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A COMPARATIVE STUDY OF ANNUAL PREMIUM RESERVE DYNAMICS IN TERM AND WHOLE LIFE INDIVIDUAL HEALTH INSURANCE USING THE PROSPECTIVE METHOD

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ABSTRACT

Premium reserve management is an important aspect of health insurance because inaccurate reserve calculations may affect an insurer's ability to meet future claim obligations. This study aims to calculate and compare annual premium reserves for individual health insurance under two types of insurance products, namely term insurance and whole life insurance, using the Prospective Method. The analysis was conducted through a simulation involving a family of three consisting of a father aged 40 years, a mother aged 36 years, and a son aged 9 years. The calculations were based on the CSO 1941 mortality table, an annual interest rate of 2.5%, and health insurance benefits covering Rp 200.000 per day for hospital room charges, Rp 75.000 per day for physician visits with a maximum of 180 days, and Rp 4.000.000 per treatment period for medical expenses. The results indicate that the annually renewable premium increases with the insured's age, with the total premium rising from Rp 704.060 in the first year to Rp 1.196.260 in the tenth year. The reserve values obtained using the Prospective Method show different patterns for the two insurance products. Premium reserves for term insurance gradually decrease over the policy period and reach zero at the end of the contract, whereas premium reserves for whole life insurance increase continuously from year to year. These findings demonstrate the different reserve characteristics of term and whole life insurance and provide useful actuarial information for insurers in planning and managing long-term reserve funds.

Keywords: *Health insurance, Individual insurance, Premium reserves, Prospective reserves*

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INTRODUCTION

Insurance is a form of agreement between the insured (policyholder) and the insurer (insurance company) where the insurance company agrees to bear the risks that will occur to the insured in the future. Meanwhile, according to the Financial Services Authority, insurance is an agreement between an insurance company and a policyholder within a certain period (Pardede et al., 2024). Every insurance participant is obliged to pay a premium. Premiums are contributions that must be paid every month or year in accordance with the contract that has been approved by insurance participants for participation in the insurance programme. Insurance premiums are used to cover insurance costs at the beginning of the year for making insurance policy, medical examination of insurance participants, payment of agent commissions, unexpected compensation, and others (Ariani et al., 2020).

Health insurance is a financial tool that provides funds for the cost of treating the member's hospitalisation of the insured member and his/her family while he/she is unable to work. Through health insurance, the cost of medical treatment and hospital care borne by a person will be reimbursed by the insurance company (Hetharie et al., 2018). The purpose of health insurance is to obtain health benefits, in return for the benefits provided by the insurance company. In the health insurance , the customer pays a premium to the insurance company which is generally paid annually (Rosita & S, 2024).

Every individual needs coverage so that when they need medical treatment, the burden of high costs is not an obstacle. In this case, health insurance plays a vital role as a means to ease the burden of medical treatment costs, both for inpatient and outpatient care. Health insurance provides a guarantee to policyholders that they will receive financial protection in the face of expensive treatment costs. However, while health insurance may seem like an ideal solution, there are issues that arise mainly related to the premiums that must be paid. Health insurance premiums, which are usually paid annually or monthly, increase as the policyholder ages (Kurnianingtyas et al., 2021).

Not a few insurance companies have suffered losses because the company has not been precise in managing its insurance premium reserves. in managing its insurance premium reserves. As a result, the insurance company is unable to pay the sum insured to the insured party when a claim occurs before maturity. This situation can be anticipated by determining the right premium reserves (Hetharie et al., 2018).

The reserve fund is determined by actuarial techniques, specifically retrospective and prospective procedures. The insurance company offers two types of life insurance products: group insurance products and individual insurance products (Kurnianingtyas et al., 2021). Using the prescribed methodology, the business has computed premium reserves for these two goods. Insurance is an agreement between the policyholder and the insurance company, in which the policyholder pays premiums in exchange for financial protection against specified risks. In the context of health insurance, companies need to offer products that provide tangible value to policyholders. Such value may include long-term coverage guarantees at an affordable premium and access to quality hospital services. These features can increase the attractiveness of health insurance products while meeting the financial protection needs of policyholders (Fatimah et al., 2024).

Insurance of life is one of the most important insurance’s types because every human being need health or others things about life. Life insurance companies all as the contractual saving institutions in addition to offer a social protection to economic agents are specialized in mobilization of domestic savings from many small investors; and to channel it to productive investment opportunities (Raiyan & Nathanael, 2024).

