Abstract—In the United States, the human life value method is often used in court cases involving personal injury and death litigation, attempts to measure the compensatory economic damages. However, there are some weaknesses of using human life value in the calculation. Currently in Malaysia, courts use the traditional multiplicand-multiplier approach when assessing the economic losses and damages. The objective is to calculate a lump sum amount to compensate the plaintiff for future loss of earnings and to cover expenses. I believe this is where actuarial scientists need to play a role in developing a new scientific model in order to acquire an appropriate amount of court award, which is relevant and satisfy both plaintiff and defendant. Therefore, the objective of this research is to develop a scientific model using the human live value method with few revisions that can be used as a guide to determine the amount of court award in personal injury and death litigation. References will be made to the appropriate acts and court cases, where applicable, throughout this paper. Using the actuarial model, the research findings indicate that victims are being under compensated. The economic damages that are awarded are insufficient to cover their losses of future earnings. Legal reform is necessary to address this issue.

Keywords—Death litigation, human life value, loss of dependency, loss of earnings, personal injury.

I. INTRODUCTION

Court awards for compensatory damages are intended to give victims a sum of money in the form of damages which will restore the individual, in financial terms, as nearly as possible to the position they would have been in if the wrong had not been committed. The compensation comprises an award for economic losses which often referred to as monetary losses, include medical expenses, wage loss, and other out-of-pocket expenses; and non-economic losses associated with pain and suffering.

In the United Kingdom, the use of actuaries or forensic economists in calculating economic damages in personal injury and death litigation is rare. In the past, judges have used their own ‘common law’ and ‘common sense’ standards for calculating damages [1]. These standards usually consisted of multipliers that could be applied to a plaintiff’s income or medical costs to estimate their economic loss. These multipliers were derived from past court decisions and had little scientific basis.

In an attempt to bring some sound actuarial principles to the use of multipliers, the Government Actuary’s Department, United Kingdom (GAD) produced a set of multipliers in year 1984 named “Actuarial Tables with Explanatory Notes for Use in Personal Injury and Fatal Accident Cases”, also known as the “Ogden Table” named after the first chairman of a multi-disciplinary working party that developed the actuarial tables, Sir Michael Ogden.

Judges in the United Kingdom were not required to use the Ogden Tables in calculating damages until year 1999, where in the case of Wells v Wells [1999] AC 345, the House of Lords approved actuarial technique as the primary method of calculating future economic losses and made it compulsory to utilise the Ogden Tables when assessing a settlement. The tables take into account life expectancy and provide a range of discount rates. The most recent edition of the tables also sets out a method for taking into account contingencies other than mortality, including the assessment of a claimant’s residual earning capacity after an accident.

Currently in Malaysia, courts use the traditional multiplicand-multiplier approach when assessing the economic losses and damages as specified by the Civil Law Act 1956 (CLA). However, there is still a marked reluctance on the part of Malaysian courts to accept actuarial assessment dealing with personal injury and death litigation cases, for instance in the case of P.S. Lum v H.H. Lim [2001] 4 AMR 4171. The question often asks, are these laws and their interpretations and applications fair to the dependants whose breadwinner has been killed or the accident victim who has been seriously injured?

To be fair in estimating economic loss for all personal injury and death litigation cases handle by jurisdiction and to satisfy both plaintiff and defendant party according to the award calculation, the objective of this research is to develop a standard actuarial model that can be used as a guide to determine the amount of court award.

The current methods that have been developed by forensic economists generally take a conservative and perhaps overly narrow approach to valuing life and household production especially in areas of wrongful injury and death. Researcher suggested that an accurate estimation should consider factor as family profile [2]. Therefore, in this research I used a family lifetime modelling in order to develop an
actuarial model in estimating economic loss in personal injury and death litigation.

Despite the sometimes scathing remarks made by the judiciary on the role of actuaries in valuing personal injury and death claims, I believe that the courts have in effect attempted to use actuarial practice in making their own assessment of damages. Actuaries do not claim to predict the future but they do aim to place current values on future uncertain events, especially those with a financial outcome, in a sound and scientific manner [3].

References will be made to the appropriate acts, case law, court cases, where applicable, throughout this paper.

