THE DETERMINATION OF ECONOMIC AND PUBLIC HEALTH BENEFITS ACHIEVABLE BY INCREASING REGULAR PHYSICAL EXERCISE

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Abstracts: There are various methods at our disposal to determine the direct expenses of the factors, which influence the state of health – such as inactive lifestyle –, but research studies aimed at comprehensively determining all direct and indirect expenses have not been conducted in Hungary, yet. We desired to remedy this deficiency with our research, which was prepared at the commissioned order and with the support of the Hungarian Society of Sport Science and the Department for Sport of the Ministry of Human Resources of the Hungarian Government. Using the factual data of OEP (National Health Insurance Fund) we determined the annual cost of illnesses, along with the extent of the cost of physical inactivity, (HUF billion), and we prepared an estimate of the possible amount of savings in Hungary (sick-pay, medication costs etc.), the methodology of which we adapted from international research projects, thus the resulting data in the case of Hungary will later be comparable to international data. International examples reveal the savings achievable by increasing physical exercise in a broad range, even though having conducted the research in different ways and time periods. All research projects concur about one thing, namely that the reduction of physical inactivity can result in significant savings. Our results have verified this statement statistically as well.

Key words: physical inactivity, costs of illnesses, opportunity for savings, the PAR method

Introduction

In the wake of the 2012 Summer Olympic Games the fact, that Hungary achieved the number nine ranking in consideration of Olympic success among all nations fills all Hungarian citizens with pride. It can be boldly declared that *we are a nation of sports*, preceding many nations, which have more robust economies. The divergence between competitive sports and recreational sports is also conspicuous in the course of the analysis of macro-economic and other indicators, from which the difference between a nation of sports and a sports-participating nation can be deduced as well. This is also supported by a correlation-level analysis illustrated in a correlation-matrix. The number of gold medals at the 2012 Summer Olympic Games, as a proxy indicator of the success of a nation of sports doesn't show a significant correlation with the proportion of the sports-participating population (r=0.08; P=0.721; n=23). Comparing the number of gold medals with further economic indicators (GDP in Purchasing Power Standards, activity rate), similarly not significant results is given. However, the average household expenditure for sports and recreational activities (PPS) shows a significant correlation (R=0.421; p=0.04; n=23) with the number of Olympic gold medals.

According to our calculation based on the Euro-barometer data, the population involved in regular sport activities as the proxy indicator of a nation of sports showed a significant correlation with several variables (activity rate, GDP in PPS, household expenditures on sports and recreation, land area usage for recreational purposes %), but not at all with the indicators studied by us (the number of Olympic gold medals in 2012, total number of medals, ranking according to medal-count in 2012).

It's well visible in the figure, that in those nations where sports activity is higher, households also spend more on sports and recreational activities. Vörös (2010) established that theoretically a 4 percentage point increase of the proportion of the population who participate in sports could result in a 1 percentage point rise in the activity rate. Currently, when discussing the participation ratio data of the sports sector factual data is originated from Euro-barometer 2010. This indicates, that more than half of Hungary's population (53%) never participate in any kind of sports activity. 24% of the population participate in sports activities 1-3 times a month or less. Physical exercise 1-3 times a month or less has no health preserving effect, thus furthermore it can be stated about Hungary's population, that it's 77% physically inactive. (Euro-barometer 2010)

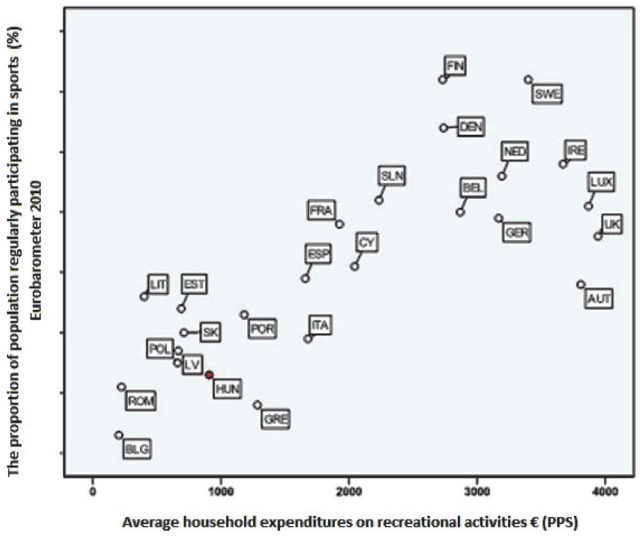

Figure 1: The correlation between household sports expenditure and sports activity in the European Union

