

## *Evaluation of the benefits costs to cover the needs arising from personal injury*

Anna JĘDRZYCHOWSKA<sup>1</sup>  
*Wrocław University of Economics*

Received: 24 August 2017; Accepted: 12 November 2017; Published: 30 December 2017

*Abstract.* The source of a personal injury can be e.g. a road traffic accident, a work accident, medical malpractice, etc. This article will focus on determining the financial impact of personal injury. In particular, the cost of victim treatment will be estimated and also the capital to cover increased needs after accident. Such calculations are essential for the proper management of the financial effects of personal injury in the victim's household. Grounds for such a claim are civil law, which is applicable in European countries to a similar extent. If an accident victim has suffered bodily injury, the person who has caused the accident should provide the injured person with funds to cover their increased needs. The increased needs, which might arise for an accident victim, include for instance: additional costs of medical appointments, travel to health facilities, medicines and medical equipment, physical therapy, special diet, care and also: loved ones' travels to the hospital and employment of a housekeeper.

The aim of this paper is to present a possible methodology for capital valuation, corresponding to the impact of personal injury on the basis of an actuarial account. Knowledge of the current value of such capital (annuity) is important for the person who is to pay it (e.g. an insurer). The victim may also want to know the present value of the annuity, because it can be changed in the case of a one-off payment. The article includes a proposal to use an actuarial pension to assess the costs that arise as a result of personal injury. The article focuses solely on the costs of treatment and rehabilitation. The examples contained in this article show what high costs are generated by personal injury. In addition, the article mentions a number of significant differences in treatment costs in the EU. Being aware of these differences is important because the damage to a person can be related to the citizens of EU countries (especially if one considers motor vehicle liability insurance).

*Keywords:* personal injury, increased needs, actuarial pensions, liability insurance, personal finance.

*JEL Codes:* J33, G22, D14, K13.

---

<sup>1</sup> Contact with author: Anna Jędrzychowska, Department of Insurance, Wrocław University of Economics, Komandorska 118/120, 53-345 Wrocław, Poland; e-mail: anna.jedrzychowska@ue.wroc.pl.

## 1. Introduction – law and literatures

The term ‘*personal injury*’ has not been clearly defined. This might arise from its multifaceted scope, i.e. it is related to economics, law, economic analysis of law, or mathematics. However, there are scientific publications which provide understanding of this notion [for instance: Czachórski 1994; Green 1955; Karaś 2007; Wigmore 1895]. For the purpose of this paper, the definition developed by Ilona Kwiecień [Kwiecień 2015, p. 17] will be applied: “*Hence, personal injury may be treated as one of the forms of loss consisting in infringement of personal interests (in broad terms) or violation of bodily and health integrity (in narrow terms), or as a set of the related adverse consequences.*” In Poland, the legal grounds for determining compensation for this type of loss are mainly the Civil Code – Articles 415 and also 444–447. Similar provisions can be found in other European Codes, such as in the German § 249-254, § 842-846 BGB [Bürgerliches Gesetzbuch of 18 August 1896]; the French Articles 1382 of the Civil Code of 21 March 1804 and the British Fatal Accident Act and Article 8 of the Human Rights Act of 1998.

The financial significance of personal injury for the insurance sector will be demonstrated here, since in particular damages and compensation for pain and suffering disbursed from the third-party liability insurance of motor vehicle owners are the most common source of funding the financial losses that arise. The number of claims related to bodily injury currently constitutes fewer than 13% of all claims in respect to the third-party liability insurance of motor vehicle owners [Insurance Europe 2016], whereas the value of such claims is nearly half of the total benefits and damages disbursed in respect to this type of insurance in Europe – it was 48.4% of the total amount of the benefits and damages in respect to the third-party liability insurance of motor vehicle owners in 2013, and was similar to that of 2012. The highest level of damages was recorded in France, Spain, and Italy. The average claim value in European countries in 2013 amounted to ca. EUR 16,000 compared to EUR 15,500 in 2012. The average value of the loss arising from the MTPL insurance in Europe increased by approx. 20% in 2013 relative to the previous year [Insurance Europe 2016]. The average claim value differs considerably between various countries and, most importantly, it is continuously growing. When studying the relevant literature, one can find publications indicating the sources (legal, social, and economic factors) of such trends, e.g. in the study by Holzheu and Lechner [2009]. At the same time, it is emphasised that social attitudes are the most significant factors – Leimbacher et al. [2009], Enz and Holzheu [2004], Schmit [2009], Carmignani and Giacomelli [2010]. The greatest growths were recorded in Greece (55%) and Italy (45%) in 2013 [Scor Global P&C 2015, p. 34]. The highest average claim was recorded in Greece (ca. EUR 33,000) and France (ca. EUR 22,000) in 2013. The lowest were recorded in Czechia (ca. EUR 1,500) and Turkey (ca. EUR 4,000). When considering these values, it should be noted that the personal injury damages systems differ significantly in individual European countries. This regards among other things limits on damages or the ability to submit new claims if circumstances such as an increase in the cost

