a person aged  $x$  years ( $v_x$ ) is first calculated, referring to an interest rate of 2.25%, the number of people who live to the age of  $x$  years ( $l_x$ ), and the number of people who die between ages  $x$  and  $x+1$  ( $dx$ ), based on the 2019 Indonesian Mortality Table. After calculating for  $t = 1$ , the value is 18.709067, which decreases until  $t = 35$ , where it is 0.



Table 3 Single premium health insurance

t	A (Rp)
1	5.363.920
2	5.910.460
3	6.704.200
4	6.735.800
5	6.779.440
6	6.805.900
7	6.857.460
8	6.896.200
9	6.936.280
10	6.975.500
11	6.991.000
12	7.050.220
13	7.084.294
14	7.115.120
15	7.162.000
16	7.163.480
17	7.379.600
18	7.185.400
19	7.184.500
20	7.175.040
21	7.156.400
22	7.128.660
23	7.090.222
24	7.043.580
25	6.985.840
26	6.916.720
27	6.834.660
28	6.777.400
29	6.650.300
30	6.483.740
31	6.319.986
32	6.126.600
33	5.900.000
34	5.635.600
35	5.160.322
36	4.971.800
37	4.553.740
38	4.052.580
39	2.251.172
40	0

For a single premium with  $t = 1$ , the value is IDR 5,363,920, which increases until  $t=17$ , amounting to IDR 7,379,600, and then begins to decrease until  $t = 40$ , amounting to IDR 0. For annual payments, the income is IDR 179,277, and the modified premium obtained is IDR 179,524.

Table 4 Calculation of premium reserves

t	Cadangan Premi Asuransi Jiwa Berjangka Menggunakan Metode Commissioner dengan Formula Woodhouse
1	Rp. 1.971.444
2	Rp. 2.551.600
3	Rp. 3.370.000
4	Rp. 3.504.500
5	Rp. 3.562.980
6	Rp. 3.722.120
7	Rp. 3.831.160
8	Rp. 3.942.220
9	Rp. 4.056.500
10	Rp. 4.171.820
11	Rp. 4.256.455
12	Rp. 4.491.191
13	Rp. 4.520.913
14	Rp. 4.635.554
15	Rp. 4.783.192
16	Rp. 4.857.178
17	Rp. 5.059.665
18	Rp. 5.152.068
19	Rp. 5.224.208
20	Rp. 5.238.170
21	Rp. 5.308.698
22	Rp. 5.317.580
23	Rp. 5.457.342
24	Rp. 5.517.082
25	Rp. 5.564.751
26	Rp. 5.616.832
27	Rp. 5.654.641
28	Rp. 5.722.053
29	Rp. 5.756.501
30	Rp. 5.693.088
31	Rp. 5.673.528
32	Rp. 5.612.385
33	Rp. 5.557.675
34	Rp. 5.329.400
35	Rp. 5.160.322
36	Rp. 5.155.852
37	Rp. 4.944.866
38	Rp. 4.665.199
39	Rp. 3.987.053
40	0

After determining the annuity values, single premiums, annual premiums, and modified premiums, the reserve value of term health insurance premiums is calculated using the Commissioner's method with the Woolhouse formula. For  $t = 1$ , the reserve value is IDR 1,971,444, for  $t = 2$  it is IDR 2,551,600, for  $t = 3$  it is IDR 3,370,000, for  $t = 4$  it is IDR 3,504,500, and it continues to increase until  $t = 29$ , reaching IDR 5,736,501. The value starts to decrease slightly as the end of the payment year approaches, reaching IDR 5,160,322 at  $t = 35$ , and then rapidly decreases after premium payments stop, with  $t = 36$  at IDR 5,155,852,  $t = 37$  at IDR 4,944,866,  $t = 38$  at IDR 4,663,199,  $t = 39$  at IDR 3,987,053, and ending at  $t = 40$  with IDR 0, indicating the insurance period has ended.

Based on the calculations that have been made, a chart will be displayed to observe the results obtained from the premiums reserve value of the early age of the insured.

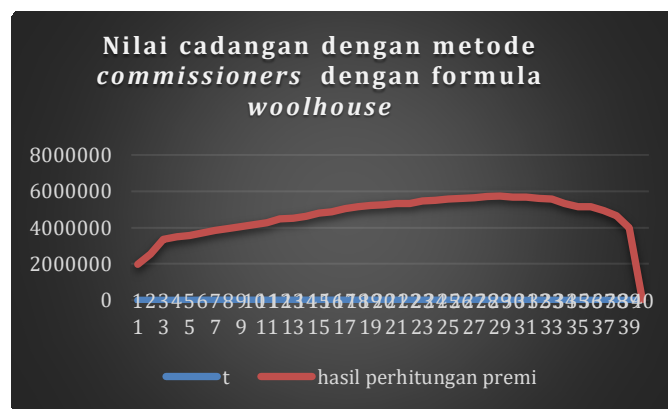


Figure 1 Result Calculation

Figure 1 Graph results of the calculation of the insurance premiums reserve with the commissioners method with the woolhouse formula at the interest rate of 2.25% Based on figure 1, it can be seen that when the early age of the insured with  $t = 29$  yields a greater reserve value when compared with other payment times. In future health insurance, the policyholder will receive a bail if he dies before the period following the insurance expires, which is what causes the value of the premiums at  $t = 40$  worth Rs. 0 which has been assumed the bail to be paid by the company has been received by the policy holder at the time of the policemaker's death. Thus, the value of the reserves obtained by the insurance companies that the insurance company will obtain will decrease as a person ages. This is because the mortality rate of old age tends to be higher than that of young age. It shows that the reserve of health insurance premiums using the commissioners method with the woolhouse formula is more effective with the case of this research.

#### 4. Conclusion

Based on the research and calculations, it can be concluded that the value of health insurance term premium reserves using the Commissioner's method with the Woolhouse Formula for a 35-year-old person is IDR 1,971,444 for  $t = 1$ , increasing to IDR 5,736,501 at  $t = 29$ , and then slightly decreasing to IDR 5,160,322 at  $t = 35$ . The premium reserve experiences a significant decrease when premium payments cease, ending at IDR 0 at  $t = 40$ , marking the end of the insurance period. The author suggests that future research could explore other types of insurance, such as motor vehicle insurance, social security, or labor insurance. This research focused on premium reserves, and future studies could investigate claims reserves. Additionally, other methods such as the Canadian, Illinois, or Full Preliminary Term methods could be explored alongside the Commissioner's method with the Woolhouse Formula.

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