II. THE MODEL

A. General Model

I developed a general model of the court award as follows:

\[
CA = L \left[ P(SD) + P_2(GD) \right] (1 + i)^T
\]

where,
- \( CA \) = Court award
- \( L \) = Percentage of assessing liability
- \( P_1 \) = Probability of personal injury assessment for special damages
- \( P_2 \) = Probability of personal injury assessment for general damages
- \( SD \) = Special damages (pre-trial economic losses)
- \( GD \) = General damages (non-economic losses added to post trial economic losses)
- \( i \) = Interest rate
- \( T \) = Years of court trial

B. Estimating Special Damages (SD)

This research used a revision method of human life value that has been developed using a family lifetime modelling [4].

To begin the family lifetime model formulation, I estimated the person’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. I used a constant future salary increment rate at 6% per annum in the computation. Let,

- \( x \) = Current age
- \( I_{x+t} \) = Total income for at age \( x+t \)
- \( e_x^{ow} \) = Working life expectancy
- \( s \) = Constant future salary increment rate per annum
- \( EPF \) = The statutory minimum Employee Provident Fund (EPF) contribution rate (employee)
- \( (EPF \text{ Savings})_{x+t}^{e_x^{ow}} \) = EPF savings on retirement
- \( V' \) = Present value at time \( t \)

The total income for the person at age \( x+t \) is,

\[
I_{x+t} = 12S_{x+t} (1 + s) (1 - EPF)
\]

Therefore, the present value of the income is as follows,

\[
PV(I) = I_{x+t} V^0 + I_{x+t} V^1 + I_{x+t} V^2 + \ldots \ldots + I_{x+t} V^{e_x^{ow} - 1}
\]

\[
+ \left(EPF \text{ Savings}\right)_{x+t}^{e_x^{ow}} V^{e_x^{ow}}
\]

\[
= \sum_{t=0}^{e_x^{ow}} I_{x+t} V^t \quad t = 0, 1, 2, 3 \ldots t < e_x^{ow} \quad (2)
\]

The projection of EPF savings is the accumulation of future contributions and therefore it involves time value of money. The summation of these accumulated future contributions involves the summing of a geometric series. The contribution rate for the employer and employee are assumed at 12% and 11% respectively, thus \( k = 23\% \). The dividend rate is assumed at 5% per annum. Let,

- \( X \) = Salary per month at entry into EPF membership
- \( k \) = Total statutory minimum EPF contribution rate
- \( s \) = Constant future salary increment rate per annum
- \( d \) = Constant future EPF dividend rate
- \( n \) = Number of completed years in service

The projected EPF savings at the end of \( n \) years,

\[
= 12Xk(1+d)^{-1} \begin{cases} 
1 - \frac{(1 + s)^n}{(1 + d)^n} & \text{if } s < d \\
1 - \frac{(1 + s)^n}{(1 + d)^n} & \text{if } s > d \\
12Xk(1+d)^{-1} & \text{if } s = d
\end{cases}
\]

Next, income tax for the person is calculated for each year until retirement age using the existing tax tables and rules produced by the Inland Revenue Department in Malaysia. Let,

- \( x \) = Current age
- \( T_{x+t} \) = Total tax payable at age \( x+t \)
- \( e_x^{ow} \) = Working life expectancy
- \( V' \) = Present value at time \( t \)

The present value of the total income tax payable is,

\[
PV(T) = T_{x+t} V^0 + T_{x+t} V^1 + T_{x+t} V^2 + \ldots \ldots + T_{x+t} V^{e_x^{ow}}
\]

\[
= \sum_{t=0}^{e_x^{ow}} T_{x+t} V^t \quad t = 0, 1, 2, 3 \ldots t < e_x^{ow} \quad (3)
\]

Then, I estimated the total amount of household expenditures, which are calculated using the data published by the Department of Statistics, Malaysia. Let,

- \( x \) = Current age

\(^1\) Since the EPF contribution rates for the employer were maintained at 12% since December 1980, therefore I assumed the rate is 12% in this analysis. For the employee, the contribution rates were between 9% to 11% since December 1980, with the current rate at 11%.
The present value of the total household expenditures is

\[ PV(HE) = HE_{\text{OE}}V^0 + HE_{\text{HE}}V^1 + HE_{\text{EV}}V^2 + \ldots + HE_{\text{other}}V^{t<0} \]

\[ = \sum_{i=0}^{t} HE_{\text{OE}_i} V^t \quad t = 0, 1, 2, \ldots, t < e_{\text{OE}}^o \]  \hfill (4)

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

\[ PV(\text{OE}) = (\text{Education cost for the first child})_{\text{OE}_1} V^{x-b_1} + (\text{Education cost for the second child})_{\text{OE}_2} V^{x-b_2} + \ldots + (\text{Education cost for the n^th child})_{\text{OE}_n} V^{x-b_n} + (\text{Funeral expenses for the husband})_{\text{OE}_n} V^{x-b_n} \]  \hfill (5)

Then, the present value of net future income (special damages) flow for the person can be calculated by sum up (2), (3), (4) and (5).

