

Modelling the life insurance needs using the human life value revision method

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Abstract. There are numerous methods to determine the appropriate amount of life insurance a person needs – it can be scientific or simplistic. Many life insurance agents and financial advisors simply rely on traditional rules of thumb using the multiple of income method. The more scientific methods are the needs analysis and the human life value. The needs analysis is regarded as the most commonly used sales tool and the human life value is the most agreed academic expression for the purpose of life insurance. However, there are several weaknesses of using both methods. By using needs analysis as a sales tool, the recommendation amount of life insurance would leave a person underinsured. Similar goes to the human life value method. Nevertheless, both methods can be improved with a few revisions. The post-death needs under the needs analysis must be revised to incorporate the reality that the family's standard of living changes over time. The projection of a changing standard of living is a part of human life value analysis. Therefore, this research looked into both methods and combines both concept of needs analysis and human life value to create a powerful methodology that provide adequate life insurance protection – a method we name it as '*the Human Life Value Revision Method*'.

1. Introduction

"How much life insurance does a person need?" This is a common question, but the answer can be quite complicated. This has been at the core of the dilemma of life insurance agents and financial advisers. They can merely guess using a simple multiple of current income or some of them turn to tools like life insurance or financial calculators that used scientific methods. The fact is, not all life insurance agents and financial advisers scientifically evaluate the life insurance cover needed for their clients and hence a professional basis has been lacking in life insurance selling. This is the reason why a person is frequently under or overinsured.

There are many different methods of calculating how much life insurance a person should carry, ranging from the simple to the complex. Many life insurance agents and financial advisors simply rely on traditional rules of thumb. A common rule is that a person life should be insured for a minimum of six to ten times of annual income [1]. An older person would use the lower end of the range and a younger person should consider insurance coverage at the higher end since they typically have less savings, fewer investments and modest amounts in their retirement plans. Clearly, this method is very simple, but it fails to take into account a person individual needs and obligations such as household demographics, past savings, social security offsets and housing expenses. It also ignores expected life

changes and individual preferences about sustaining the living standard of survivors. In addition, different life insurance agents may suggest different multiples.

The more scientific methods to determine the appropriate amount of life insurance a person should carry are the human life value and the needs analysis. The human life value concept was invented in 1927 by Solomon Huebner, to establish what a family would lose in income upon the death of the breadwinner of a family. This concept is not limited to life insurance in its application and has been used in many other area including judicial awards in accidental death and disability liability cases and key value of a man. This method uses four factors to determine how much life insurance will be needed to protect a family and assets. These factors are annual income and expenses, years left until retirement, and the expected value of the current ringgit at the end of this period due to inflation. Using these factors, a reasonably accurate assessment of the value of an income can be made. In mathematical terms, it is the net present value of a person potential future earnings for the rest of their working life.

The other scientific method commonly used by life insurance agents and financial advisors in calculating the amount of life insurance should be purchased is the needs analysis. It also has been used by most financial planning websites. A needs analysis looks at the sources of income and assets such as investments, social security and pension as a portfolio and relates those assets to needs that would have to be covered and determine any additional life insurance requirements.

Another way to calculate life insurance needs is using the economic approach which is based on the life-cycle model of saving and the canonical model of life insurance. The goal of the economic approach is to smooth household's living standards over their life-cycle and to ensure comparable living standards for potential survivors. In the economic approach, spending targets are endogenous. The targets are derived by calculating the most that each household can afford to consume in the present given that it wants to preserve that living standard into the future [2]. Economic Security Planner, known as *ESPlanner* software was developed by Douglas Bernheim, Jagadeesh Gokhale and Laurence Kotlikoff based on this approach [3]. The software calculates a person and his family's highest sustainable living standard and the amounts they need to save and insure to maintain their standard of living through time. However, the software requires a tremendous amount of data entry about the user's past, present and future financial life to begin the financial planning process.

