Public health

ASSESSMENT OF HEALTH AND ECONOMIC BENEFITS OF WALKING IN THE REPUBLIC OF NORTH MACEDONIA USING HEALTH ECONOMIC ASSESSMENT TOOL (HEAT)

Jansun Bukovetz[1], Kristina Shuntova[2], Igor Spiroski[1], Shaban Memeti[1]

[1] *Institute of Public Health of the Republic of North Macedonia; Ss Cyril and Methodius University in Skopje, Faculty of Medicine, Republic of North Macedonia*

[2] *Ss Cyril and Methodius University in Skopje, Faculty of Medicine, Republic of North Macedonia*

Citation: Bukovetz J, Shuntova K, Spiroski I, Memeti S. Assessment of health and economic benefits of walking in Republic of North Macedonia via Health Economic Assessment Tool (HEAT). Arch Pub Health 2021; 13 (2). 17-29.

doi.org/10.3889/aph.2021.6010

Key words: economic benefit, walking, assessment, health, tool

***Correspondence:** Jansun Bukovetz, Institute of Public Health of the Republic of North Macedonia, Skopje,

E-mail:cansun-97@hotmail.com

Received: 7-Avg-2021; **Revised:** 18-Oct-2021; **Accepted:** 25-Oct-2021; **Published:** 20-Noe-2021

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Competing Interests: The author have declared that no competing interests

Abstract

Walking as a form of physical activity has immense health benefits, but it also has economic benefits. Walking is a very efficient activity that prevents certain diseases and enables better quality of life of people who already have some disease.A considerable contribution of walking is detected in cardiovascular diseases, type 2 diabetes, obesity and chronic pulmonary diseases. The aim of this study was to make a health and economic assessment of the benefits of walking in the Republic of North Macedonia by using the Health and Economic Assessment Tool (HEAT). Materials and methods:Health Economic Assessment Tool is a relatively new tool, developed by WHO experts whose expertise is in the field of Public health and is able to calculate the health effects of regular walking and/or cycling. This study was based on using this tool for walking mode for the first time in the Republic of North Macedonia in a population group of 191 participants between the age of 20 to 73 years, with the average age of 35 years.Results:Besides the aforementioned health benefits, HEAT calculates the economic benefits of walking. The tool applied to 191 participants resulted in a total economic value of 108 808.8€ for one yearas well as reduction in mortality rate. Conclusion: We found that less than one fifth of our assessed population spends time in walking according to the WHO, CDC and AHA recommendations. The rest of them, more than four fifths are not following these recommendations. Our assessed population was relatively young, the average age being 35 years old, and the population was healthy, but still the results from this survey were not satisfying.

Јавно здравје

ПРОЦЕНКА НА ЗДРАВСТВЕНИТЕ И ЕКОНОМСКИ ПРИДОБИВКИ ОД ПЕШАЧЕЊЕТО ВО РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА СО УПОТРЕБА НА АЛАТКАТА ЗА ЕКОНОМСКА ПРОЦЕНКА И ЗДРАВЈЕ

Џансун Буковец[1], Кристина Шунтова[2], Игор Спироски[1], Шабан Мемети[1]

[1] *Институт за јавно здравје на Република Северна Македонија; Универзитет Св. Кирил и Методиј во Скопје, Медицински факултет, Република Северна Македонија*

[2] *Универзитет Св. Кирил и Методиј во Скопје, Медицински факултет, Република Северна Македонија*

Цитирање: Буковец Џ, Шунтова К, Спироски И, Мемети Ш. Проценка на здравствените и економски придобивки од пешачењето во Република Северна Македонија со употреба на алатката за економска проценка и здравје. Арх Ј Здравје 2021;13(2) 17-29.

doi.org/10.3889/aph.2021.6010

Клучни зборови: економска придобивка, пешачење, проценка, здравје, алатка

***Кореспонденција:** Џансун Буковец Институт за јавно здравје на Република Северна Македонија, Скопје, Северна Македонија. E-mail:cansun-97@hotmail.com

Примено: 7-авг-2021; **Ревидирано:** 18-окт-2021; **Прифатено:** 25-окт-2021; **Објавено:** 20-ное-2021

Печатарски права: ©2021 Џансун Буковец, Кристина Шунтова, Игор Спироски, Шабан Мемети. Оваа статија е со отворен пристап дистрибуирана под условите на нелокализирана лиценца, која овозможува неограничена употреба, дистрибуција и репродукција на било кој медиум, доколку се цитираат оригиналниот(ите) автор(и) и изворот.

Конкурентски интереси: Авторот изјавува дека нема конкурентски интереси.