of claims arise. However, benefits in respect to personal injury are not uniform. The main components are care costs (these constituted almost 54% of all payments from motor liability insurance made in the period 2010-2011), medical costs (16.4% of all payments), loss of earnings (9.36% of all payments), and compensation for pain and suffering (7.32% of all payments). This aspect of the amount of damages still varies between countries. The highest general payment level can be seen in Great Britain, where EUR 15 million per person can be achieved. This is nearly 9 times as high as in the Netherlands and Spain and 4 times as high as in Italy [Scor Global P&C 2015, p. 12].

An accident causing bodily injury or health disorders to its victim results in the necessity for the victim to take measures aimed at treating, minimising or eliminating the health impairment suffered (e.g. through physical therapy or other forms of necessary care provided to the injured person), which are determined by the increased needs of the injured person under the discussed provision. All needs of that kind mean higher costs for the injured person and it is the person who has caused the loss, and hence the insurance company providing the injuring person with a third-party liability insurance cover, that is obliged to cover such costs.

The legal grounds for claiming an annuity from the injuring person or their insurer by the injured person are specified in Article 444 § 2 of the Act of 23 April 1964 Civil Code (Journal of Laws no. 16, item 93, as amended): “*Where the injured party has lost their earning capacity in whole or in part or where their prospects for the future have diminished, the injured party may claim a suitable annuity from the person obliged to redress the damage.*”

Therefore, the injured person is entitled to claim an annuity where:

- they have lost their earning capacity in whole or in part;
- their prospects for the future have diminished;
- or their needs have increased.

The third case refers to the option to claim the so-called annuity for increased needs, which is a future loss manifesting in recurring expenses for permanent treatment, surgeries, and physical therapy to achieve improvement or prevent deterioration of the injured person’s health, special diet, care by third parties, etc. When asserting claims related to an annuity for increased needs, the scope of the increased needs and the probable period in which they will occur should be evidenced, mainly by means of doctors’ opinions, if necessary. Both the type and extent of the injured person’s increased needs and the amount of the related loss in the form of increased expenses depend on individual considerations of the injured party’s situation. The amount of the loss suffered by the injured person will be individualised, in part due to a different availability and price of particular services and products applicable in a given location<sup>2</sup>. The Supreme Court’s position<sup>3</sup> on covering increased needs consisting in the necessity to use third party care, where the Court decided that

<sup>2</sup> Judgment of the Supreme Court of 22 June 2005 (file ref. no. III CK 392/04, LEX no. 177203).

<sup>3</sup> Judgment of the Supreme Court of 4 March 1969 (file ref. no. I PR 28/69, publ. OSNCP 1969, no. 12 item 229).

the injured person's right in this respect does not depend on proving that the injured person has effectively spent relevant amounts on care costs, ought to be invoked here. The circumstances where an injured person was cared for by members of his or her household does not deprive the person of the right to claim an annuity increased due to this. The principle invoked in British law providing that the claimant may claim damages for the costs of care provided free of charge by their friends or relatives can be mentioned in addition to the discussions on covering care costs. Yet the amount of damages is based in such cases on the costs of commercial care provided with a discount of, normally, 25-33%. The discount reflects the free family nature of the care and the fact that the carer does not need to incur costs such as taxes, social insurance, or commuting to work. Polish law does not apply this rule, arguing that the fact of provision of such care by family members does not mean that the situation cannot change, and the injured person will not be forced to buy such care on the market (e.g. due to a divorce or illness of the carer).

## 2. Component identification and valuation

Hence, when determining the amount of capital related to treatment costs and the increased needs, it is necessary to estimate all the costs associated with the suffered damage that have to be and will be paid periodically. This is an approximate estimate of expenses based on the prepared treatment plan and the predictable additional costs associated with the victim's functioning in life. The amount of capital will be affected by the costs:

- 1) of treatment (hospitalisation and surgeries) and doctor appointments;
- 2) of care;
- 3) of medicines, vitamin preparations and ointments, sanitary hygiene products;
- 4) of an individual physical therapy at home and one provided in centres or clinics for payment (e.g. classes at the swimming pool);
- 5) of travel to rehabilitation camps and sanatoriums;
- 6) of the loved ones' travels to the hospital for visits during the injured person's stay;
- 7) of the appropriate diet, e.g. purchase of fruit, juices, dietary supplements of protein, calcium, etc.;
- 8) the depreciation of equipment: a wheelchair, anti-bedsore pillow and mattress, prostheses, physical therapy devices, aids and equipment, as well as the costs of purchase of a car and car equipment for the disabled, etc.;
- 9) of care, home help related e.g. to doing the shopping, cleaning the flat, doing everyday minor household chores;
- 10) the necessity to take private lessons by the injured person who is a student due to him or her lagging behind in learning;
- 11) any other(s) required to compensate for the loss.