The main issues in this study are how the calculation of annual premiums for individual health insurance using the prospective method can affect the amount of premiums that must be paid by policyholders, as well as how these premiums differ between term insurance and whole life insurance. This research also aims to explore more about the prospective method in calculating premium reserves, which focuses on future expenses. The prospective method provides a premium reserve calculation projected future expenses, which means that the calculation results are more quickly obtained when the premium is paid. However, as policyholders age, premium expenses tend to increase, making it important to assess whether this method is fair and efficient in the long run (Jannah et al., 2022).

The main objective of this study is to provide a more comprehensive view of how health insurance premiums are calculated, especially in the context of increasing age which has an impact on increasing premiums. In addition, this study will examine the differences between term insurance and whole life insurance. Specifically, term insurance products are typically structured with Annually Increasing Premiums during the renewal period (renewable term) as the policyholder ages, reflecting increased mortality risk; conversely, whole life insurance products feature Level (Constant) Premiums fixed at policy inception that remain unchanged throughout the policyholder's lifetime, providing premium certainty and long-term financial predictability. This research is expected to provide a more effective solution in determining a fair premium amount for policyholders by taking into account the age factor and the type of insurance chosen (Khoa & Huynh, 2023).

The benefits of this research are not only to provide more in-depth knowledge. The results of this study are expected to help them make better decisions in choosing health insurance products that suit their needs and conditions, but also provide practical contributions for insurance companies in determining the right strategy in offering insurance products (Pardede et al., 2024). For the public, the results of this study are expected to help them make better decisions in choosing insurance products that suit their needs and conditions. Thus, this study has relevance for insurance practitioners and also for the wider community who rely on health insurance as financial protection from future health risks.

MATERIALS AND METHODS

Life Annuity

A life annuity is a series of periodic payments made as long as a person is alive (Ariani et al., 2020). The present value of a whole life annuity for a person aged x is (Akbar et al., 2025)

$$\ddot{a}_x = \frac{N_x}{D_x} \tag{2.1}$$

for a term life annuity the initial term life annuity cash value is

$$\ddot{a}_{x:n]} = \frac{N_x - N_{x+n}}{D_x} \tag{2.2}$$

Insurance

Insurance is a mechanism where individuals accept small, certain costs today to mitigate potentially large, uncertain losses in the future Clarissa et al., 2024). Rooted in the word assurance (promise/insurer), this economic concept mathematically functions as a numerical process to calculate the gains and losses of risk coverage (Raiyan & Nathanael, 2024)

Life Insurance

Life insurance mitigates the financial risks associated with unpredictable human longevity, specifically premature death or outliving one's resources (Khoa & Huynh, 2023). Under this contractual agreement, the policyholder pays regular premiums to ensure that the insurer delivers a designated payout upon their death. In the case of whole life insurance, these payments also accumulate cash value over time (Rosita & S, 2024).

The net single premium for whole life insurance is :

$$A_x = \frac{M_x}{D_x} \tag{2.3}$$

The cash value for discrete term life insurance is given by :

$$A^1_{x:n]} = \frac{M_x - M_{x+n}}{D_x} \tag{2.4}$$

for n-year endowment life insurance for a person aged x is

$$M_{x:n]} = \frac{M_x - M_{x+n} + D_{x+n}}{D_x} \tag{2.5}$$

(Hetharie et al., 2018)

Mortality Table

The life table, commonly known as the mortality table, is a crucial tool in life insurance, as it determines the premium rates for policyholders. This table contains information about the likelihood of an individual's death based on age. Therefore, the most important column in the mortality table is the ${}_nq_x$ column, where ${}_nq_x$ represents the probability of a person dying at age x before reaching age $x + n$. The components of the mortality table used in this study are $D_x, N_x, C_x, and\ M_x$.

Health Insurance

For an insured individual aged x with an average number of claims T^{sh} and a 1 unit benefit, the probability of health insurance utilization shifts over time from qx^{sh} in year one, to qx+1sh in year two, and qx+2sh in year three, compounded by survival probabilities $1Px$ and $2Px$ respectively (Douven et al., 2018; Hetharie et al., 2018) **.** Projecting this pattern over an n-year period, the net single premium for individual health insurance is formulated as follows (Hetharie et al., 2018) :

$$= v^{\frac{1}{2}} q_x^{sh} T^{sh} + v^{1+\frac{1}{2}} {}_1p_x q_{x+1}^{sh} T^{sh} + v^{2+\frac{1}{2}} {}_2p_x q_{x+2}^{sh} T^{sh} + \cdots + v^{(n-1)+\frac{1}{2}} {}_{(n-1)}p_x q_{x+(n-1)}^{sh} T^{sh}$$