Извадок

Пешачењето како форма на физичка активност има огромни здравствени придобивки, но покрај нив и економски придобивки за човекот. Пешачењето е ефикасна активност која може да превенира одредени болести и да овозможи подобар квалитет на живот кај лица кои веќе имаат некоја болест.Значаен придонес од пешачењето е регистриран кај кардиоваскуларните болести, дијабет тип 2, обезност и хронични белодробни болести.Целта на ова истражување беше да се направи здравствена и економска проценка на пешачењето во Република Северна Македонија користејќи ја Health Economic Assessment Tool (HEAT) алатката.Материјали и методи: Health Economic Assessment Tool е релативно нова алатка, развиена од експерти на СЗО, чие поле на експертиза е јавното здравје и е оспособена да ги пресмета здравствените и економските ефекти од редовното пешачење и/или возење велосипед. Нашата студија беше базирана на употреба на оваа алатка за првпат во Република Северна Македонија за пешачење, на популациона група од 191 учесник, на возраст помеѓу 20 и 73 години, со просечна возраст од 35 години.Резултати: Покрај гореспоменатите здравствени придобивки, HEAT ги пресмета и економските бенефити од пешачењето. Алатката употребена за 191 учесник резултираше со целосна економска вредност од 108808,8 евра за една година и редукција настапката на морталитетот. Заклучок: Со ова истражување заклучивме дека помалку од една петтина од проценетата популација пешачи во склоп на препораките од СЗО, ЦКБ и АСА. Останатите, повеќе од четири петтини, не ги следат препораките за пешачење. Нашата популација беше релативно млада, просечната возраст беше 35 години, а дополнително и здрава, но и покрај тоа, резултатите од ова истражување не се задоволителни.

Introduction

Walking is the oldest and simplest form of engaging the muscle apparatus. Although nowadays walking is not appreciated as gym training (weight lifting, pilates, crossfit etc.), it is still the safest form of physical activity, since walking accidents happen rather rarely as opposed to accidents in gym training.

Overthe last century the working environment has become more and more digitalized with little physical loading and the working processes have been concentrated in offices and cubicles. Physical activity does not economically encumber people, and having in mind that preventive health programs are far more cost-effective than the curative ones, we can conclude that physical activity is primarily significant in prevention of health issues, sustaining and improving health of the entire population[1].

Walking, cycling, wheeling, sports, active recreation and play are popular ways to be active, and they can be practiced at any level of skill and for enjoyment by everybody.

The WHO Guidelines on physical activity and sedentary behavior provide evidence-based public health recommendations for children, adolescents, adults and older adults on the amount of physical activity (frequency, intensity and duration) required to offer significant health benefits and mitigate health risks[2].

Walking as a healthful form of physical activity began to receive attention in the 1990s due to new recommendations that emphasized moderate-intensity physical activity. In 1995, the American College of Sports Medicine and the Centers for Disease Control and Prevention published national guidelines on Physical Activity and Public Health[3]. The Committee on Exercise and Cardiac Rehabilitation of the American Heart Association endorsed and supported these recommendations.

WHO guidelines and recommendations provide details for different age groups and specific population groups on how much physical activity is needed for good health.

For adults from 18-64 years of age, individuals above 65 years and those with diabetes type 2, hypertension, cancer survivors and HIV infected, the recommended time for moderate physical activity is 150-300 minutes or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate and vigorous-intensity activity throughout the week. Besides, all these groups of people should limit the amount of time spent being sedentary.

Physical inactivity is one of the leading risk factors for non-communicable disease mortality. People who are insufficiently active have a 20% to 30% increased risk of death compared to people who are sufficiently active[4].

Walking, as much as it seems trivial, futile and worthless is not that unimportant as it may seem. Every day there are scientific discoveries over the benefits of physical activity.

The objective of this study was to measure the health and economic benefits of walking. Even though the economic arguments should not be the only reason for decision making, expressing through a monetary unit is a facilitating way for the decision makers to understand results from the assessments and can also be a tool for creating intersectoral politics.

The aim of this study was to make a health and economic assessment of the benefits of walking in the Republic of North Macedonia by using the Health and Economic Assessment Tool.

Materials and methods

Health Economic Assessment Tool or HEAT is a quantitativetool initially developed in 2007 and upgraded to its 2017 version by WHO that is able to calculate the health and economic effects of regular walking and/or cycling. It quantifies the number of deaths occurring in a population over a given period of time by a basic calculation with multiplying a mortality rate by the population size and the assessment time[5]. The tool offers two types of calculations based on the comparative risk assessment approach. The risk of interest is compared between the reference and comparison case. Thus, according to the module the user chooses, there are single and two-case assessments. In the first one, the user only specifies walking level for the reference case and then this case is compared to an implicit case of no walking. In the two-case assessment, the user specifies levels for both the reference and comparison case. For this study we chose the single-case assessment, therefore we specified walking level for our reference case. The effects of walking or cycling are quantified as relative risks, comparing the risk of exposure in people or, in our case, population that regularly walks to the risk among people that are not exposed, or people that are not walking regularly. These relative risk estimates refer to long-term exposure; data provided by the user must represent estimates of long-term walking or cycling.