Due to the international nature of the issues discussed in the article later in this chapter, such economic quantities as may be the basis of valuation of particular

components will be indicated. These amounts will be invoked for various European countries.

*Re. 1.* In the case of planned or expected surgeries, also their costs need to be taken into account. The following information was used to demonstrate the costs of such surgeries (Table 1).

*Table 1. Prices of selected surgeries in 2016 (in EUR)*

	LT	LV	FR	DE	IE	NO	PL	UK	CZ
<b>ACL (ligament) Reconstruction</b>	3,000	3,700	6,500	5,500	6,800	10,200	3,000	7,500	-
<b>Hip Surgery</b>	3,800	-	11,000	10,500	15,700	10,000	4,500	11,800	7,100
<b>Knee Arthroscopy</b>	1,500	2,200	3,600	1,300	-	-	1,200	6,400	1,200

Source: Author's own elaboration based on [Surgery Prices in UK 2017].

The calculation of the costs involved in hospitalisation can be aided by the data regarding the hospitalisation costs in public hospitals. The costs of doctor appointments can be calculated in a similar manner. For instance, Table 2. Part II contains the average cost of one doctor appointment in selected countries in 2016. The diversity of the prices of medicine and medical service is also illustrated in Table 2.

*Table 2. Prices of medicine, check-up and X-ray 2016 (in EUR)*

AT	BG	CZ	FI	FR	DE	HU	IE	IT	NL	PL	RO	RS	EE	TR	UK
<b>Aspirin, 100 tablets (supermarket)</b>															
12.64	1.89	16.07	18.68	13.40	8.79	14.44	14.37	26.37	7.97	17.56	14.53	34.93	26.65	1.37	15.00
<b>Routine check-up at family doctor (average)</b>															
87.36	22.47	102.00	124.00	74.18	41.21	88.16	68.68	132.00	58.79	36.26	22.71	174.00	335.00	172.00	227.00
<b>One X-ray at doctor's office or hospital (average)</b>															
151.00	15.45	124.00	153.00	65.93	54.95	44.08	118.00	192.00	93.41	23.54	23.40	135.00	212.00	75.60	311.00

Source: Author's own elaboration based on [Emis 2017].

*Re. 2.* In this case, it needs to be determined, in accordance with the doctor's opinion, how much time (days, months, or years) the injured person needs to be aided by nurses or cared for. The determination of such a cost can be based on the value of the average rate per hour of work in a given occupation (in Poland, a nurse is occupation no. 222, the average 2014 rate was as presented in Table 3).

Table 3. Average gross hourly wage of a nurse in Poland in 2014 (in PLN/EUR)

Public sector			Private sector		
total	male	female	total	male	female
19.65 / 4.80	20.10 / 4.90	19.64 / 4.80	17.89 / 4.36	20.84 / 5.08	17.87 / 4.36

Source: Author's own elaboration based on [Central Statistical Office of Poland 2015].

The day care costs can be calculated based on the cost of such care in social welfare centres. In some City Social Welfare Centres (MOPSS) in Poland, the cost of 24/7 care is based on the minimum pension level, e.g. the day care cost in the Wrocław MOPS is 2.3% of the minimum pension amount, thus the Monday-Friday rate was EUR<sup>4</sup> 4.60, and the holiday rate was higher – EUR 4.90 in 2014. Obviously, like for any value assumed for estimation, it needs to be taken into consideration that the hourly care rate in MOPSS can vary between the regions of the country, not to mention the differences across Europe. For example, the hourly day care rate in Warsaw (MOPS Warszawa-Żoliborz) was EUR 2.50, in Chełm - EUR 2.10, and in Koszalin - as much as EUR 6.40 in 2016. It needs to be stressed that these are the lowest rates on the market – private centres charge higher rates.

*Re. 3.* When determining the value of the funds needed for the purchase of medicines in the future, one needs to remember (like in each of the discussed points, as mentioned in the methodology) about inflation and amendments to the law regarding the lists of reimbursable medicines. It needs to be borne in mind that it is only the persons covered by the social insurance system that can benefit e.g. from discounts for medicines or subsidies. It also needs to be emphasised that there is a prescription charge in some countries (e.g. in Great Britain). The differences in the cost medicine are illustrated by the price of 100 aspirin tablets provided in Part I of Table 2.