$$= T^{sh} (v^{\frac{1}{2}} q_x^{sh} + v^{1+\frac{1}{2}} {}_1p_x q_{x+1}^{sh} + v^{2+\frac{1}{2}} {}_2p_x q_{x+2}^{sh} + \cdots + v^{(n-1)+\frac{1}{2}} {}_{(n-1)}p_x q_{x+(n-1)}^{sh})$$

$$= \boldsymbol{T^{sh} \sum_{t=0}^{n-1} v^{t+\frac{1}{2}} {}_t p_x q_{x+t}^{sh}} \quad (2.6)$$

If the premium is annual, then the formula can be expressed as $P\ \ddot{a} = A$

$$P\ \ddot{a}_{x:n]} = A = T^{sh} - \sum_{t=0}^{n-1} v^{t+\frac{1}{2}} {}_t p_x q_{x+t}^{sh}$$

$$P = \frac{T^{sh} \sum_{t=0}^{n-1} v^{t+\frac{1}{2}} \frac{l_{x+t}}{l_x} q_{x+t}^{sh}}{\frac{N_x - N_{x+n}}{D_x}}$$

$$P = \frac{T^{sh} \sum_{t=0}^{n-1} v^{t+\frac{1}{2}} \frac{l_{x+t}}{l_x} q_{x+t}^{sh} D_x}{N_x - N_{x+n}}$$

$$\boldsymbol{P = \frac{T^{sh} \sum_{t=0}^{n-1} v^{x+t+\frac{1}{2}} l_{x+1} q_{x+t}^{sh}}{N_x - N_{x+n}}} \quad (2.7)$$

Annual Premium

Paid at the beginning of each year, the annual life insurance premium annual premium (P_x) is derived from the standard actuarial equivalence principle $P_x . \ddot{a}_x = A_x$ which yields

$$\boldsymbol{P_x = \frac{A_x}{\ddot{a}_x} = \frac{M_x}{N_x}}, \quad (2.8)$$

The annual premium for term insurance is calculated based on the formula $P^1_{x:n]} . \ddot{a}_{x:n]} = A^1_{x:n]}$, and obtained

$$P^1_{x:n]} = \frac{A^1_{x:n]}}{\ddot{a}_{x:n]}} = \frac{M_x - M_{x+n}}{N_x - N_{x+n}}$$

(Fatimah et al., 2024)

The annual premium for endowment insurance is calculated based on the formula $P_{x:n]} . \ddot{a}_{x:n]} = A_{x:n]}$, and obtained (Akbar et al., 2025)

$$\boldsymbol{P_{x:n]} = \frac{A_{x:n]}}{\ddot{a}_{x:n]}} = \frac{M_x - M_{x+n} + D_{x+n}}{N_x - N_{x+n}}} \quad (2.9)$$

Prospective Reserves

Utilizing the Prospective Method, this study calculates reserves by subtracting the present value of projected future premium income from the present value of expected future benefits. This forward-looking approach efficiently provides rapid results once premiums are fully paid (Reisnanda & Subartini, 2024). The first-year premium reserve equation is formulated as follows:

$${}_1V_x = \frac{v.d_{x+1} + v^2.d_{x+2} + \cdots + v^n.d_{x+n}}{l_{x+1}} - \frac{P(l_{x+t} + v.l_{x+2} + \ldots + v^{n-1}.l_{x+n})}{l_{x+1}}$$

The prospective premium reserve for whole life insurance is

$${}_tV = A_{x+t} - P_x . \ddot{a}_{x+t}$$

and get the equation

$${}_tV = \frac{M_{x+t}}{D_{x+t}} - P_x . \frac{N_{x+t}}{D_{x+t}}$$

Term insurance prospective premium reserves are, (Akbar et al., 2025)

$$\boldsymbol{{}_1V = A^1_{x+t:,n-t} - P^1_{x:n} . \ddot{a}_{x+t:n-t}}$$

$$\boldsymbol{{}_tV = \frac{M_{x+t} - M_{x+n}}{D_{x+t}} - P^1_{x:n} . \frac{N_{x+t} - N_{x+n}}{D_{x+t}}}, \quad (2.10)$$