Source: compiled by the authors

In the past the participants of sports was depicted in two large groups: one is *competitive sports*, the other is *recreational sports*, which have sharply different participants, goals and missions. It can be undoubtedly stated, that according to the Act LXXXII of 2011 – because of the Corporate Tax Allowance (TAO) opportunity – the competitive sports sector has been expanded by a new independent segment, *spectator sports (Figure 2).*

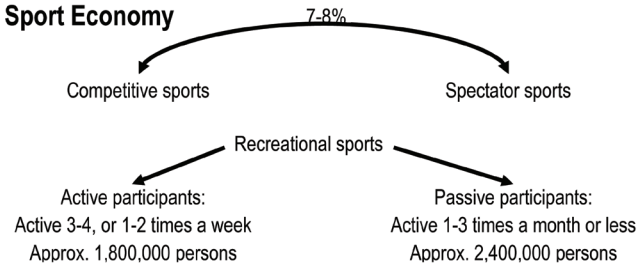

Figure 2: The participants of the sports-economy and their total numbers

Source: compiled by the authors

In Figure 2 the Hungarian society as a statistical population is illustrated. Due to the lack of factual data concerning the number of registered athletes in the competitive sports segment, we were forced to accept the 3% proportion, which originated from the data in the 2007 Healthcare Statistical Almanac about athletes who visited doctor's offices for the purpose of registering as athletes. This means, that in 2007, 3% of Hungarian society had athletes' registrations, thus were registered athletes. Recently the sector has shown an expansion considering the number of participants, which is partly due to the referred Act, since the corporate tax allowance for registered minor-league aged children, who appear in spectator sports has generated positive effects. This means, that we estimate the number of participants in competitive sports at 7–8%, and the total number of those participating in recreational sports is higher by magnitudes. The intensity of physical activity is most often used to determine the participants of recreational sports, but there are other fundamental-concept determinations as well (Szabó 2009).

It can be stated, that an average 4.2% of land area is utilized for recreational purposes in the member nations of the E.U. Hungary ranks slightly under the average with 3.05%, Northern-European nations are mostly in the leading group in this regard as well: the Netherlands 14.9%, Sweden 11.2%, Estonia 9.17%, Finland 6.5% (Vörös 2010) In connection to life-expectancy it can be observed, that there is a strong correlation between the proportion of the population who are "physically active"[1], which is illustrated by the rank-correlation coefficient.

$$\rho = 1 - \frac{6\sum_{i=1}^{n}\left[R(y_i) - R(x_i)\right]^2}{n(n^2-1)} = 1 - \frac{6\sum_{i=1}^{n} D_i^2}{n(n^2-1)} = 0{,}8$$

This means, that the nations which have populations with greater physical activity generally have higher life-expectancies, this also means, that the number of years of their healthy lives is higher, thus their quality of life is measurably (both under subjective and objective circumstances) better.

The nations possessing a better quality of life have a higher economic performance, their economic growth is faster and because of this, through the growth of the national economic performance, the improvement of the quality of life reduces poverty, although indirectly. The interconnection between the state of health, as one of the key factors of the quality of life, and the performance of a nation's economy is so strong, that Barro considers the population's state of health as one of the most important indicators of economic performance and economic growth (Barro 1997). The analysis prepared by Suhrcke and his colleagues (Suhrcke et al. 2005a; 2005b; 2008) determines, that an increase of the life-expectancy of the population by one year could induce an economic growth of 4% in each country. Nordhaus (2002) estimated the value of one extra year of life to be 3 million USD.

The interest in examining the quality of life is gradually increasing in Hungary as well, however Hungary is at the very beginning of the improvement of the quality of life. According to the WHO's statistics published in the May of 2010, the health-behaviour indicators of Hungary's residents (such as smoking, alcohol consumption, inactive life-style) are at the end of the rank list in Europe (WHO, 2010). The health protective effects of physical activity as well as recreational forms of exercise (such as the preventive effect in the case of certain forms of chronic diseases, cardio-vascular, motor disorders, diabetes, tumours) are supported by several Hungarian and international research studies. Through its direct anxiety reducing and mood improving effect, it

[1]The proportion of the population who are physically active indicates the strata of society, members of which are involved in physical activity in some regular intervals, so those individuals don't belong among them, who according to their own accounts never do any sports.

contributes to the maintenance of mental health, with which it improves the quality of life. As a matter of fact, sports are the most effective and, not least importantly, the cheapest method of stress management (Balogh et al. 2008). According to the estimates of Edwards – Tsouros (2006), physical inactivity is responsible for approximately 600,000 deaths in the European Union and it leads to the loss of another 5.3 million healthy years of life as a result of premature disability and degradation of health.