*Re. 4.* The costs of physical therapy are also significant for the amount. Such costs were, for instance, EUR 24.40 per hour [Mobilmed 2017] on the Warsaw market in 2016. In this case, it is also necessary to determine, based on the doctor's opinion, the period (number of days, months, or years) in which the injured person will need to be supported by physical therapists. An intensive course of several months' physical therapy is required after virtually every surgery resulting from an accident. In the case of hospitalisation, the number of days of the hospital stay must be calculated.

*Re. 5.* This component is also necessary for convalescence. It needs to be remembered that, due to a considerable improvement of the standard in sanatoriums, the price for a stay has significantly increased, now being approx. 30% higher than 5 years ago.

<sup>4</sup> The rate: 1 EUR = 4.1 PLN.

*Re. 6.* When calculating this factor, one may use the lump-sum rates set for travel in the public administration. The frequency of visits, in turn, could be regulated by principles like e.g. in the USA.

*Re. 7.* This point speaks of both a special diet (e.g. enteral nutrition) and simply a varied diet which, owing to its positive psychological influence on the patient, accelerate the healing process. It must be borne in mind that the calculation of this portion of the annuity should include only the nutritional elements which have been added to the diet, not its total daily cost. This can be achieved, for example, through creation of a basket of goods to be added to the daily diet. The basket ought to be valued at the cost of the products applicable in the country from which the injured person comes.

*Re. 8.* The costs of a wheelchair, anti-bedsore pillow and mattress, crutches, protheses, physical therapy devices, aids and equipment, as well as the costs of purchase of a car and car equipment for the disabled, could be taken into account in an annuity with respect to the increased needs by including the amount of equipment depreciation in a given period in the periodic payment. For instance, the estimated cost of purchasing a typical wheelchair is EUR 120-730 in Poland, the cost of an electric wheelchair is ca. EUR 1,830, and its depreciation period is 4 years [PFRON 2015].

*Re. 9.* In the situation where the accident victim is unable to perform the household chores they used to do before the accident, the annuity should also include the funds required to employ a home help. Like in the case of care for the injured party, if some or all chores can be taken over by the injured person's family members, this does not release the injuring party from the obligation to provide the injured person with the funds to purchase such a service on the market. The cost can be determined based on the statistical data of the average hourly rate in a given occupation (in Poland, code 911 corresponds to the profession Home, Office and Commercial Helps and Cleaners, and code 512 - to Cooks, the average occupations are in Table 4).

*Table 4. Average hourly gross remuneration of a home help and a cook in Poland in 2014 (in PLN/EUR)*

	Public sector			Private sector		
	total	male	female	total	male	female
<b>Home help</b>	12.26 / 2.99	13.62 / 3.32	12.19 / 2.97	10.91 / 2.66	10.90 / 2.66	10.92 / 2.66
<b>Cook</b>	13.07 / 3.19	14.63 / 3.57	12.98 / 3.17	11.57 / 2.82	12.27 / 2.99	11.07 / 2.7

Source: Author's own elaboration based on [Central Statistical Office of Poland 2015].

*Re. 10.* This annuity component is temporary, but its significance can be two-fold. It can be granted for the time when a child has a break from school resulting from

being hospitalised or staying at home after a surgery or in a sanatorium. In such a case, private lessons are supposed to help the child catch up and prepare him or her to return to school. Or when the child is unable to go back to school, this ought to be the cost of substitute teaching.

*Re. II.* The list of compensation capital components may be from time to time extended by untypical individually added components. As an example of the expenses which could be disbursed as part of the amount<sup>5</sup>, the judgement of the court which allowed for the costs of a preparation used for treating erectile dysfunctions in adult men consisting in the inability to achieve or maintain an erection sufficient for a satisfactory sexual intercourse could be invoked. As was decided by the court, the judicial and sexological opinion prepared by an expert sexologist provided that the claimant had a regular sexual life, a regular partner with whom he had sex 1-2 times a week using a special preparation which would not have been necessary if it had not been for the accident. Therefore, in the court's opinion based on expert opinions, it needs to be stated that the quantity and value of the purchased substance over the period defined by the claimant was representative for planning the costs involved in purchasing the preparation in the future and the expenses must be included in the annuity for increased needs of the injured party.

### 3. Methodology of determining the value of capital

This section will propose the concept of estimating the amount of capital for medical expenses and the increased needs. The model will be based on financial mathematics (time value of money) and actuarial mathematics (life annuity). The size of the annuity will be approximated by its present value. Knowing the present value of future payouts is important for two reasons. First, the person responsible for paying the annuity (the insurer or individual person) must have a capital reserve for this payment. Secondly, in some countries, it is possible to replace the interim payment (that is, in the form of an annuity) and receive a one-time payment from the victim.

Due to the long time horizon of disability benefits, the time value of money should be included in the calculation. In the annuity model, inflation will therefore be taken into account (increasing annuity). If possible, the exact level of inflation shall be taken for the elements related to medical services, medicines, etc. to adopt inflation for that area, while for calculating the cost of the diet one can assume the general inflation rate. With respect to nursing services and domestic help, the index of salary increase may be used for indexation.