Table 1. Mathematical notations and symbols used throughout this study

Notation	Description
x	Age of the insured (in years)
n	Policy period / insurance duration (in years)
t	Time elapsed since policy inception (in years)

v	Discount factor = $\frac{1}{1+i}$, where i is annual interest rate
i	Annual interest rate (2.5% in this study)
S	Benefit / sum insured (Rp per day or per period)
Tsh	Average number of individual health insurance claims per year
qx	Probability of death at age x (from mortality table)
qx^{sh}	Probability of using individual health insurance at age x
tpx	Probability of surviving t years from age x
lx	Number of survivors at age x (from mortality table)
dx	Number of deaths at age x (from mortality table)
Dx	Commutation function: $Dx = v^x \cdot lx$
Nx	Commutation function: $Nx = \Sigma\, Dx + t$ (sum from t=0 to ∞)
Mx	Commutation function: $Mx = \Sigma\, Cx + t$ (sum from t=0 to ∞)
Cx	Commutation function: $Cx = v^{x+1} \cdot dx$
ax	Present value of whole life annuity for age x: $ax = \frac{Nx}{Dx}$
$ax{:}n$	Present value of n-year term life annuity: $ax{:}n = \frac{Nx - Nx+n}{Dx}$
Ax	Net single premium for whole life insurance: $Ax = \frac{Mx}{Dx}$
$Ax{:}n^1$	Net single premium for n-year term insurance: $Ax{:}n^1 = \frac{Mx - Mx+n}{Dx}$
$Ax{:}n$	Net single premium for n-year endowment insurance: $Ax{:}n = \frac{Mx - Mx+n + Dx+n}{Dx}$
P	Annual net premium
Px	Annual premium for whole life insurance: $Px = Mx/Nx$
$Px{:}n^1$	Annual premium for term insurance: $Px{:}n^1 = \frac{Mx - Mx+n}{Nx - Nx+n}$
$Px{:}n$	Annual premium for endowment insurance: $Px{:}n = \frac{Mx - Mx+n + Dx+n}{Nx - Nx+n}$
tV	Prospective premium reserve at time t
tVx	Whole life prospective reserve: $tVx = Ax + t - Px \cdot ax + t$
$tVx{:}n^1$	Term insurance prospective reserve: $tVx{:}n^1 = Ax + t{:}n - t^1 - Px{:}n^1 \cdot ax + t{:}n - t$
NSP	Net Single Premium

RESULTS AND DISCUSSION

Application Example

A family consists of a father aged 40 years, mother aged 36 years, a son aged 9 years bought a health insurance policy for $n = 10$ years with compensation (S) of $Rp.\,200.000$ per day for room charges and $Rp.\,75.000$ per day for the cost of doctor visits for a maximum of 180 days and $Rp.\,4.000.000$ for treatment costs per period per year (Hetharie et al., 2018)

a. If the premium is not renewed every year, the annual health insurance premium is:

1. **Father, 40 years old:**

$$P = \frac{T^{sh}\sum_{t=0}^{9}\bar{D}_{40+t}\,q_{40+t}^{sh}}{N_{40} - N_{50}}$$

$$= \frac{[(200.000 + 75.000) \times 180) + 4.000.000][(328.983{,}61 \times 0{,}00618) + (318.976{,}11 \times 0{,}00659) + \cdots + (244.624{,}00 \times 0{,}01145)]}{6.708.572{,}66 - 3.849.487{,}58}$$

$$= 447.380{,}06183 \approx Rp.\,447.380,-$$

2. **Mother, 36 years old:**

$$P = \frac{T^{sh}\sum_{t=0}^{9}\bar{D}_{36+t}\,q_{36+t}^{sh}}{N_{36} - N_{46}}$$

$$= \frac{[(200.000 + 75.000) \times 180) + 4.000.000][(370.968{,}10 \times 0{,}00486) + (360.161{,}02 \times 0{,}00515) + \cdots + (280.638{,}95 \times 0{,}00861)]}{8.128.447{,}43 - 4.881.357{,}04}$$

$$= 390.014{,}9219 \approx Rp.\,390.015,-$$

3. **Son, 9 years old:**

$$P = \frac{T^{sh}\sum_{t=0}^{9}\bar{D}_{9+t}\,q_{9+t}^{sh}}{N_9 - N_{19}}$$

$$= \frac{[(200.000 + 75.000) \times 180) + 4.000.000][(779.804{,}53 \times 0{,}00212) + (759.171{,}73 \times 0{,}00197) + \cdots + (612.917{,}42 \times 0{,}00230)]}{23.275.899{,}11 - 16.340.808{,}38}$$

$$= 111.198{,}86 \approx Rp.\,111.199 -$$

So, the annual net premium of individual health insurance for the family is as follows:

$$Rp.\,447.380 + Rp.\,390.015 + Rp.\,111.199 = Rp\ 948.594,-$$

b. If the premium is renewed every year, the annual health insurance premium is :