2. Human Life Value and Needs Analysis as Scientific Methods to Estimate Life Insurance Needs

This research focuses on two scientific methods in determining the life insurance needs – the human life value and needs analysis. The human life value approach is more comprehensive insofar as it covers both specific and unforeseen needs. Whereas, the needs analysis covers only specific needs and its accuracy relies completely on the assumptions it uses to calculate the needs. Both methods are accepted practices used within the life insurance industry. According to John Scarborough in his article *the Balance of Life* that was published in *Advisor Today*, the most commonly used sales tool is the capital needs analysis and the human life value is the most agreed academic expression for the purpose of life insurance. This section presents an extensive review of both methods.

2.1. Human life value

The human life value concept is generally associated with life insurance. The concept however is not limited to insurance in its application and has been used in many other areas – an analysis of population to estimate the value of nation, life insurance programs, judicial awards in accidental death and disability liability cases, assessment of public policies and key value of a man.

One of the first attempts to estimate the monetary value of a human being was made in year 1691 by an English statistician, William Petty. He used the concept of human capital to determine the capital value of nation. The earliest reference to the human life value concept in life insurance was made by Jacob Greene in his book *An Agent's Work: How to Represent the Connecticut Mutual Life Insurance Company*. The book that was published in 1885 discussed the money value of human life as a foundation of life insurance. According to Greene, the money value of a person's life is the present

value of what he may fairly be able to earn in the future and during his probable life. If he dies, his family loses that sum just as really, as if they lost that much in any other form of property. His life is their property and that sum is the value. An insurance practitioner, John Holcombe had been one of the first to recognise the possibilities of the human life value concept as a basis for marketing insurance when he pointed it in a speech given at the National Association of Life Underwriters (NALU) convention of 1900. Three years later, when he had become president of Phoenix Mutual, Holcombe was invited to join in Yale University's first course in Insurance. He discussed the application of the human life value concept to life insurance in his first lecture and again in an address before the Economic Club of Providence, Rhode Island in January 1906.

The name most often associated with the human life value is Solomon Huebner. It was mainly through his efforts that the concept gained widespread recognition and acceptance. He began his discussion of the application of human life value concept to life insurance in his *Life Insurance* book published in 1915. In this book, he devoted a section of the *Capitalization of the Value of a Human Life and Indemnification of that Value*. The philosophy that governs his theory is that the family must be seen as a business, run according to business principles and protected against financial impairment or bankruptcy due to the loss of the spouse's life, which has a certain economic value. Huebner developed this concept further in 1927 with the publication of his *Economics of Life Insurance* book. In this book, he discussed the human life value concept as the economic basis of life insurance, the monetary importance of human life values, the need for scientific treatment and methods for appraisal. Huebner capitalised a person's contribution to his family over the period to retirement age, or to the end of his life expectancy.

In 1930, Louis Dublin and Alfred Lotka published a book in this area, *the Money Value of a Man*. They developed for life insurance business uses a series of tables, which should give the money value of persons at various ages, according to the amount of their earnings. These tables would be useful as a guide to life insurance agents in advising their clients, as a measure of what is in his effort to protect his family and as a measure of the cost of disease and premature death. The works of Dublin and Lotka represents a real contribution in that it was the first to be devoted entirely to an estimation of the human life values of the population and one of the best expositions available. Unfortunately, the statistical base of the work is essentially a reflection of the limited availability of usable data at the time it was written.

An American researcher, Alfred Hofflander has continued the research in human life value. He defined the concept of human life value both verbally and mathematically and showing how the concept might be applied to life in different fields. He developed a mathematical model of the human life value for life insurance by finding a single sum, which represents the amount necessary to replace the amount a person would normally have provided for his family had he lived. He also used the same techniques to establish a mathematical model of the money value of a person in cases of recovery for wrongful death [4].

In life insurance industry, the human life value concept is a subject which has been of interest for many years, since the time of Huebner. The human life value was agreeable as the accurate approach to writing life insurance on people's lives because of full economic replacement. Also in 1928, the National Association of Life Underwriters (NALU) met in Los Angeles, California to determine the best methods for evaluating life insurance needs for individuals. They agreed that the human life value approach was an appropriate way to solve for the death benefit amount for consumers. However, later on the life insurance industry began to slowly drift away from this approach and adopt the needs analysis method that generates smaller amount of life insurance recommendations than the human life value. This was viewed as easy to sell by many marketing and sales department.