In calculation of the present value of an annuity, it is necessary to take into account the discounting of individual amounts – in line with the principle of the time value of money. The author proposes to make an assumption: the average technical rate

---

<sup>5</sup> A substantiation of the judgment of the Appeal Court in Lublin of 25 June 2009 (file ref. no. I ACa 272/09, unpublished)

in each country as the discount rate or the average rate of long-term government bonds.

The valuation will be based on the actuarial annuity, so it will take into account the probability of the victim surviving the next payment. The model also has a simplified assumption that payments are paid to the injured person once a year. This is related to the construction of life tables. The tables include probability of survival to the next year. It is possible to use methods that allow calculation of the probability of reaching a part of the year (i.e. the assumption about uniformity of death distribution, the assumption about the constant intensity of mortality, Balducci's assumption [Bowers et al. 1986]). Payment split for months is just a simple detail of the method.

It is assumed that the victim receives the payment at the beginning of each subsequent year. The duration of payment of the annuity is dependent on the victim's condition. In some cases (temporary and reversible harm to health), this will be a term annuity and sometimes a whole life insurance (with serious irreversible damage to health such as disability). The amount of payment depends on the cost that the victim will pay in a given year. The calculation should be preceded by the physician's findings on the course of treatment (surgery, rehabilitation, care, medication, etc.).

Taking all these assumptions into account, it can be assumed that the present value of a pension will be calculated on the basis of the treatment program, the course of the disease or the treatment prepared by the physician. The present value of the pension can therefore be described by the formula:

$$PV = \sum_{k=1}^n (1+i)^{k-1} v^{k-1} {}_k p_x A_k$$

$A_k$  – the amount of annual expenses for the first year of the pension, the value determined according to the prices of goods and services in force in the first year of the pension;  $x$  – age of the victim at the time of calculation of the annuity;  ${}_k p_x$  – probability of survival for the victim to the next payment of the annuity;  $n$  – number of years for that the annuity is calculated;  $i$  – annuity indexing rate (e.g. the average inflation for a long period);  $v=1/(1+r)$ , where  $r$  – discount rate (e.g. long-term technical rate or yield-to-maturity (YTM) for treasury bonds).

The author is aware that for severe illness and related health impairment, this should be used in the calculation of life tables for people with disabilities. The probability of surviving each year in the situation of people with disabilities is often lower than for people without disabilities.

Here are two examples showing the possibility of calculating a pension for a short time and for whole life. They include a proposal for a calculation of present value (PV) annuity and possible ways for payoff payment.

*Example 1*

The 25-year-old Pole – a man living in Ostrołęka who was not socially insured – suffered an accident. A knee operation is required in the first year. It was found that the annuity will be calculated for 3 years; after this time the injured person will return to health according to the doctor's opinion. The following assumptions were made for the calculation:

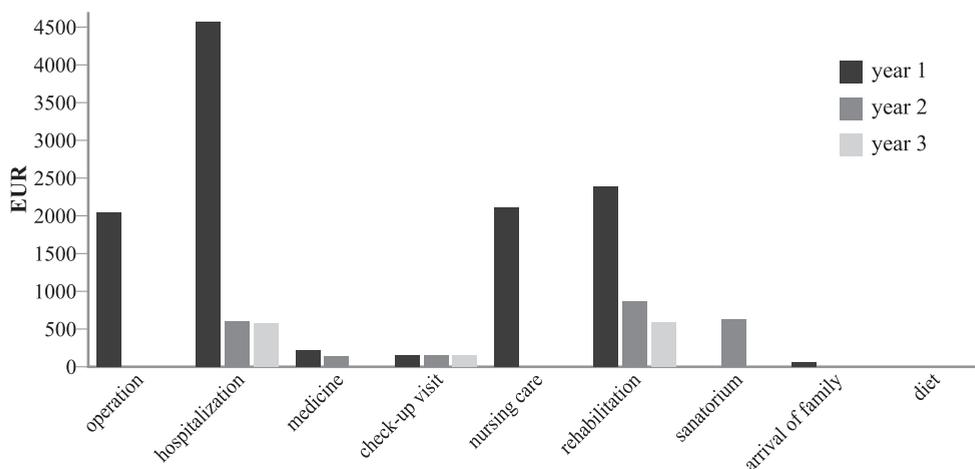
- surgery: surgery of the knee ligaments (cost according to hospital price list in Ostrołęka (price list, 2017, code 81.45/1) this is EUR 2,043.66);
- hospitalization: the first year the victim will stay in the hospital about 30 days, in years 2 and 3, 4 days each (the cost of a day's stay in a hospital in Poland is, for example, EUR 152.20 - price list, 2017, code 009);
- medicines: in the first 6 months, the injured will take medication with a monthly value of EUR 24.39, in the next months, EUR 12.20. Medicines will be taken for 2 years;
- medical visits: the victim has to have a follow-up visit once a month for 3 years. The one time cost (price list, 2017, code 02.01) is EUR 12.93;
- care: for the first 6 months, the injured person needs care 2 hours daily (cost of one hour of a surgical nurse - price list, 2017, code 008 is EUR 5.85);
- rehabilitation: for the first 3 months, the rehabilitation requires 3 hours a day, then to the end of year 1, 6 hours per week, year 2 requires rehabilitation of 15 hours a month, and year 3 requires rehabilitation of 10 hours a month. An hourly cost of rehabilitation (price list, 2017, code 93.0) is ca. EUR 4.88;
- sanatorium: in the second year, it is planned to leave the injured to the sanatorium at EUR 41.46 per day, with a stay in sanatorium for 2 weeks. The cost of travel is EUR 48.78;
- arrivals of family members to the hospital: the victim has a wife and 2 children, they go to visit the victim together in one car. It was assumed that someone would come to visit every day. The model of the car is known (which will allow for the flat rate for the drive) - it is a car with engine capacity up to 900 cm<sup>3</sup>. The distance to the hospital is 8 km one way. According to the flat rate [Minister of Infrastructure 2002] cost for 1 km is EUR 0.13;
- diet: for the first 6 months, the victim will eat a diet rich in calcium and fruit. It was assumed that price of a daily diet is about EUR 1.95 more than the traditional diet.