Several researchers have dealt with physical activity and inactivity (Weiss et al. 2000; Martin et al. 2001; Katzmarzyk et al. 2000; Felderer et al 2006; Chenoveth 2005; BHF National Centre 2007; Ackermann et al 2008). Hungarian research projects reported most of all about what kind of demonstrable advantages regular physical activity, physical exercise have. In summary all of them state, that with the reduction of inactivity positive changes can be facilitated in the indicators of health care, the quality of life, welfare and the economy. Gémes in her 2009 work, using the large sample (n=12,634) health care survey of Hungarostudy, states, that among those, who had inactive life-styles (didn't participate in sports at all) it occurred more often, that they couldn't perform their jobs, and were on sick-pay more. The author states that those who had inactive life-styles were also hospitalized more, as opposed to those who were active. (Gémes, 2009).

Research questions and assumptions

In the course of the research, which provides the basis for this study our two main objectives were, to compile mathematical formulas, with the help of which the burdens of illnesses in Hungary can be circumscribed numerically, and to determine the extent of savings in sick-allowance, which could be achieved by reducing inactive life-style. In this paper the following the research questions are tackled: what is the annual cost of illnesses, along with the extent of the cost of physical inactivity in Hungary, (HUF billion)? How much can be possibly saved from this amount (sick-pay, medication costs etc.) with the increase of physical activity in Hungary?

To answer the research questions the following assumptions are used about the Hungarian economy: 1) the labour market is over-supplied and suffers from frictions, 2) the commodity market is over-supplied, 3) performance expectations in companies are based on groups, 4) an average people work 230 days of the year and 5) the basis of loss is the GDP per capita.

Materials and methods

A broad spectrum of international research studies illustrates the savings, which can be achieved by the reduction of inactivity, the size of which is hardly negligible. In the following table the data prepared by similar methodology is presented (Table 1).

In the U.S. half a million premature deaths annually are attributed to inactive life-style and obesity, which result in at least $ 100 billion in health care expenses (Myers 2008). According to a preceding earlier research study the lack of recreational physical activity generated a loss of $ 24 billion (in 1998 dollars), which represented 2.4% of health care expenditures at the time (Colditz 1999). It is important to emphasize, the measurements of the economic burdens of physical inactivity still shows a large diffusion, thus it's risky to make direct comparisons between nations, since each country employs different methodologies.

Table 1: The monetary benefit achievable with the reduction of physical inactivity in various nations

Countries	The burdens of physical inactivity	Benefit achievable with the reduction of inactivity
Austria	No data available	€ 254 million
Norway	€ 980/person/year	No data available
Finland	No data available	€ 1200/person
Switzerland	€ 1.76 billion	€ 1.76 billion (direct expenses) + € 910 million indirectly
United Kingdom	No data available	£ 8.2 billion
USA	USD 21.6 billion	USD 1.3 billion (proportion of inactive population reduced by 5%
Canada	CAD 2.1 billion	CAD 150 million (level of inactivity reduced by 10%)

Source: compiled by authors

Research studies similar to the data shown above have not been conducted in Hungary, more precisely, estimates considering the comprehensive cost savings achievable with the reduction of inactive life-style have not been calculated yet.[2] Only the Sport XXI. National Sports Strategy indicates, that in case of the increasing of the proportion of sports participating population from 10% to 15% Hungary could realize savings of HUF 1.1 billion annually (Sport XXI. National Sports Strategy, 2007). However, this calculation is obsolete, so in the present study it is updated based on current economic data.

In the course of our research project the economic effects of regular physical activity is statistically described in an indirect way. However, difficulty was caused by the fact, that in scientific literature practically every research group – both in Hungary and abroad – define regular physical activity in a different way. Consequently, when cross-checking the unbelievably scarce statistical data this fact should always be paid attention to, and regular physical activity has to be defined (sports activity) very strictly. Because of the motley interpretation of physical activity, we can only consider the level of physical inactivity as original and acceptable facts (this is interpreted the same way by everyone), since this exercise deficient life-style defines the lack of physical activity (exercise), which is necessary for the preservation of health.

[2]The diploma theses of Roland Hécz (2009) is the sole pioneering attempt, which examined the economic burdens of physical inactivity originating from the lack of recreational sports activity, expressively for the case of illnesses.

In the course of our research project we treat as relevant fundamental data – the currently latest editions at our disposal – the Euro-barometer 2005 and 2012 data, the OEP 2009 data, the ONYF (Central Administration of National Pension Insurance) 2009 data and the data of KSH (Central Statistical Office). Beside these a nation-wide large sample questionnaire study (n=1158) was conducted, which data is also utilized .