1. Father, 40 years old :

Year 1, age 40:

$$P = \frac{T^{sh}\bar{D}_{40}q_{40}^{sh}}{N_{40} - N_{41}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [328.983,61 \times 0,00618]}{6.708.572,66 - 6.379.589,04}$$

$= 330.629,989 \approx Rp\ 330.630$,-

Year 2, age 41 :

$$P = \frac{T^{sh}\bar{D}_{41}q_{41}^{sh}}{N_{41} - N_{42}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [318.976,11 \times 0,00659]}{6.379.589,04 - 6.060.612,93}$$

$= Rp\ 352.565$,-

Year 3, age 42 :

$$P = \frac{T^{sh}\bar{D}_{42}q_{42}^{sh}}{N_{42} - N_{43}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [328.983,61 \times 0,00618]}{6.708.572,66 - 6.379.589,04}$$

$= Rp\ 376.105$,-

The same equation will be continued in year 10.

Year 10, age 49 :

$$P = \frac{T^{sh}\bar{D}_{49}q_{49}^{sh}}{N_{49} - N_{50}}$$

$$P = \frac{[\{(200.000 + 75.000) \times 180) + 4.000.000] \times [244.624 \times 0,01145]}{4.094.111,59 - 3.849.487,58}$$

$= 612.574,9749 \approx Rp\ 612.575$,-

2. Mother, 36 years old:

Year 1, age 36:

$$P = \frac{T^{sh}\bar{D}_{36}q_{36}^{sh}}{N_{36} - N_{37}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [370.968,10 \times 0,00486]}{8.128.447,43 - 7.757.479,33}$$

$= Rp\ 260.010$,-

Year 2, age 37 :

$$P = \frac{T^{sh}\bar{D}_{37}q_{37}^{sh}}{N_{37} - N_{38}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [360.161,02 \times 0,00515]}{7.757.479,33 - 7.397.318,32}$$

$= 275.525,00765 \approx Rp\ 275.525, -$

Year 3, age 38 :

$$P = \frac{T^{sh}\bar{D}_{38}q_{38}^{sh}}{N_{38} - N_{39}}$$

$$P = \frac{[(200.000 + 75.000) \times 180) + 4.000.000] \times [349.566,91 \times 0,00546]}{7.397.318,32 - 7.047.751,41}$$

$= Rp\ 292.110$,-

The same equation will be continued in year 10.

Year 10, age 45 :

$$P = \frac{T^{sh}\bar{D}_{45}q_{45}^{sh}}{N_{45} - N_{46}}$$

$$P = \frac{[\{(200.000 + 75.000) \times 180) + 4.000.000] \times [280.638,95 \times 0,00861]}{5.161.996,00 - 4.881.357,04}$$

$= 460.634,983 \approx Rp\ 460.635$,-

3. Son, 9 years old:

Year 1, age 9 :

$$P = \frac{T^{sh}\overline{D}_9 q_9^{sh}}{N_9 - N_{10}}$$

$$P = \frac{[(200.000 + 75.000)\ \times 180) + 4.000.000] \times [779.804,53 \times\ 0,00212]}{23.275.899,11\ - 22.496.094,59}$$

$= 113.420,001 \approx Rp$ 113.420,-

Year 2, age 10:

$$P = \frac{T^{sh}\overline{D}_{10} q_{10}^{sh}}{N_{10} - N_{11}}$$

$$P = \frac{[(200.000 + 75.000)\ \times 180) + 4.000.000] \times [759.171,73 \times\ 0,00197]}{22.496.094,59 - 21.736.922,85}$$

$= 105.394,9986 \approx Rp$ 105.395,-

Year 3, age 11:

$$P = \frac{T^{sh}\overline{D}_{11} q_{11}^{sh}}{N_{11} - N_{12}}$$

$$P = \frac{[(200.000 + 75.000)\ \times 180) + 4.000.000] \times [739.196,60 \times\ 0,00191]}{21.736.922,85 - 20.997.726,25}$$

$= Rp$ 102.185,-

The same equation will be continued in year 10.

Year 10, age 18 :

$$P = \frac{T^{sh}\overline{D}_{18} q_{18}^{sh}}{N_{18} - N_{19}}$$

$$P = \frac{[\{(200.000 + 75.000)\ \times 180) + 4.000.000] \times [612.917,42 \times\ 0,0023]}{16.953.725,80 - 16.340.808,38}$$

$= Rp$ 123.050,-

The annual net premium of hospitalization health insurance for father, mother and son, renewed annually throughout the policy period, is presented in Table 2.