The assessment was done in the early months of the year 2020 (March and April), on the territory of the Republic of North Macedonia with multiple towns and cities. The data was obtained using a questionnaire that included 12 questions (five multiple choice questions and seven open-ended). In total, 191 pedestrians aged 20 to 73 years were included in the study. Twenty-three interviews were done in person and 168 through the Google Forms platform. The data was processed by a descriptive statistical method. The average age was 35 years with majority of participants between 20-35 years old. As previously mentioned, we used the single-case assessment and the option for calculating the impact for only one year, with reference case being set in the year of 2020. As our impact pathway we chose only physical activity to be taken into account. In regard to data unit or type, we worked with distance unit-kilometers and time unit-minutes and hours. As for spatial and temporal data adjustment, we used none since our survey was designed for habitual pedestrians and was long-term related.

To accomplish the set aim and realize the study, these data were indispensable:

- An estimate of the size of the study population
- An estimate of the average amount of walking which can be provided as average per person per day with the specifics of duration, distance, trips(count data), frequency and steps (pedometer data).Trip or count data needs to be combined with an estimate of average trip length to calculate the volume of walking. Pedometer data refers to numbers of steps for intentional brisk walking[5].

HEAT offers two types of generic values:

- Default values provided for HEAT assessment, but with available option for the user to overwrite if they prefer other values and
- Background values considered to represent the best scientific consensus, which the user cannot change.

Table 1. General default values used by HEAT[5]

Description	Value	Unit
Average number of trips per day using all likely modes	3	Trips per person per day
Average walking speed	5.3	Km/h
Average distance by walking trip	1.3	Km/trip
Time frame for calculating the mean annual benefit	10	Years
Average length of walking steps	72	Cm
Discount rate	5	%

Sometimes input data may not be adequate or sufficient for all calculations of impact. HEAT offers several options for adjustment or providing additional information in order to calculate the assessment. These data adjustment options for single-case assessment include:temporal and spatial adjustment, for long-term average input, and data from multiple locations and proportions of trips shifted from another mode[5].

Results

As presented in Table 2, majority of the respondents were female.

The smallest percentage of participants (7.8%)was in the age group of 66-73 years, and the highest percentage(59.1%) was in the age group of 20-35 years.

74.9% of participants had completed a high school. They live in 19 different towns and cities in the Republic of North Macedonia.

Regarding body mass index (BMI), majority of our assessed participants or 47.1% had BMI in range of 18.6-24.9, which is considered a normal healthy body weight.

The prevalence of participants that had hypertension in our assessed participants was 12%. Prevalence of diabetes type 2 and heart failure in both cases was 3.7% and the prevalence of chronic pulmonary disease was 4.2%

Table 2. Demographic and health characteristics of the respondents in the survey

Gender

- Male 29%
- Female 71%

Age

- 20-35 y/o 59.1%
- 36-50 y/o 21.4%
- 51-65 y/o 11.5%
- 66-73 y/o 7.8%

Education

- Primary 7.9%
- Secondary 74.9%
- Higher 17.2%

BMI

- <18.5 2.6%
- 18.6-24.9 47.1%
- 25-29.9 39.8%
- 30-35.9 8.9%
- >40 1.6%

Chronic diseases

- None 159
- Chronic Pulmonary Disease 8
- Diabetes Melitus 7
- Heart Failure 7
- Hypertension 23

Malignant disease

- No 190
- Yes 1

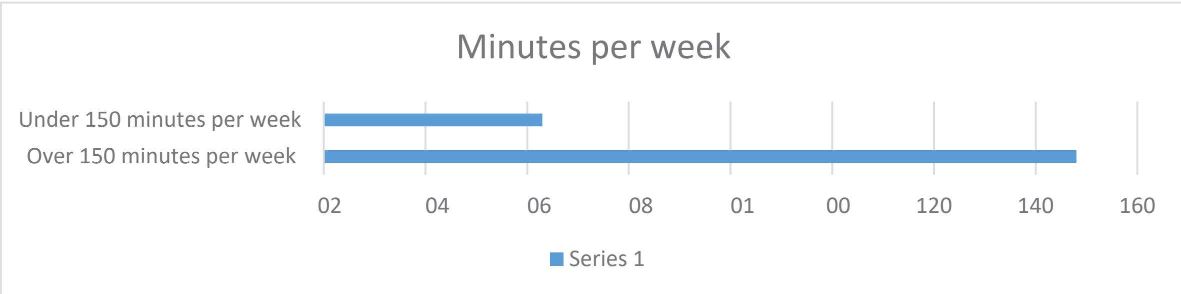

Figure 1. Time per week the respondents spent walking

Based on the given answers of the participants on the time they spent walking on a daily basis, we divided them in two groups. One group walked over 150 minutes and the remaining participants under 150 minutes per week as recommended by the WHO guidelines and recommendations4.