I used the same model to estimate the loss of dependency\(^2\) or loss of future earnings. The income and personal tax of the breadwinner are assumed to be nil. Household expenditures and other expenses like education costs and funeral expenses are calculated for each year until the dependents’ expected age of death, or until the children leave tertiary education at the age of 21.

III. CASE STUDIES

A. Mohamed Mat Amin & ORS v Mohd Rabu Ihsan [2002]

According to the court case of Mohamed Mat Amin & ORS v Mohd Rabu Ihsan (18 July 2001), on 18 December 1992, Mohd Nor Mohamed (the first deceased) was riding motorcycle and Noor Hasisan Mohd Nor (the second deceased) was riding another motorcycle, an accident occurred in which both of them died. The plaintiffs wanted to claim their loss of dependency and special damage arising out of the road accident. In the circumstances, the judge found that the defendant wholly to be blamed for the accident. In respect of the first deceased person, the following damages are paid by the defendant — under special damage, the parties agreed to the sum of RM2,000 for funeral expenses and the sum of RM450 for the cost of repair to the motorcycle.

For the loss of dependency, the first, second and third plaintiffs are the father, mother and the son of the deceased person. The claim for loss of dependency is made under the CLA. The deceased was 35 years old at the time of his death. Based on section 7(3)(iv)(d) of the Act, the multiplier works out as follows: 55 – 35 = 20/2 = 10*12 months = 120 months.

In all the circumstances of the case, taking into account the number of family member relying on the deceased person, the judge decided a sum of RM600 per month to be given to the plaintiffs. Therefore, the total award for the loss of dependency in respect of the first, second and third plaintiffs was 120*RM600 = RM72,000.

However, there are weaknesses of using the multiplier method. Clearly, this method is very simple and misses a range of important factors such as household demographics, expenditures and social security offsets. It also ignores expected life changes and individual preferences about sustaining the living standard of survivors.

I used the human life value revision method described above to estimate the amount for loss of dependency. Firstly, I developed a family lifetime model for this case study and estimate the present value of the net future income of the deceased as shown in Table I. If the breadwinner is still alive, the monetary value of himself would be RM109,044.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>CASE STUDY I: PRESENT VALUE OF NET FUTURE INCOME OF THE DECEASED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of Deceased</td>
<td>Age of Plaintiffs</td>
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</tr>
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<td>36</td>
<td>65</td>
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<td>50</td>
<td>79</td>
</tr>
<tr>
<td>51</td>
<td>80</td>
</tr>
</tbody>
</table>

Note: 1. The expected age of death for a male aged 64 is 79.

2. The expected age of death for a female aged 66 is 80.

3. Dependents include children up to 21 years old.


5. Funeral expenses.

The death of the breadwinner usually terminates an income stream that the family has relied upon. The costs of daily living for survivors and post death expenses are needed to leave the family in their current standard of living. Thus, I estimated the household expenditures for the surviving families. There are also other needs that arise following the death of the breadwinner, for instance household debts and funeral expenses. Using the human life value revision method, the expected amount for loss of dependency is RM221,850 as shown in Table II.

\(^2\) Loss of dependency claims brought by spouse, children and parents of the deceased often arise due to the death of victims in accidents under Section 7(1), (2) & (3) of CLA.
Finally, the court award is then estimated using (1). I assumed the liability is 100% for the death accident as in this case study.

\[
CA = L \left[ P_1(\text{SD}) + P_2(\text{GD}) \right] (1+i)^T
\]

= 100% \left[ 100\% \text{ (cost of motorcycle repair + funeral expenses)} + 100\% \text{ (loss of dependency)} \right] (1.03)^9

= RM292,661

The result calculated using the human life value revision method in this case study is much more higher compared to the amount of RM74,450 that has been awarded by the court. This is because I considered other important factors into the computation for loss of dependency, for instance the expected salary increment, funeral expenses and cost of education for children.