Table 2. Annual Premiums for the Father, Mother, and Son with Annual Renewal

Year	Father	Mother	Son	Total
1	Rp 330.630	Rp 260.010	Rp 113.420	Rp 704.060
2	Rp 352.565	Rp 275.525	Rp 105.395	Rp 733.608
3	Rp 376.105	Rp 292.110	Rp 102.185	Rp 770.400
4	Rp 401.785	Rp 310.835	Rp 102.720	Rp 815.340
5	Rp 430.140	Rp 330.630	Rp 105.930	Rp 866.700
6	Rp 460.635	Rp 352.565	Rp 110.745	Rp 923.945
7	Rp 493.805	Rp 376.105	Rp 115.025	Rp 984.935
8	Rp 530.185	Rp 401.785	Rp 117.165	Rp 1.049.135
9	Rp 569.240	Rp 430.140	Rp 120.432	Rp 1.119.812
10	Rp 612.575	Rp 460.635	Rp 123.050	Rp 1.196.260

Based on the calculations and results in Table 2 it is obtained that the annual premium renewed each year is increasing and is paid in the range of $Rp.$ 704.060 to $Rp.$ 1.196.260.

- Calculation of individual Term Health Insurance Premium Reserves for hospital care using the Prospective Method.

1. Father, Year 1, age 40 :

$${}_1V = \left(S.\frac{M_{41}-M_{50}}{D_{41}}\right) - \left(P^1_{40:10}.\frac{N_{41}-N_{50}}{D_{41}}\right)$$

$${}_1V = \left(S.\frac{M_{41}-M_{50}}{D_{41}}\right) - \left(\frac{M_{40}-M_{50}}{N_{40}-N_{50}}.\frac{N_{41}-N_{50}}{D_{41}}\right)$$

$$= \left(200.000.\frac{163.376,38-142.035,1}{318.976,11}\right) - \left(\frac{165.359,89-142.035,1}{6.708.572,66-3.849.487,58}.\frac{6.379.589,04-3.849.487,58}{318.976,11}\right)$$

$= 13.381,05 \ \approx$ Rp 13.381,-

Year 2 , age 41:

$_2V = \left(S.\frac{M_{42}-M_{50}}{D_{42}}\right) - \left(P^1_{40:10}.\frac{N_{42}-N_{50}}{D_{42}}\right)$

$_2V = \left(200.000.\frac{161.325{,}68-139.199{,}47}{309.145{,}51}\right) - \left(0.008158\,.\frac{6.060.612{,}93-3.849.487{,}58}{309.145{,}51}\right)$

$= 12.479{,}87 \approx$ Rp 12.480,-

2. Mother, Year 1, age 36:

$_1V = \left(S.\frac{M_{37}-M_{46}}{D_{37}}\right) - \left(P^1_{36:10}.\frac{N_{37}-N_{46}}{D_{37}}\right)$

$_1V = \left(S.\frac{M_{37}-M_{46}}{D_{37}}\right) - \left(\frac{M_{36}-M_{46}}{N_{36}-N_{46}}.\frac{N_{37}-N_{46}}{D_{37}}\right)$

$= \left(200.000.\frac{170.954{,}2-152.379{,}4}{360.161{,}02}\right) - \left(\frac{172.713{,}28-152.379{,}4}{8.128.447.43-4.881.357{,}04}\,.\frac{7.757.479{,}33-4.881.357{,}04}{360.161{,}02}\right)$

$= 10.314{,}66978 \approx$ Rp 10.315,-

Year 2,37 years old :

$_2V = \left(S.\frac{M_{38}-M_{46}}{D_{38}}\right) - \left(P^1_{36:10}.\frac{N_{38}-N_{46}}{D_{38}}\right)$

$_2V = \left(S.\frac{M_{38}-M_{46}}{D_{38}}\right) - \left(\frac{M_{36}-M_{46}}{N_{36}-N_{46}}.\frac{N_{38}-N_{46}}{D_{38}}\right)$

$= \left(200.000.\frac{169.144{,}51-152.379{,}4}{349.566{,}91}\right) - \left(\frac{172.713{,}28-152.379{,}4}{8.128.447.43-4.881.357{,}04}\,.\frac{7.397.318{,}32-4.881.357{,}04}{349.566{,}91}\right)$