2.2. Needs analysis

Because human life value concept has essentially been ignored in life insurance and financial services, the industry has created alternatives. Needs analysis has been around since the early days but it was refined in the late 1960's by Thomas Wolff. At the 1966 Million Dollar Round Table meeting, Wolff

introduced the concept of capital preservation in estate planning and called it needs analysis. The purpose was to address the real as well as the immediate needs of the family after the breadwinner's death. In 1981, he designed a new financial needs analysis to suit the needs of single households and a two-income family. The plan is flexible so the life insurance agent can sell the type and amount of insurance best suited to the customer's lifestyle and income.

This method attempts to determine the amount of life insurance a person needs by looking at two categories – post death needs and asset available to meet post death needs. Post death needs consist of the amount of capital needed after death of the breadwinner, for instance children education fund, household debts and funeral expenses. Existing assets including life insurance and post-death sources of income that could satisfy some of those requirements are identified. Any shortfall implies a need for additional life insurance.

The needs analysis method is the life insurance agent's most commonly used sales tool and has been used by most life insurance agents, financial advisors and financial-planning websites. There are hundreds of websites provide various forms of calculators and make calculations based on different methodologies. There are at least two different types of calculators – needs analysis and human life value, whereby the needs analysis method is by far more popular [5]. However, the life insurance recommendations generated by internet websites generally were unreliable and wide variations in advice [6]. Two possibilities exist for bad output from these calculators is because of there is an inadequate input or the underlying mathematical model is inaccurate or illogical [7].

2.3. Weaknesses of both human life value and needs analysis

There are several weaknesses of using human life value method alone, or needs analysis alone as a life insurance selling tool. The weakness of using human life value to estimate the amount of life insurance is that it does not take into consideration there may be capital needed immediately upon the death of the breadwinner to satisfy certain financial obligations, for instance funeral expenses, children education cost, mortgages and debts.

The same applies to needs analysis. There are some weaknesses of using needs analysis in estimating the amount of life insurance needed. A needs analysis ignoring future changes and only identifies the needs of a family at the current situation. Needs inevitably change in the future as family characteristics and finances change. By ignoring these factors, needs analysis would leave a person underinsured. The needs analysis also raises several concerns. If a person sets a spending target too high for survivors, the method will generate a larger amount of life insurance than is appropriate. This will cause the person too much in life insurance coverage. If the spending target is set too low, the recommended amount will leave the person underinsured. Moreover, a needs analysis does not explicitly take account of other financial planning goals such as having an adequate income in retirement. As an analytical engine, needs analysis is really no matter than asking three basic questions: “*What money do you think your family will want after you die?*”, “*what do you think they will have after you die?*” and “*how much of the difference do you want to pay for while you live?*” [8]. It is suggested that needs must incorporate the reality that the family's standard of living changes over time and not simply because of inflation. The projection of a changing in standard of living is an integral element of human life value method.

Both human life value and needs analysis do not explicitly mean having an adequate income in retirement. It would also be affected by surviving spouse's age and ability or inability to work. By using needs analysis alone as a sales tool, the recommendation amount of life insurance would leave a person over or underinsured. Similar goes to the human life value method. However, both methods can be improved with a few revisions. The post-death needs under the needs analysis must be revised to incorporate the reality that the family's standard of living changes over time. The projection of a changing standard of living is a part of human life value analysis.

This research looked into both methods and combine both concept of needs analysis and human life value to create a powerful methodology that provide adequate life insurance protection – a method that we name the ‘*Human Life Value Revision Method*’.

3. Formulation of the Human Life Value Revision Method

The primary function of life insurance is to cover the economic loss to a family caused by the death of the breadwinner. A breadwinner's demand for life insurance depends on the demographic structure of his household. In Malaysia, generally the breadwinner is the husband and the beneficiaries are his wife and children. In this research, three major areas are emphasised in developing the human life value revision method model:

- Modelling of income: The breadwinner's total annual income over the remaining years of his working lifetime as well as his retirement benefits.
- Modelling of income tax: The income tax is calculated using the existing tax tables and rules produced by the Inland Revenue Department in Malaysia.
- Modelling of expenditures: The household expenditures of the breadwinner and his family members are calculated using the data published by the Department of Statistics, Malaysia. Any capital needed immediately upon the death of the breadwinner is identified, for example children's education cost.