B. Azman Kasri & Anor v Md. Isa Endut & Government of Malaysia [1988] 1 CLJ

Azman, the first plaintiff was knocked down from the rear by a military truck driven by the first defendant on 11 February 1982 while cycling. Injuries are briefly described as crush injury of left leg, six-inch laceration wound vertical exposing the lower end of left femur and upper end of left tibia and fibula, dislocation of left knee with separation, and lateral popliteal nerve partially torn near neck of left fibula. Left leg was subsequently amputated above the knee. The second plaintiff is the mother of the victim, which has been awarded transportation expenses to visit the first plaintiff amounting RM1,720 and expenses to buy nourishing foods for the first plaintiff for RM100. In this case study, I only estimated the court award for the first plaintiff.

The judge estimated that if not for the first plaintiff’s amputated left leg, at the age of 20, he would be able to work as a rubber tapper or welder in an estate and earn about RM400 per month. The first schedule of the Workmen’s Compensation Ordinance 1952 states that the loss of earning capacity of a worker for loss of a leg above the knees would be 60%. The judgement considered that the first plaintiff’s loss of earning capacity to be 60% of RM400 which is RM240 per month. Thus, it give a multiplier of 24 years (55 – 20 = 35* 2/3), and loss of future earnings of RM39,740.

Other awards are general and special damages. General damages for the first plaintiff are pain and suffering due to the nature of injuries to his left leg prior to amputation of the left leg for the amount of RM12,000; amputation of left leg above the knee amounting RM45,000; skin grafting and resultant scar for RM10,000. An interest at 6% per annum on general damages from date of accident to date of judgment was also awarded for the total sum of RM 171,480.

Special damages for the first plaintiff include cost for fitting artificial limb amounting RM33,600; cost for future renewal of consumptive items for the amount of RM20,640 and travelling expenses for servicing of artificial limb (3 trips per year at RM100 per trip for 35 years) for RM10,500. In total, the amount of court award for the first plaintiff that had been awarded was RM342,960.

Now, I used the human life value revision method to estimate the amount for loss of future earnings. Firstly, I developed a family lifetime model for this case study and estimated the present value of net future income of the deceased as shown in Table III. If the plaintiff’s left leg is not amputated, he would be able to work and the monetary value of himself is estimated at RM96,479.

Since the plaintiff had become permanently disabled as his left leg amputated above the knee, he would not be able to work. It is expected that the amount for loss of the plaintiff’s future earnings is RM284,953 as shown in Table IV.
Finally, a court award is then calculated. I assumed the liability is 100% as the plaintiff had become totally and permanently disabled. As for the loss of future earnings, I followed the first schedule of the Workmen’s Compensation Ordinance 1952, which states that the loss of earning capacity of a worker for loss of a leg above the knees would be 60%.

C. Case Study 3: Zulkifli Ayob v Velasini K. Mathavan & Anor [2000] 1 CLJ

In the High Court Malaya, Kuala Terengganu (13 November 1999), the appellant was the defendant in a negligence suit brought by the plaintiffs against him. The first respondent’s claim was brought pursuant to section 7 of the CLA for the benefit of the dependants of the deceased, Mathavan Kunjapoo. This accident happened on 10 August 1984. The car driven by the second respondent with the deceased as a passenger was involved in a road collision with the car driven by the appellant resulting in the injuries to the respondents and the passenger succumbed to his injuries and died later in the hospital. At the time of his death, the deceased was 36 years old. He was an independent contractor working with Petroliam Nasional Berhad (Petronas) earning a monthly income of about RM3,000. The appellant being dissatisfied with the quantum awarded, filed an appeal. At the hearing of the appeal, the appellant limited his appeal only to the quantum awarded in respect of loss of support. It is contended for the appellant that the amount awarded was manifestly excessive for the reason that the judge based his assessment on a higher number of multipliers.

By an order of 12 June 1996, the session’s judge decided that the loss of dependency was at RM1,500 per month. As the deceased died at the age of 36 years, the number of multiplier was decided to be 15 years. In the circumstances, the loss of dependency is RM270,000 based on the formula of RM1,500 per month * 12 months * 15 years. No reason at all was given by the judge as to how he arrived at RM1,500 per month as the monthly loss of dependency and as to how he arrived at the figure of 15 years as the multiplier. The counsel for the appellant submitted that the multiplier should be 13 years instead. He based his argument on the court case of Ahmad Nordin & Anor v Ngak Hua & ORS [1985] 2 MLJ 431. In that case, the judge decided on a multiplier of 25 years in respect of the deceased who died at the age of 24 years. This was based on the probable retiring age of 65 years. The supreme court was of the view that the retiring age should be fixed at 55 and as the deceased was 24 at the time of his death and deducting 13 years for contingencies that would leave 18 years of multiplier. The appellate court agreed that based on the principle laid down in Ahmad Nordin & Anor v Ngak Hua & ORS [1985] 2 MLJ 431, the determination that the multiplier in this case would be 13. Consequently, the court awarded RM234,000 for the loss of support. Other awards are pre-trial loss of support amounting RM211,500; funeral expenses for RM3,000 and interest at the rate of 4% per annum in respect of loss of support for the amount of RM8,460, adding to the total overall court award of RM456,960.