$= 9.591{,}887 \approx$ Rp 9.592,-

3. Son, Year 1, age 9 :

$_1V = \left(S.\frac{M_{10}-M_{19}}{D_{10}}\right) - \left(P^1_{9:10}.\frac{N_{10}-N_{19}}{D_{10}}\right)$

$_1V = \left(S.\frac{M_{10}-M_{19}}{D_{10}}\right) - \left(\frac{M_9-M_{19}}{N_9-N_{19}}.\frac{N_{10}-N_{19}}{D_{10}}\right)$

$= \left(200.000\,.\frac{210.486{,}5-198.036{,}38}{759.171{,}73}\right) - \left(\frac{212.099{,}67-198.036{,}38}{23.275.899{,}11-16.340.808{,}38}\,.\frac{22.496.094{,}59-16.340.808{,}38}{759.171{,}73}\right)$

$= 3.279{,}905 \approx$ Rp 3.280,-

Year 2, 10 years old :

$_2V = \left(S.\frac{M_{11}-M_{19}}{D_{10}}\right) - \left(P^1_{9:10}.\frac{N_{11}-N_{19}}{D_{11}}\right)$

$_2V = \left(S.\frac{M_{11}-M_{19}}{D_{11}}\right) - \left(\frac{M_9-M_{19}}{N_9-N_{19}}.\frac{N_{11}-N_{19}}{D_{11}}\right)$

$= \left(200.000.\frac{209.027{,}75-198.036{,}38}{739.196{,}6}\right) - \left(\frac{212.099{,}67-198.036{,}38}{23.275.899{,}11-16.340.808{,}38}\,.\frac{21.496.094{,}6-16.340.808{,}38}{739.196{,}6}\right)$

$= 2.973{,}855 \approx$ Rp 2.974,-

Table 3. Premium Reserves for Term Health Insurance for Father, Mother and Son for 10 years

Year	Father (40 years old)	Mother (36 years old)	Son (9 years old)
1	Rp 13.381	Rp 10.315	Rp 3.280
2	Rp 12.480	Rp 9.592	Rp 2.974
3	Rp 11.466	Rp 8.788	Rp 2.671
4	Rp 10.329	Rp 7.891	Rp 2.359
5	Rp 9.052	Rp 6,895	Rp 2.026
6	Rp 7.622	Rp 5.788	Rp 1.666
7	Rp 6.022	Rp 4.558	Rp 1.280
8	Rp 4.233	Rp 3.194	Rp 876
9	Rp 2.234	Rp 1.680	Rp 448
10	Rp 0	Rp 0	Rp 0

The calculation results in Table 3 show that the annual premium reserves for both the father and son decrease continuously over time. This declining pattern reflects the actuarial principle of diminishing residual risk; as the policy nears maturity, the insurer's future obligations shrink because fewer years of coverage remain. Evaluated through the prospective method which offsets future benefits against future premiums the net liability for term insurance inevitably drops to Rp 0 at policy expiration. This is clearly demonstrated by the father's reserve, which decreases from Rp 13.381 in year one to Rp 0 by year ten, validating that term insurance is inherently self-liquidating. Operationally, this predictable decline enables insurers to release capital progressively, enhancing financial efficiency. Ultimately, this highlights the necessity for insurers to front-load reserves in the early stages of a term policy and systematically de-provision them as expiration approaches.

- Calculation of Lifetime Health Insurance Premium Reserves for individual hospital care using the Prospective Method.

1. **Father , Year 1, age 40 :**

$_1V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_1V = \left(S.\frac{M_{41}}{D_{41}}\right) - \left(\frac{M_{40}}{N_{40}}.\frac{N_{41}}{D_{41}}\right)$

$= \left(200.000\,.\frac{163.376,38}{318.976,11}\right) - \left(\frac{163.376,38}{6.708.572,66}.\frac{6.379.589,04}{318.976,11}\right)$

$= 102.437,5109 \approx$ Rp 102.438,-

Year 2 , age 4:

$_2V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_2V = \left(S.\frac{M_{42}}{D_{42}}\right) - \left(\frac{M_{40}}{N_{40}}.\frac{N_{42}}{D_{42}}\right)$

$= \left(200.000\,.\frac{161.325,68}{309.145,51}\right) - \left(\frac{163.376,38}{6.708.572,66}.\frac{6.060.612,93}{309.145,51}\right)$

$= 104.368,2905 \approx$ Rp 104.368,-

2. **Mother , Year 1, age 36 :**

$_1V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_1V = \left(S.\frac{M_{37}}{D_{37}}\right) - \left(\frac{M_{36}}{N_{36}}.\frac{N_{37}}{D_{37}}\right)$