There are no plans to purchase orthopedic equipment, nor is there a substitute for home work.

The assumptions are as follows: in Poland inflation in the last 10 years (2005 - 2015) was at an average level of 2.53%, the rate of 10-year treasury bonds was 1.44%.

First, the cost values (inflation indexed) were calculated in each year according to the cost and scenario proposed in the example (Figure 1). The present value of the pension is then calculated: EUR 15,703.95.

Figure 1. Costs by category of needs for particular years (in EUR)



Source: Author's own calculation.

Note: Inflation taken into account.

### Example 2

The same man as in first example suffered an accident. It is necessary to amputate both legs in the first year. It was established that the annuity will be paid for his whole life. The following assumptions were made for the calculation: surgery: amputate both legs (cost - price list, 2017, code 84.172; is EUR 329.51 for one leg)

We have the same type of costs (listed below). So, the cost for these are the same as in the first example. Different is the size of the needs for this:

- hospitalization: in the first year, the victim will stay in the hospital about 60 days and 5 days a year thereafter;
- medicines: in the first 6 months, the injured will take medication with a monthly value of EUR 36.59, in the next months EUR 12.20. Medicines will be taken the entire life;
- medical visits: once a month, the victim must have a checkup, for the rest of his life;
- care: for the first 2 years, the injured needs 5 hours of daily care, in the following years such care should be provided 6 hours a week;
- rehabilitation: for the first 3 years, the victim needs rehabilitation for 3 hours a day, then until the end of 10 years, 6 hours a week, and then 10 hours a month for the rest of the victim's life;
- sanatorium: in 2<sup>nd</sup>, 7<sup>th</sup>, 12<sup>th</sup> and 17<sup>th</sup> years;
- arrivals of family members to the hospital every time when the victim is in hospital
- diet: the victim will eat a diet rich in calcium and fruit his entire life.

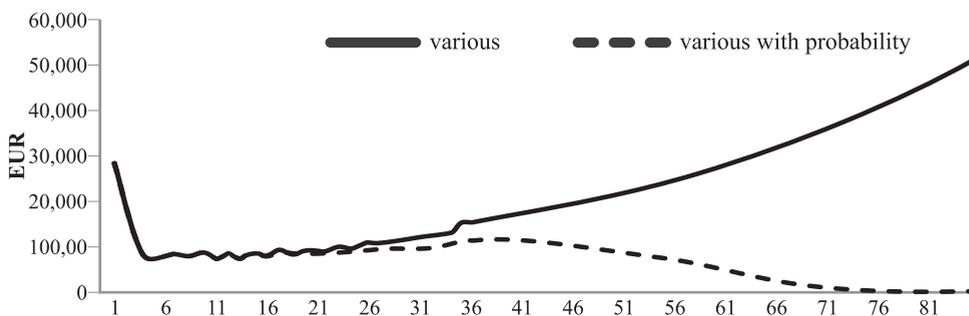
There are also two new costs:

- purchase of orthopedic equipment: plans to purchase a wheelchair every 5 years. The cost of buying a wheelchair is about EUR 731.71. Included not as a one-time purchase and as depreciation of equipment;
- domestic help: the injured needs housework help (cleaning, laundry and shopping) 10 hours a week, and after 60 years of age, needs help 15 hours a week. The cost of hours of domestic work in Poland is as indicated in Table 3 - EUR 2.66 (the lowest bid was chosen).