For the examination of the national economic burdens of inactivity, the national economic burdens of illnesses have to be the staring point, because inactivity is one of the most important risk factors of a number of illnesses and deaths. On the national economic level illnesses have direct and indirect burdens. Considering the indirect burdens in the case of illnesses and inactivity as indirect costs is invalid, because in the result of the loss of work caused by the illness the point is exactly, that there isn't any resource-sacrifice, thus costs can't arise from it either. In contrast to this the lost production still results in a loss to the economy and society, thus it has to be considered as a burden.

In the direct costs of illnesses we included the treatments directly connected to the illness, medications and other compensations. In Hungary the direct costs are fundamentally financed by OEP, however the cost of sick-pay and the private costs should not be disregarded, which are outside of OEP's financing, but which directly burden members of society. Therefore these are also included among the indirect burdens as these constitute losses to the economy or to the society as a result of the loss of work performance. However, it's important to emphasize, that long term loss of production is only possible in the case of under-manned professions and very special cases. To perform the calculations, the current conditions in Hungary has to be integrated into our assumptions, thus the assumptions stated in the research questions and assumptions section are used. The calculations were inspired by a similar calculation used in a study by Kollányi-Imecs (2007), however we replaced their assumptions with the above mentioned, we broadened and tightened formulas and we corrected the data, which since have become facts, thus there is practically no congruency between the two studies, other than the data concerning sick-allowance.

The bulk of direct costs are paid for by the Hungarian government through OEP because of social security. Costs related to medications, hospital care, treatments and sick-allowance can be found here. The other portion of direct costs is related to private expenses, which members of society spend on health care products, out-patient care or on gratuity. While the third portion of direct costs is paid for by corporations, when they finance sick-pay without compensation, these values are presumably underestimated, because in the absence of data we could only account for the mandatory sick-pay before employees enter the sick-allowance system. Based on this we couldn't consider those cases, when the employee is on sick-pay for such a short period of time, that he doesn't enter the sick-allowance system at all.

From among indirect burdens the loss of production caused by illnesses or disability are calculated first, in which we assume a 6 month friction period, in other words, when someone exits the labour market, the corporation employing him finds an employee capable of similar performance within 6 months (including labour search, selection and training). On the Hungarian labour market there is a strong over-supply with the exception of a few under-manned professions, on the individual, as well as or the corporate level we could certainly find a case, in which this assumption doesn't hold true, however on the national economic level in our opinion we are still overestimating the friction period, since filling most available jobs takes a shorter time than this.

In calculating losses of work performance the assumption about the commodity markets is crucial as the performance of companies does not depend on their employees' production but it depends on the sales of their products and services. Since there is significant over-supply in the commodity markets there is no guarantee that the additionally manufactured products and service can be sold. The fact that the performance expectations of companies are not based on the individual level should also be faced, but on the group or the organizational unit. Therefore if someone drops out from the group for a short period of time his performance will be compensated by the other members of the group (in most cases with continuous, unpaid, overtime). Unfortunately we can not compute the effect of stress or decrease in free time because of the coworker's sickness. Annual working days are defined in 230 days, as holidays and vacations had to be also deducted. The basis of loss of production is the GDP per capita, as this is the most reliable aggregate measure and with this the added value is included in the national level and do not care on the performance distribution of companies. If only the average daily wage would be taken into consideration than the income of the company would be disregarded. The decrease of wage because of sick-pay is another type of economic loss, as this amount is not disposable for the household, therefore decreases the national economic performance. Other economic burden is the presenteeism which is the phenomenon when someone works under illness and therefore performs worse which concludes in loss of operation. It has to be taken into consideration however the organizational unit level performance, which means real losses are accounted only in positions of sales or partner relations.

The savings on sick-pay with the decrease of physical inactivity can be measured with the PAR-method (Population Attributable Risk) and its versions are used in most international researches.

$$PAR = \frac{P \times (RR - 1)}{1 + P \times (RR - 1)}$$

The Summary Relative Risk (RR) means the number of the recipients of sick-pay allowances in the physically inactive population. Prevalence (P) means the prevalence of physically inactive population in the full population. We made a survey research to determine the Summary Relative Risk. We were unable to make a representative research among the Hungarian adult population due to lack of time and resources, but we think our results suitable to estimate tendencies, because these

are based on large sample. We used the classical paper and pencil method (n=383) and the online data recording (n=775) to create the primer database. The database consists of 1,158 records covering all the country.

To calculate per capita measures population data from KSH are used. To calculate economic value the net present value method is used with valorized perpetuity of national level savings (Illés 2002).

Results and discussion

In 2005 the economic burdens of illnesses was more than 2 526 billion HUF, which was 11.49% of that years GDP. Direct costs accounted almost 83% of the economic burden and the sick-pay allowance (97 billion HUF) was less than 5% of direct costs. The significantly less indirect burden was more than 430 billion HUF, which is 1,97% of the Hungarian GDP in the year of 2005 (see table 2.).