The central feature of the model is that individuals are born, work for a period of time, retire and die. During their working lifetime, a person has to save for retirement. This type of model has a long tradition since the original work of Franco Modigliani and Albert Ando in their life-cycle hypothesis. Therefore, all major stages of a life-cycle were analysed in our model – unattached, marriage, parenting from babies through adolescents, launching adult children, retirement and senior years.

3.1. Modelling of income

To begin the human life value revision method formulation, we estimated the breadwinner's total income for each year from projection of his current salary over the remaining years of his working lifetime, and income after retirement such as retirement benefits. For married couples, we estimated the income of both the husband and wife. In Malaysia, the head of the household is the husband. He is the source of an income or earnings stream to his family. We followed Goldsmith's method that includes wife's income in determining the amount of life insurance needs on the husband [9]. In his research, Goldsmith considered the wife's human capital accumulation in determining purchases of life insurance on the husband, taking into consideration the wife's labour force participation and the household size.

The factors involved in calculating the present value of income are,

- x = Current age
- $I_{h(x+t)}$ = Total income for the husband at age $x+t$
- $(e_x^{ow})_h$ = Husband's working life expectancy
- $(EPF\ Savings)_{x+(e_x^{ow})_h}$ = Husband's Employee Provident Fund (EPF) savings on retirement
- S_x = Current monthly salary at age $x+t$
- EPF = The statutory Employee Provident Fund (EPF) contribution rate (employee)
- $SOCSO$ = Social Security Organisation's contribution rate
- s = Constant future salary increment rate per annum
- p = Constant promotional increment rate
- ${}_tP_x$ = Probability that a person age x will survive for t more years
- i = Interest rate
- V^t = Present value at time t

The formula to estimate the total income for the husband at age $x+t$ is as follows,

$$I_{h(x+t)} = 12S_x(1+s)^t(p) {}_tP_x [1 - EPF - SOCSO]$$

And, (1) $SOCSO = 0$, when $S > RM3,000$

- (2) $s = 0.06$, when $x + t > 1$
 (3) For the promotional scale, we define $1 \leq n \leq 9$
 $p = (1 + p_1)(1 + p_2)(1 + p_3) \dots (1 + p_9)$, where $x + t \geq a_n$
 And where, $p_1 = 0.099$, when $a_1 = 25$
 $p_2 = 0.094$, when $a_2 = 28$
 $p_3 = 0.049$, when $a_3 = 31$
 $p_4 = 0.032$, when $a_4 = 34$
 $p_5 = 0.021$, when $a_5 = 40$
 $p_6 = 0.021$, when $a_6 = 46$
 $p_7 = 0.021$, when $a_7 = 52$
 $p_8 = 0.021$, when $a_8 = 56$
 $p_9 = 0.021$, when $a_9 = 58$

The income for the breadwinner, which is the husband is estimated for each year until retirement age. On the retirement age, the husband receives the full amount of EPF savings. Therefore, the present value of income for the husband is as follows,

$$PV(I_h) = I_{h(x+0)}V^0 + I_{h(x+1)}V^1 + I_{h(x+2)}V^2 + \dots + I_{h[x+(e_x^{ow})_h-1]}V^{(e_x^{ow})_h-1} + (EPF \text{ Savings})_{x+(e_x^{ow})_h}V^{(e_x^{ow})_h}$$

$$PV(I_h) = \sum_x^{x+(e_x^{ow})_h} I_{h(x+t)}V^t + (EPF \text{ Savings})_{x+(e_x^{ow})_h}V^{(e_x^{ow})_h} \quad t = 0, 1, 2, 3 \dots t < (e_x^{ow})_h \quad (1)$$