As I calculated in case study 1 and 2, the same model and method applied in this case study. I developed a family lifetime model for this case study and estimated the present value of net future income of the deceased as shown in Table V. If the breadwinner is still alive, the monetary value of himself would be RM372,619.

The quantum calculated in this manner is quite close to the court award in terms of the methodology and the multiplier applied.
Next, I estimated the loss of support using the human life value revision method. I ignored social security’s benefit (SOCSO) for the reason that under the Employees’ Social Security Act 1969 and the Employees’ Social Security (General) Regulations 1971, an employee earning a monthly income of RM2,000 or above is not obligatory contribute to SOCSO.

Table VI shows the computations, and it is expected that the amount for loss of the plaintiff’s future earnings is RM519,976. As an employee of Petronas, the deceased contributed a percentage of his salary into EPF. Thus, the amount of RM519,976.05 is then subtracted from the projected EPF savings, which could be withdrawn by the next-of kin in the event of death of the breadwinner. I also assumed the deceased entered into labour force when he was at the age of 22, therefore $n = 14$.

### TABLE VI
**CASE STUDY 3: THE EXPECTED AMOUNT FOR LOSS OF SUPPORT**

<table>
<thead>
<tr>
<th>Age of Plaintiff</th>
<th>Income (T)</th>
<th>Income Taxes (T)</th>
<th>Household Expenditures (LD)</th>
<th>Other Expenses (OE)</th>
<th>Surplus</th>
<th>Present Value</th>
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</table>

The projected EPF savings is

\[
= 12 X k (1 + d)^{-1} \frac{1 + s}{1 + d}^{n - 1}, \text{if } s > d = RM102,898
\]

Therefore, the estimated amount for loss of future earnings after subtracting EPF savings is RM417,077.

Next, a court award is then calculated. I assumed the liability is 100% for the death accident as in this case study.

\[
CA = L \left[ P_{1}(SD) + P_{2}(GD) \right] (1 + i)^T
\]

\[
= 100\% \left[ 100\% \text{ (funeral expenses)} + 100\% \text{ (loss of future earning)} \right] (1.03)^{15}
\]

\[
= RM654,466
\]

Using the human life value revision method, the expected amount for the court award is RM654,466, which is much higher than what had been awarded by the court.

## IV. CONCLUSION

When assessing economic loss in personal injury and death litigation, courts often use traditional multiplicand-multiplier method. The objective is to calculate a lump sum amount to compensate the plaintiff for a stream of future lost earnings. Most judges select the multipliers by reference to past court decisions and had little scientific basis. Within the legal profession, there has been concern that there is too much uncertainty involved in calculating the multiplier. It has been described as ‘an arbitrary process’, in which the multiplier is not calculated in a precise or logical manner [5]. In particular, the multiplier takes virtually no account of the factors that influence the way an individual’s earnings change over time.

In personal injury and death litigation, the object of valuation is the value of a life. This research has developed a scientific model using the human live value method with few revisions that can be used as a guide to determine the amount of court award in personal injury and death litigation, which focuses only on the economic losses in special and general damages, particularly on the loss of future earning capacity and the dependency claim. Non-economic losses are ignored in the model. Non-economic losses are awarded with respect to the ‘pain and suffering’ endured and be awarded by judges based on previous court cases.

To compute economic losses, it is necessary to take into consideration factors affecting the monetary value of a human life such as salary increment, social security, taxes, household expenditures, funeral expenses, children education costs, inflation, retirement age and life expectancy. As such, a lifetime model of the plaintiff need to be constructed from which to begin projections of economic value lost in future years. The human life value revision method is then applied to the model. In the application of the human life value revision method, I compute the expected amount for loss of dependency in the event of death of the breadwinner, or the estimated amount for loss of future earnings in the event of personal injury. Finally, using a general model formulation, a court award is then calculated. This amount could be a guide to determine the appropriate amount of court award in personal injury and death litigation.

## REFERENCES