$= \left(200.000\,.\frac{170.954,2}{360.161,02}\right) - \left(\frac{172.713,28}{8.128.447,43}.\frac{7.757.479,33}{360.161,02}\right)$

$= 94.931.63688 \approx$ Rp 94.932,-

Year 2 , age 37:

$_2V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_2V = \left(S.\frac{M_{38}}{D_{38}}\right) - \left(\frac{M_{36}}{N_{36}}.\frac{N_{38}}{D_{38}}\right)$

$= \left(200.000\,.\frac{169.144,51}{349.566,91}\right) - \left(\frac{172.713,28}{8.128.447,43}.\frac{7.397.318,32}{349.566,91}\right)$

$= 96.773.30392 \approx$ Rp 96.773,

3. **Son, Year 1**, **age 9**:

$_1V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_1V = \left(S.\frac{M_{10}}{D_{10}}\right) - \left(\frac{M_9}{N_9}.\frac{N_{10}}{D_{10}}\right)$

$= \left(200.000\,.\frac{210.486,5}{759.171,73}\right) - \left(\frac{212.099,67}{23.275.899,11}.\frac{22.496.094.59}{759.171,73}\right)$

$= 55.451.34696 \approx$ Rp 55.451,-

Year 2 , age 10:

$_2V = \left(S.\frac{M_{x+t}}{D_{x+t}}\right) - \left(P_x.\frac{N_{x+t}}{D_{x+t}}\right),$

$_2V = \left(S.\frac{M_{11}}{D_{11}}\right) - \left(\frac{M_9}{N_9}.\frac{N_{11}}{D_{11}}\right)$

$= \left(200.000\,.\frac{209.027,75}{739.196,60}\right) - \left(\frac{212.099,67}{23.275.899,11}.\frac{21.736.922,85}{739.196,60}\right)$

$= 56.555.11933 \approx$ Rp 56.555,-

Table 4. Lifetime Health Insurance Premium Reserves of Father, Mother and Son for 10 years

Year	Father (40 years old)	Mother (36 years old)	Son (9 years old)
1	Rp 102.438	Rp 94.932	Rp 55.451
2	Rp 104.368	Rp 96.773	Rp 56.555
3	Rp 106.319	Rp 98.639	Rp 57.697
4	Rp 108.288	Rp 100.527	Rp 58.869
5	Rp 110.274	Rp 102.438	Rp 60.063
6	Rp 112.276	Rp 104.368	Rp 61.278
7	Rp 114.292	Rp 106.319	Rp 62.514
8	Rp 116.320	Rp 108.288	Rp 63.779
9	Rp 118.359	Rp 110.274	Rp 65.070
10	Rp 120.407	Rp 112.276	Rp 66.389

Table 4 indicates that whole life insurance premium reserves for the father and son increase continuously each year. Unlike term insurance, whole life coverage represents a permanent liability. Under the prospective method, as the insured ages and mortality risk accelerates, the present value of projected benefits exceeds that of future premiums, requiring the insurer to accumulate reserves annually. For example, the father's reserves expand by 17% from Rp 102.438 in year one to Rp 120.047 by year ten. This progressive accumulation ensures level-premium structures remain self-supporting over an indefinite timeline, ultimately maintaining insurer solvency to honor lifetime obligations.

CONCLUSION

This study calculated and compared annual premium reserves for individual health insurance using the Prospective Method across term and whole life insurance products. The empirical results indicate that the annually renewable premium increases with the insured's age, with the total premium rising from Rp 704.060 in the first year to Rp 1.196.260 in the tenth year. Specifically, the annual premiums for the father, mother, and son all exhibited a continuous upward trend over the 10-year observation period due to escalating age-related risks.

Regarding the reserve dynamics, the values obtained using the Prospective Method show different patterns for the two insurance products. Premium reserves for term insurance gradually decrease over the policy period and reach zero at the end of the contract, both for the father, mother, and son, reflecting the systematic reduction in residual risk over time. Conversely, premium reserves for whole life insurance increase continuously from year to year, showing a significant accumulation across all family members to fund indefinite, long-term obligations.

In conclusion, these findings demonstrate the different reserve characteristics of term and whole life insurance and provide useful actuarial information for insurers in planning and managing long-term reserve funds. Future research can extend this analysis by incorporating dynamic interest rate assumptions, utilizing the updated Indonesian Mortality Tables, and analyzing the impact of inflation on reserve adequacy in long-term coverage scenarios.

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