Where, $V = \frac{1}{1+i}$

And (EPF Savings) is the projected EPF savings at the end of n years,

$$= 12Xk(1+d)^{n-1} * \left[\frac{1 - \left(\frac{1+s}{1+d}\right)^n}{1 - \left(\frac{1+s}{1+d}\right)} \right], \text{ if } s < d$$

$$= 12Xk(1+d)^{n-1} * \left[\frac{\left(\frac{1+s}{1+d}\right)^n - 1}{\left(\frac{1+s}{1+d}\right) - 1} \right], \text{ if } s > d$$

$$= 12Xk(1+d)^{n-1}, \text{ if } s = d$$

Next, again on a year-to-year basis, the income for the wife is projected. Let,

- x = Husband's current age
- y = Wife's current age
- $I_{w(y+t), h(x+t)}$ = Total income for the wife at age $y+t$ (while the husband's age is $x+t$)
- $(e_x^{ow})_h$ = Husband's working life expectancy
- $(EPF \text{ Savings})_{x+(e_x^{ow})_h}$ = Husband's Employee Provident Fund (EPF) savings on retirement
- S_x = Husband's current monthly salary at age $x+t$
- EPF = The statutory Employee Provident Fund (EPF) contribution rate (employee)
- $SOCSO$ = Social Security Organisation's contribution rate

- s = Constant future salary increment rate per annum
- p = Constant promotional increment rate
- ${}_tP_x$ = Probability that a husband age x will survive for t more years
- ${}_tP_y$ = Probability that a wife age y will survive for t more years
- f_{y+t} = Women's labour force participation rate at age $y+t$
- i = Interest rate
- V^t = Present value at time t

The formula to estimate the total income for the wife at age $y+t$ is as follows,

$$I_{w(y+t),h(x+t)} = 12S_x (1+s)^t (p) {}_tP_x (f_{y+t}) {}_tP_y [1 - EPF - SOCSO]$$

And, (1) $SOCSO = 0$, when $S > RM3,000$

(2) $s = 0.06$, when $x + t > 1$

(3) For the promotional scale, we define $1 \leq n \leq 9$

$$p = (1 + p_1)(1 + p_2)(1 + p_3) \dots (1 + p_9), \text{ where } x + t \geq a_n$$

And where, $p_1 = 0.099$, when $a_1 = 25$

$p_2 = 0.094$, when $a_2 = 28$

$p_3 = 0.049$, when $a_3 = 31$

$p_4 = 0.032$, when $a_4 = 34$

$p_5 = 0.021$, when $a_5 = 40$

$p_6 = 0.021$, when $a_6 = 46$

$p_7 = 0.021$, when $a_7 = 52$

$p_8 = 0.021$, when $a_8 = 56$

The income for the wife is estimated for each year until retirement age. Therefore, the present value of income for the wife is as follows,

$$PV(I_w) = I_{w(y+0)}V^0 + I_{w(y+1)}V^1 + I_{w(y+2)}V^2 + \dots + I_{w[y+(e_y^{ow})_w]}V^{(e_y^{ow})_w - 1} + (EPF \text{ Savings})_{y+(e_y^{ow})_w} V^{(e_y^{ow})_w}$$

$$PV(I_w) = \sum_y^{y+(e_y^{ow})_w} I_{w(y+t)}V^t + (EPF \text{ Savings})_w^{(e_y^{ow})_w} t = 0, 1, 2, 3 \dots t < (e_y^{ow})_w \tag{2}$$

Lastly, the general formula for the total present value of income is derived as follows,

$$PV(I) = (1) + (2), \text{ where } PV(I_w) = 0 \text{ for single person} \tag{3}$$

3.2. Modelling of income tax

A portion of individual incomes is paid as taxes. These tax calculations are made using the existing tax tables and rules published by The Inland Revenue Department Malaysia as stipulated in the Income Tax Act 1967. An individual is taxed on his chargeable income at graduated rates from 1% to 28% after the deduction of tax reliefs. Projecting income taxes requires performing tax calculations for each year in which the total family income is projected.