Table 2. Economic burdens of illnesses in Hungary in 2005

	Economic Burdens of Illnesses in Hungary in 2005	**Total Sum (million HUF)**	**Whose burden is it?**
Direct costs	Medicine	348,869	NHIFA (OEP)
	Medical devices	44,132	NHIFA (OEP)
	Family doctor treatment	62,917	NHIFA (OEP)
	Dental treatment	21,689	NHIFA (OEP)
	Outpatient treatment, CT, MRI	119,695	NHIFA (OEP)
	Care centre nursing (without SID)	9,287	NHIFA (OEP)
	Artificial kidney treatment	16,775	NHIFA (OEP)
	House nursing	3,086	NHIFA (OEP)
	Inpatient treatment	411,492	NHIFA (OEP)
	Patient transport	6,276	NHIFA (OEP)
	Spa	4,759	NHIFA (OEP)
	Governmental health expenditures	109,429	NHIFA (OEP)
	Sick-pay allowances	97,024	NHIFA (OEP)
	Disability pensions	257,350	CANPI (ONYF)
Private expenses	Out-of-pocket expenditures	507,039	Individual
	Expenditures of absenteeism	73,675	Employer
Indirect burdens	Organizational and other costs of Health Insurance Administration	28,120	NHIFA (OEP)
	Friction costs of absenteeism	272,573	Employer
	Earnings reduction due to sick-pay	62,512	Employee and State
	Friction costs of disability	50,772	Society
	Presenteeism costs	18,957	Employer
	Total sum	2,526,427	

Source: compiled by authors

To 2009 the economic burdens of illnesses increased to 3 019 billion HUF, which was 11,6% of that years GDP. Direct costs accounted 84,25% of the economic burden and the sick-pay allowance (101 billion HUF) was less than 4% of the direct costs. Indirect burden increased to 475 billion HUF, which is 1,83% of the Hungarian GDP in the year of 2009 (see table 3.).

The increase of the economic burdens unequivocal, but behind the nominal and GDP proportional growth there is a 4% decline in the real rate if it is corrected by the inflation. The causes of decrease can contain several factors, but one of these is the decrease of physical inactivity (the increase of physical activity). Since in the Eurobarometer it can be seen that in 2005 60% of the Hungarian population never do any sports, and this measure decreased in 2009 to "only" 53%.

Table 3. Economic burdens of illnesses in Hungary in 2009

	Economic Burdens of Illnesses in Hungary in 2009	**Total Sum (million HUF)**	**Whose burden is it?**
Direct costs	Medicine	343,175	NHIFA (OEP)
	Medical devices	46,352	NHIFA (OEP)
	Family doctor treatment	77,612	NHIFA (OEP)
	Dental treatment	22,652	NHIFA (OEP)
	Outpatient treatment, CT, MRI	129,282	NHIFA (OEP)
	Care centre nursing (without SID)	4,194	NHIFA (OEP)
	Artificial kidney treatment	22,934	NHIFA (OEP)
	House nursing	3,818	NHIFA (OEP)
	Inpatient treatment	410,432	NHIFA (OEP)
	Patient transport	5,861	NHIFA (OEP)
	Spa	4,038	NHIFA (OEP)
	Governmental health expenditures	112,729	NHIFA (OEP)
	Sick-pay allowances	101,571	NHIFA (OEP)
	Disability pensions	632,101	CANPI (ONYF)
Private expenses	Out-of-pocket expenditures	548,400	Individual
	Expenditures of absenteeism	79,255	Employer
Indirect burdens	Organizational and other costs of Health Insurance Administration	48,959	NHIFA (OEP)
	Friction costs of absenteeism	285,656	Employer
	Earnings reduction due to sick-pay	66,046	Employee and State
	Friction costs of disability	55,035	Society
	Presenteeism costs	19,867	Employer
	Total sum	3,019,968	

Source: compiled by authors

The 7% percentage point increase in physical activity is likely to manifest in better health conditions and less absenteeism (the average sick-day per employee was decreasing with almost 1 day in this period – exactly with 0.87 day). The decrease in the real value could be a good sign, but it is not enough because of the decrease of the GDP, as according to our opinion the economic burdens' proportion to GDP has to be considered. The society and the government should focus on project, with which the physical activity can be increased, since its effect can be measured in percentage points of the GDP, through the decrease in illnesses.

It should be examined as well that who and how much bore from the burdens of inactivity (see table 4.). Most of the economic burdens were born by the state in 2005 and in 2009 as well through the National Health Insurance Fund Administration and Central Administration of National Pension Insurance. The governments involvement was 61% in 2005 and 65% in 2009, while the individuals' burden decreased from 22,5% in 2005 to 20,35% in 2009 and the employers' burden also decreased from 14,46% to 12,74%.