The assumptions about inflation and discount rate are the same as those in the first example.

The present value of the lifetime annuity is EUR 405,216.30. The use of an actuarial annuity (life expectancy based) is justified because another payout is made only provided that the victim is still alive. The present value of the annuity without taking the probability of survival into account would be EUR 895,152.36. The difference is shown Figure 2.

Figure 2. Nominal value of annual payments with and without probability of survival (in EUR)



Source: Author's own calculation.

Based on this example, one can also discuss the way the annuity is paid. It can be paid according to needs every year (various version). The other way is to standardize payouts (unified version). First, the size of the first payment is to be determined so that by then indexing the inflation rate for each successive year the total PV is used. In this situation, in the first year the victim in example 2 should receive EUR 6,806.68. As can be seen in the examples, the highest costs are in the first year of the annuity. That is why I proposed a third mixed payment model (mix version). At the beginning, part of the present value of the annuity is paid, for example 10%. The remainder is then written into an annuity as in a unified variant. This solution is tailored to the needs of the injured (it allows coverage of high costs in the first year). It is also easy to manage by paying. If we used this mix version for the 2<sup>nd</sup> case, in the first year EUR 40,521.63 shall be paid and starting with the second year EUR 6,281.

#### 4. Conclusions

The article was intended to discuss the possibility of calculating the amount of capital needed to cover the cost of treatment of a victim after an accident. Costs related to treatment connected with the loss of health (permanent or temporary) are only one of many financial consequences after an accident.

Considerations for only one component of compensation for the financial consequences of personal injury show that these effects are not small. First, the shown multiplicity of factors and components that need to be taken into account in calculating the annuity were shown. Next, it was proposed which economic quantities (prices, rates, etc.) may be helpful in annuity valuation. And finally, a method of consistent calculation of the annuity in order to know its current value was proposed.

The examples presented how one can calculate the compensation annuity. In addition, the second example shows the magnitude of the problem of financing of treatment needed as a result of serious accident and serious injury. The annuity was calculated and disbursed in homogeneous annual payments, to be indexed in the future by the inflation rate, yielded an annual value of EUR 6,806.68. In Poland in 2016, the average monthly salary was PLN 4,277 = EUR 1,043.17, i.e. the average annual salary was EUR 12,518.05. This means that the increased needs after an accident can reach as much as half of the average annual salary.

Finally, it should be noted that the most common source of personal injury financing is civil liability insurance, and especially motor vehicle owners (MTPL). Due to the high and still increasing value of these damages, the European Commission adjusts the minimum guaranteed sums (based on Directive 2009/103/EC of the European Parliament and the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability). According to Art. 9 sec. 2, one of the tasks of the European Commission is to valorize the amounts specified in the Directive according to the current inflation rate. Once every 5 years, it reviews the quotas to take account of changes in the European Consumer Price Index covering all Member States and published by Eurostat. Starting in 2017, in the European Union the following guarantee sums are applicable in the event of personal injury: EUR 1,220,000 per victim and EUR 6,070,000 per road accident.

Other sources of funding for the effects of personal injury include: social security, personal injury, loans from relatives and bank loans, personal injury insurance (e.g. life insurance or accident insurance) and public and corporate reinsurance NGOs.