The factors involved in calculating the present value of tax are,

- x = Current age
- y = Wife's current age
- $T_{(xy+t)}$ = Total tax payable for married couple at age $x+t$ (husband) and $y+t$ (wife)
- $T_{(x+t)}$ = Total tax payable for a single man before getting married at age $x+t$
- $T_{(y+t)}$ = Total tax payable for a single woman before getting married at age $y+t$

- (e_{xy}^{ow}) = Working life expectancy of husband or wife whichever occur last
- (e_x^{om}) = Age at first marriage for men
- (e_y^{om}) = Age at first marriage for women
- V^t = Present value at time t
- ded = Personal deductions
- reb = Rebates

The formula to calculate the tax is as follows,

Taxable income in year $x+t = I_{x+t} - ded$

Tax charged in year $x+t =$ Tax on the first taxable income + Tax on the next taxable income

Therefore, income tax payable in year $x+t, T_{x+t} =$ Tax charges in year $x+t - reb$

To conduct the analysis of income tax for the purpose of this human life value revision method model, payable income tax is estimated for each year until retirement age. Thus, the present value of the total income tax payable for the husband is,

$$\begin{aligned}
 PV(T) &= T_{xy+0}V^0 + T_{xy+1}V^1 + T_{xy+2}V^2 + \dots + T_{xy+(e_{xy}^{ow})}V^{(e_{xy}^{ow})} \\
 &= \sum_{xy}^{xy+(e_{xy}^{ow})} T_{(xy+t)}V^t \quad t = 0, 1, 2, 3 \dots t < (e_{xy}^{ow})
 \end{aligned}
 \tag{4}$$

For a single person, the income tax payable is estimated for each year until the age at first marriage. Then the analysis continues on the combined account assessment as shown above.

For a currently single man,

$$PV(T) = T_{x+0}V^0 + T_{x+1}V^1 + T_{x+2}V^2 + \dots + T_{x+(e_x^{om})_h}V^{(e_x^{om})_h} + \dots + T_{xy+(e_{xy}^{ow})}V^{(e_{xy}^{ow})}$$

For a currently single woman,

$$PV(T) = T_{y+0}V^0 + T_{y+1}V^1 + T_{y+2}V^2 + \dots + T_{yx+(e_y^{om})_w}V^{(e_y^{om})_w} + \dots + T_{xy+(e_{xy}^{ow})}V^{(e_{xy}^{ow})}$$

3.3. Modelling of expenditures

Expenditures in this model consist of the projection of the total amount of household expenditures and cost of university education for children. Firstly, we estimated the total amount of household expenditures for each year until the expected age of death of the husband or wife whichever occur last.

The factors involved in calculating the expenditures are,

- x = Husband's current age
- y = Wife's current age
- E_{x+t} = Total expenditure costs at age $x+t$
- HEI = Household expenditure Index
- $HE_{(xy+t)}$ = Average monthly household expenditure for married couple at age $x+t$ for the husband and at age $y+t$ for the wife
- $HE_{(x+t)}$ = Average monthly household expenditure for a single man before getting married at age $x+t$
- $HE_{(y+t)}$ = Average monthly household expenditure for a single woman before getting married at age $y+t$
- (e_{xy}^o) = Life expectancy of husband or wife whichever occur last
- (e_x^{om}) = Age at first marriage for men
- (e_y^{om}) = Age at first marriage for women
- V^t = Present value at time t

The formula to calculate the household expenditure is as follows,

$$E_{x+t} = 12HE_{x+t} HEI (1 + i)^t \quad t = 0, 1, 2, 3... t < (e_{xy}^o)$$

The present value of household expenditure for the husband is determined with this formula,

$$PV(E) = E_{xy+0}V^0 + E_{xy+1}V^1 + E_{xy+2}V^2 + \dots + E_{xy+(e_{xy}^o)}V^{(e_{xy}^o)}$$

$$= \sum_{xy}^{xy+(e_{xy}^o)} E_{(xy+t)}V^t \quad t = 0, 1, 2, 3... t < (e_{xy}^o) \tag{5}$$

For a single man and woman, we used the similar method above. For a currently single man,

$$PV(E) = E_{x+0}V^0 + E_{x+1}V^1 + E_{x+2}V^2 + \dots + E_{x+(e_x^{om})_h}V^{(e_x^{om})_h} + \dots + E_{xy+(e_{xy}^o)}V^{(e_{xy}^o)}$$

For a currently single woman,

$$PV(E) = E_{y+0}V^0 + E_{y+1}V^1 + E_{y+2}V^2 + \dots + E_{yx+(e_y^{om})_w}V^{(e_y^{om})_w} + \dots + E_{xy+(e_{xy}^o)}V^{(e_{xy}^o)}$$

The estimation of the amount of income, personal tax and household expenditures is a part of human life value analysis. This method may not fully anticipate other needs that arise with the death of a person, for instance funeral expenses, children education cost, mortgages and debts. An estimate of these additional concerns is obtained through a needs analysis approach.