Table 4: Economic burdens of illnesses in Hungary in 2005 and 2009

	2005 (million HUF)	2009 (million HUF)	Factors
NHIFA+CANPI (OEP+ONYF)	1 540 899	1 965 709	Direct costs and indirect burdens - State
Individual	569 551	614 446	Out-of-pocket expenditures and earnings reduction
Employer	365 205	384 778	Sick-pay, absenteeism, presenteeism
Society	50 772	55 035	Losses in production due to disability
	2 526 427	3 019 968	Sum
NHIFA+CANPI (OEP+ONYF)	60,99%	65,09%	Direct costs and indirect burdens - State
Individual	22,54%	20,35%	Out-of-pocket expenditures and earnings reduction
Employer	14,46%	12,74%	Sick-pay, absenteeism, presenteeism
Society	2,01%	1,82%	Losses in production due to disability

Source: compiled by authors

The economic burdens per capita have been calculated as well, which is shown in table 5.

Table 5: Economic burdens of illnesses per capita in Hungary in 2005 and 2009

	2005 (HUF)	2009 (HUF)	Factors
NHIFA+CANPI (OEP+ONYF)	152 753	196 130	Direct costs and indirect burdens - State
Individual	56 461	61 307	Out-of-pocket expenditures and earnings reduction
Employer	36 204	38 391	Sick-pay, absenteeism, presenteeism
Society	5 033	5 491	Losses in production due to disability
	250 451	301 319	Sum
NHIFA+CANPI (OEP+ONYF)	60,99%	65,09%	Direct costs and indirect burdens - State
Individual	22,54%	20,35%	Out-of-pocket expenditures and earnings reduction
Employer	14,46%	12,74%	Sick-pay, absenteeism, presenteeism
Society	2,01%	1,82%	Losses in production due to disability

Source: compiled by authors

From table 5 it can be seen that different illnesses caused 152 thousand HUF per capita for the Hungarian government in 2005 and 196 thousand HUF in 2009. Beyond this the individuals in Hungary born 56 and 61 thousand HUF in 2005 and 2009 respectively. Therefore illnesses cost 5 thousand HUF per month for the individual and 61 thousand HUF per month for the government in Hungary in 2009. Since however, not all economic burdens connected to illness can be blamed on inactivity, it has to be examined as well what kind of economic burdens emerged as a consequence of inactivity. The calculation of sick-allowance costs caused by inactivity was done based on our large sample questionnaire research study.

According to logistic regression there is significant correlation between regular participation in sports and the days on sickness benefit last year ($p=0.03$; $Exp(\beta)=0.760$). The numerically expressed effect of inactive life-style, calculated PAR indicator's values are shown in table 6. (With a 95% significance level determined confidence for the interval's lower and upper limits, and for its average)

According to the PAR indicator in 2009 of the total number of sick-allowance users 2.3–23.55% lead inactive life-styles, meaning, that with the 77% inactivity of the population, of the total number sick-allowance cases in an extreme case 23.55% can be attributed to physical inactivity. Based on this in 2009, HUF 16 billion could have been preventable, if the physical inactivity of the population had not been 77%, which the government could have used for other purposes. A 10% reduction of inactivity – in our opinion – could be an achievable, realistic objective, which could be seen drastically in the saveable costs as well.

According to Table 7 in the case of 67% inactivity an average HUF 14.07 billion could have been saved. Which means the costs of sick-allowance would expectedly, on the average, be nearly HUF 1.8 billion less with the reduction of physical inactivity by 10 percentage points, which in comparison to the costs attributable to life-style would mean an average 11.20% reduction (10.25%-14.33%). This in practical terms would result in the average saving of 573,175 sick-allowance days annually.

The current value of the annually realized HUF 1.775 billion sick-allowance savings can be easily calculated by using the valorised perpetual annuity formula, well known in the world of finance. As the assumption of the calculation let's take the current yield of government bonds on the market, as the yield-rate of savings, which at the March 13, 2012 bond auction was 7.29%, and let's estimate the growth rate of sick-allowance savings at 1%. The current value calculation is made by using the $PV=C/(r-g)$ formula, the value of which is HUF 28.22 billion.