## References

- Bowers N. L., Gerber H.U., Hickman J.C., Jones D.A., Nesbitt C.J., 1986, *Actuarial Mathematics*, The Society of Actuaries, Illinois.
- Carmignani A., Giacomelli S., 2010. *Too many lawyers? Litigation in Italian civil courts*, Temi di Discussione, 745, [www.astrid-online.it/--giustizi/GIUSTIZIA-/Studi--ric/determinanti-litigiosit--BdI.pdf](http://www.astrid-online.it/--giustizi/GIUSTIZIA-/Studi--ric/determinanti-litigiosit--BdI.pdf).
- Czachórski W., 1994, *Zobowiązania. Zarys wykładu*, PWN, Warszawa.
- Emis, 2017, *Healthcare Report*, Emis Publishing, [www.emis.com](http://www.emis.com)
- Enz R., Holzheu T., 2004, *The economics of liability losses – insuring the moving target*, “Sigma”, 6.
- Green L., 1955, *The study and teaching of tort law*, “Texas Law Review”, 34.
- Central Statistical Office of Poland, 2015, *Struktura wynagrodzeń 2014*, [www.stat.gov.pl/obszary-tematyczne/rynek-pracy/pracujacy-zatrudnieni-wynagrodzenia-koszty-pracy/struktura-wynagrodzen-wedlug-zawodow-w-pazdzierniku-2014-r-,4,7.html](http://www.stat.gov.pl/obszary-tematyczne/rynek-pracy/pracujacy-zatrudnieni-wynagrodzenia-koszty-pracy/struktura-wynagrodzen-wedlug-zawodow-w-pazdzierniku-2014-r-,4,7.html)
- Holzheu T., Lechner R., 2009, *Commercial liability: a challenge for businesses and their insurers*, “Sigma”, 5.
- Insurance Europe, *European Motor Insurance Markets*. Addendum, June 2016, [www.insuranceeurope.eu/european-motor-insurance-markets-addendum](http://www.insuranceeurope.eu/european-motor-insurance-markets-addendum).
- Karaś T., 2007, *Uwagi na temat pojęcia „szkoda” w amerykańskiej teorii prawa*, „Studia Iuridica”, 47.
- Kwiecień I., 2015, *Ekonomiczna analiza dochodzenia roszczeń o zadośćuczynienie za szkody na osobie z ubezpieczeń odpowiedzialności cywilnej*, Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław.
- Kwiecień, I. (Ed.), 2011, *Szkody osobowe kompensowane z ubezpieczenia komunikacyjnego OC. Analiza rynku*, Poltext, Warszawa.
- Leimbacher U., Murray R., Bassi D., Spiegel A., 2009, *The Globalisation of Collective Redress: Consequences for the insurance industry*, Swiss Re.
- Lowe J. (Ed.), 2002, *The cost of damages culture; Working Party of The Actuaries Society*; [www.actuaries.org.uk/\\_data/assets/pdf\\_file/0007/.../Lowe.pdf](http://www.actuaries.org.uk/_data/assets/pdf_file/0007/.../Lowe.pdf).
- Mayr D., 2011, *Severe Bodily Injury Claims In Europe - Developments And Trends*; Munich Re; [www.piu.org.pl/public/upload/ibrowser/Munich%20Re.pdf](http://www.piu.org.pl/public/upload/ibrowser/Munich%20Re.pdf)
- Minister of Infrastructure, 2002, *Regulation of the Minister of Infrastructure on the terms of determining and how to reimburse the costs of using non-employer cars, motorcycles and mopeds for business purposes*, [www.isap.sejm.gov.pl/DetailsServlet?id=WDU20020270271](http://www.isap.sejm.gov.pl/DetailsServlet?id=WDU20020270271).
- Mobilmed, 2017, [www.mobilemed.pl](http://www.mobilemed.pl).
- Monkiewicz J., Monkiewicz M., 2016, *Current trends in bodily injury claims in MTPL insurance: 2010-2015*, ProMotor, Warszawa.
- Monkiewicz J., Monkiewicz M., 2017, *Szkody osobowe z OC komunikacyjnego. W poszukiwaniu nowych rozwiązań*, Poltext, Warszawa.
- Narita S., 1997, *Product liability claims in Europe*, Swiss Reinsurance Company Ltd.
- PFRON, 2015, *Dofinansowanie zakupu wózka inwalidzkiego o napędzie elektrycznym*, [www.pfron.org.pl/pl/komunikaty/2670,Dofinansowanie-zakupu-wozka-inwalidzkiego-o-napedzie-elektrycznym.html](http://www.pfron.org.pl/pl/komunikaty/2670,Dofinansowanie-zakupu-wozka-inwalidzkiego-o-napedzie-elektrycznym.html).

Hospital in Ostrołęka, 2017, *Price list*, [www.szpital.ostroleka.pl/userfiles/Cenniki/cennikusugmedycznych-2017.pdf](http://www.szpital.ostroleka.pl/userfiles/Cenniki/cennikusugmedycznych-2017.pdf).

Schmit J.T., 2009, *Factors Likely to Influence Tort Litigation in the European Union*, “The Geneva Papers on Risk and Insurance – Issues and Practice”, 31, pp. 304-313.

Scor Global P&C, 2015, *Motor Insurance and Reinsurance. Current Issues and Future Trends*, Scor Global P&C, Focus.

Surgery Prices in UK, 2017, [www.surgeryprice.co.uk](http://www.surgeryprice.co.uk).

Walachowska M., 2014, *Wynagradzanie szkód deliktowych doznanych przez pośrednio poszkodowanych*, LexisNexis, Warszawa.

Wigmore J. H., 1895, *A general analysis of tort relations*, “Harvard Law Review”, 8, pp. 378-379.

### **Abbreviation**

AT – Austria; BG – Bulgaria; CZ – Czech Republic; DE – Germany; EE – Estonia; FI – Finland; FR – France; GUS – Central Statistical Office of Poland (*Główny Urząd Statystyczny*); HU – Hungary; IE – Ireland; IT – Italy; MTPL – Motor third party liability insurance; NL – Netherlands; PL – Poland; RO – Russia; RS – Serbia; TR – Turkey; UK – United Kingdom.