This human life value revision method model also considered household debts as post-death needs the family have to meet following the death of the breadwinner. *Bank Negara Malaysia's Annual Report 2010* reported that 45% of total household debts in Malaysia were made of mortgages, while another 20% were hire-purchase financing. Credit card debts made up only 5% of household debts. As home loans are a big commitment, repaying it can be a major burden if calamity strikes. Although it is not compulsory to have Mortgage Reducing Term Assurance (MRTA) to secure home loans, most financial institutions in Malaysia make it compulsory to insure against such an event. Alternatively, borrowers can opt for various types of life policies to secure the home loan. For the purpose of this research, we compiled information from 15 financial institutions in Malaysia offering home loans and it shows that 13 financial institutions impose as a condition of the home loan to take up an MRTA and 2 financial institutions offer lower interest rates to encourage borrowers to have MRTA. Therefore, we will not include mortgage repayment in our human life value revision method model to avoid redundant insurance coverage.

The second largest category that made up household debts in Malaysia was hire purchase financing for transport vehicles. However, we will not include this in the model since the estimation has been included in the average monthly expenditure per household based on Household Expenditure Survey. The data under the category of 'Transport and Communication' covers the expenditure for transport including vehicle purchase, road tax, motor insurance, maintenance and parking fee.

Therefore, we incorporated funeral expenses and children's university education cost into our model, as the cost is not included in the household expenditures. Let,

- x = Current age
- y = Wife's current age
- OE = Total of other expenses
- b_i = Median age at birth for the i child according to age of mother, where $i = 0, 1, 2, \dots, n$
- $(e_x^o)_h$ = Husband's life expectancy
- $(e_y^o)_w$ = Wife's life expectancy
- V^t = Present value at time t

Therefore, the present value of other expenses is as follows,

$$\begin{aligned}
 PV(OE) = & \text{(Education cost for the first child)}_{y+b_1} V^{b_1-y} \\
 & + \text{(Education cost for the second child)}_{y+b_2} V^{b_2-y} + \dots \\
 & + \text{(Education cost for the } n^{\text{th}} \text{ child)}_{y+b_n} V^{b_n-y} \\
 & + \text{(Funeral expenses for the husband)}_{x+e_x} V^{e_x} \\
 & + \text{(Funeral expenses for the wife)}_{y+e_y} V^{e_y}
 \end{aligned} \tag{6}$$

Then, the present value of net future income flow for the breadwinner can be calculated using the equation below,

$$\text{Present Value of Net Future Income} = (3) - (4) - (5) - (6) \tag{7}$$

Finally, we can estimate the amount of life insurance required for a person in times of current income by using the equation below. Any existing sources of funds available to cover those needs such as the social security benefit from the Employee’s Provident Fund (EPF) and current amount of life insurance will be deducted.

$$\text{(Life Insurance Required in Times of Income)}_x = \frac{(7) - (\text{EPF saving}) - (\text{Current Life Insurance})}{\text{Annual Income}}$$

4. Conclusion

The primary function of life insurance is to cover the economic loss to a family caused by the death of the breadwinner. A breadwinner’s demand for life insurance depends on the demographic structure of his household. In Malaysia, generally the breadwinner is the husband and the beneficiaries are his wife and children. The main purpose of this research is to identify the strength and weakness of the life insurance sales tool currently used in practice and develop a scientific method as a correct solution and hence provide adequate protection to relate the amount of life insurance a person needs to carry to the real value of a person’s earnings. The research combined two methods currently used in practice – the needs analysis and human life value, and with a few revisions, we developed a method of determining the amount of life insurance needs. A method that we name the ‘*Human Life Value Revision Method*’.

In this research, a human life value revision method model has been developed to determine the amount of life insurance required to protect the family against economic loss in the event of the breadwinner’s death. To the end, we suggest a model to compute the amount of life insurance coverage in a multiple of current annual income that can be used in the life insurance selling industry or as an underwriting guideline.

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