Thus, a 10% increase of physical activity in Hungary would result in savings of over HUF 28 billion, if the savings' value yield is estimated at the current government bond yield and the annual rate of savings increase at 1%. The practical consequence of this is, that for the Hungarian government, under the mentioned conditions merely from an economic point of view, just through the savings in the sick-allowance, even an investment of HUF 28 billion this year would be worth it, for the increase of physical activity by 10%. Naturally, profits realized from other factors would also be added to this amount, such as the savings on the expenditures of the medication fund, the excess value produced by more motivated employees and the added value of production growth, which could be realized because of the increasing average age. If the expenditure reduction realized on sick-allowance would

Table 6: Calculation of Sick-Pay and Days of Sick-Allowances Assuming 77% Physical Inactivity

	unit	PAR value using data of empirical research (n=1158) in Hungary		
		RR lower limit	RR average value	RR upper limit
Sick-pay Allowances (PAR value with 77% physical inactivity inaktivity)	%	2,3	15,6	23,6
Number of sick-allowance days (32 800 000)	day	754 400	5 116 800	7 724 400
Health care expenditures (101 571 million HUF, OEP)	Million HUF	2 336	15 845	23 920

Source: compiled by authors

Table 7: Calculation Sick-Pay and days of Sick-Allowance Assuming 67% Physical Inactivity

	unit	PAR value using data of empirical research (n=1158) in Hungary		
		RR lower limit	RR average value	RR upper limit
Sick-pay Allowances (PAR value with 67% physical inactivity inaktivity)	%	2	14	21
Number of sick-allowance days (32 800 000)	day	646 290	4 543 625	6 932 492
Health care expenditures (101 571 million HUF, OEP)	Million HUF	2 001	14 070	21 468

Source: compiled by authors

be extended to the level of the entire economic burden with extrapolation, then the government could save HUF 34 billion annually, the economic value of which is HUF 545 billion based on the above described assumptions, while the population could save HUF 10.7 billion annually, the economic value of which is HUF 170 billion, which corresponds to HUF 17 thousand per person. In other words, if health care would be treated as a financial investment, then a 10% increase of activity would be worth HUF 545 billion to the Hungarian government, in which case the population would realize an additional HUF 170 billion and employers HUF 107 billion. From another point of view, economically it would be worth HUF 17 thousand to every resident, if physical activity could be increased by 10%, while the government could add HUF 54 thousand and employers HUF 10 thousand to this amount.

Medical experts have determined those illnesses (11 main types of illnesses) and their symptoms, the causes of which can be proven to be most closely connected to physical inactivity. We have determined, that as a result of certain illnesses more than 10 million patients (10,681,110) visited doctor's offices in the examined time period.

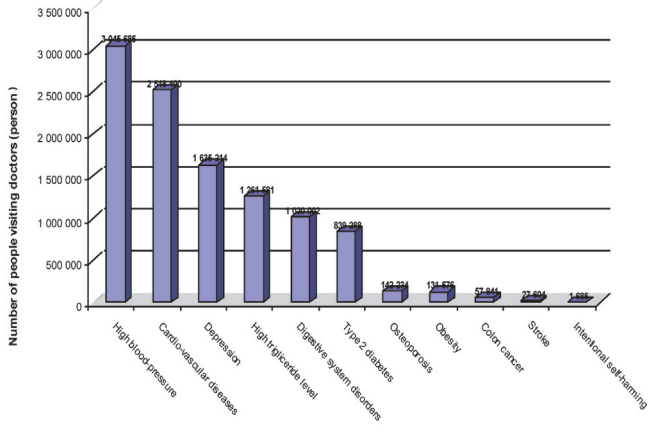

Figure 3: The number of people visiting doctor's offices (person) with regards to the examined illnesses (2009)
Source: compiled by the authors

According to OEP's data it can be stated, that more than one quarter of people (28.51%) requested medical services because of symptoms of high blood pressure (I10), 23, 57% because of cardio vascular diseases (I20; I21; I22; I23; I24; I25; I26; I61; I63; I66; I672; I674; I70; I74; I771; U9900; I801; I802; I803), 15.3% because of depression (F10; F13; F31; F32; F33; F34; F38; F39; F40; F41; F92; R45).

Considering international statistical data we can see, that in Hungary as well, metabolic syndrome has become a disease, which occurs in higher and higher numbers, on which regular physical activity has a beneficial effect.

This combination of symptoms can be considered a widespread disease, since today the "life-style disease" referred to as metabolic syndrome already threatens one out of six European adults. In connection with metabolic syndrome the illness burden data regarding obesity is introduced (E66; E67; E68), hyperlipidaemia (E78), high blood-pressure (I10), stroke (I64) and type 2 diabetes.

According to OEP's data it can be stated, that in 2009, in Hungary 5,305,734 persons visited doctor's offices because of the listed diseases. More than one half of people (57.40%) used medical services because of symptoms of high blood-pressure (I10), nearly one quarter (23.78%) because of high blood-lipids, 15.82% because of type 2 diabetes. The next figure illustrates the distribution of the costs of the services used (Figure 4)

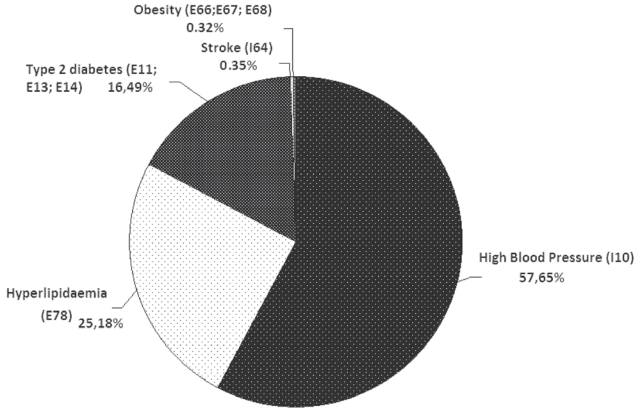

Figure 4. Distribution of patient visits of Metabolic Syndrome (2009)
Source: compiled by the authors

The listed simultaneous symptoms cost the government nearly HUF 131 billion in 2009 (HUF 130,925,805,773), among which the costs of *high blood-pressure* (HUF 75,479,094,691), of *hyperlipidaemia* (HUF 32,973,205,585), and of *type 2 diabetes* (HUF 21,588,136,789) were the highest. The number of sick-allowance days was altogether 906,743 days, 85% of which was caused by high blood-pressure, 13% by type 2 diabetes. The portion of medications and therapeutic equipment above

Social Security assistance is a cost, which appears on the expense side of individuals and households, about the structure of which the following figure (Figure 5) provides information.

It's well visible on the figure, that the individual medication cost contribution, which on the average is 30%, is 78% in the case of obesity.

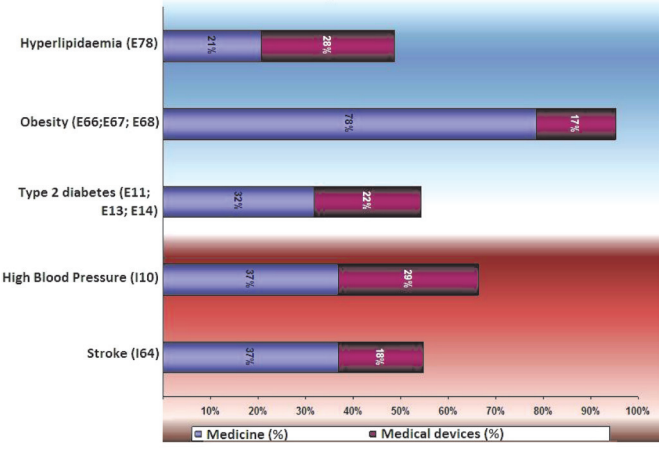

Figure 5: Personal Costs of Metabolic Syndrome in 2009 (%)
Source: compiled by the authors

According to a 2008 study the long term health care prospects of physically active obese people are better than those of physically inactive people with normal body weight (Brown 2008). It is a commonly known fact that the number of obese (overweight) people has doubled in Europe in the past 20 years. In Hungary, in 2009, according to OEP's data 131,576 people required medical services because of obesity, which caused a HUF 421.2 million cost to the government. Currently there is no registered anti-obesity medication on the market in Hungary, so we have to call the attention of decision makers and citizens to the fact, which have been supported by cost efficiency studies – and especially holds true in the case of obesity –, according to which preventing illnesses by increasing physical activity is cheaper, than the health improvement achievable with medications (Apor, 2010).

Summary and outlook

In the present paper we demonstrated our research results that minimum 28 billion HUF could be saved with 10% reduction of physical inactivity on the levels of the national economy, with additional benefits to the society and individuals alike. Paying attention to international trends, in nine member nations of the European Union official strategies have been prepared with the participation of governments and social partners for the preservation of employee health, which are expressly connected to the increasing of physical activity. The strategies placed great emphasis on advancing health preservation in the workplace and the general sense of well-being. Austria, Belgium, Denmark, Finland and Norway have made systematic efforts on the national and corporate levels to improve employee health, and have elaborated specific laws and expert policies to manage the problem. (The report of the European Foundation for the Improvement of Life and Work Conditions, 2010)

Therefore Hungarian government should introduce projects to increase physical activity with significant budget as these projects can have significant pay-off not only for the individual but for the government as well.

With the reduction of inactivity the population's state of health verifiably improves, which increases productivity and reduces the scale of social expenses connected the state of health, which has a positive effect on the nation's competitiveness.

Most important future research area would be developmental projects to increase physical activity and longitudinal research about their results according to the decrease in direct expenses and indirect burdens of illnesses.

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