In regard to the time they spent walking per week, minority answered they were walking less than 150 minutes per week and the majority answered they were walking more than 150 minutes per week. On a daily basis, 22.2% walked under 30 minutes and 77.8% walked over 30 minutes.

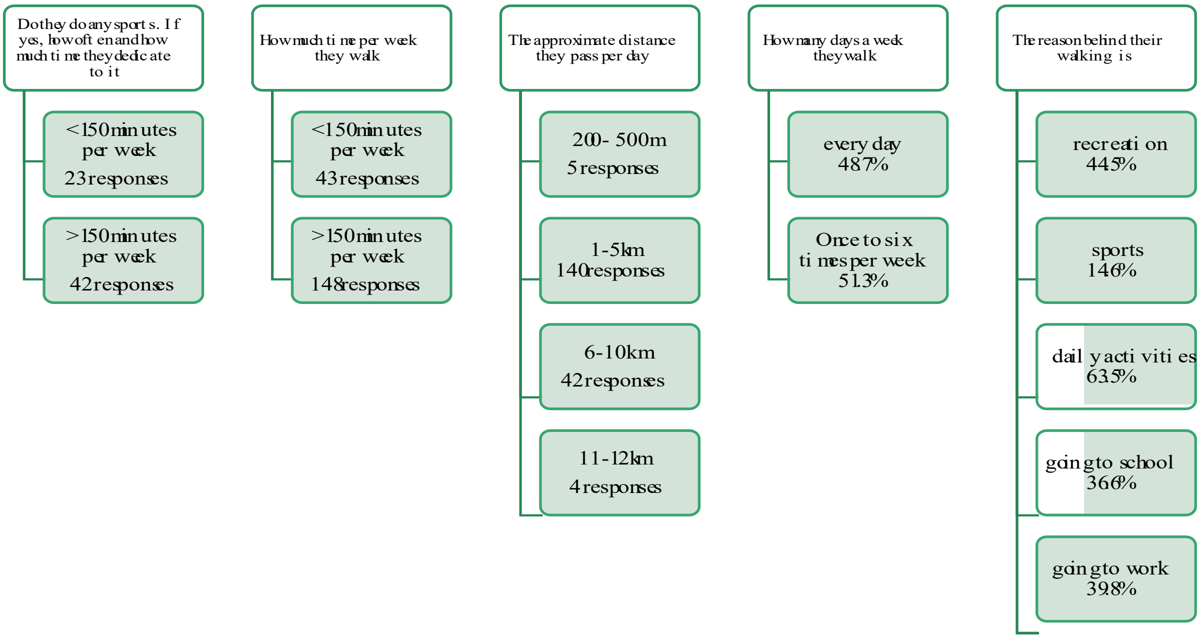

Figure 2. Detailed overview of respondents' walking habits

Majority of our participants or 63.5% were walking as a form of daily activity, meanwhile walking as a form of sport was the least answered. In our study, 63.5% or 121 person answered that they were walking as a form of daily activity, but for providing food, cleaning and housekeeping, etc. A total of 146 people answered they were walking when they were going to school or work. Eighty-five people answered they were walking as a form of recreational activity, and only 28 people or 14.6% answered they were walking as a form of sport.

The average time spent walking was 65 minutes and the average distance spent walking was 4.1km.

Table 3. Summary of the data analyzed by the HEAT tool

Population that walked a certain amount	Percentage	Assessed population	Increase of min per person per day	Impacts for mortality	Total economic impact Full assessment for 1 year	Annual discount rate	Total economic value for 1 year (EUR)
0.2km	0.5%	1	2 min/person/day	0.00007	35.4	5%	32.8€
0.5km	2.09%	4	6 min/person/day	0.0007	344	5%	328€
1km	14.1%	27	11 min/person/day	0.009	4640 €	5%	4420€
2km	21.4%	41	23 min/person/day	0.3	14100€	5%	13400€
3km	13.6%	26	34 min/person/day	0.03	13400€	5%	12800€
4km	6.2%	12	45 min/person/day	0.02	8260€	5%	7860€
5km	17.8%	34	57 min/person/day	0.006	29200€	5%	27900€
6km	5.8%	11	68 min/person/day	0.02	10600€	5%	10100€
7km	3.6%	7	79 min/person/day	0.01	6720€	5%	6400€
8km	3.6%	7	91 min/person/day	0.01	6720€	5%	6400€
9km	0.5%	1	102 min/person/day	0.002	960€	5%	914€
10km	8.4%	16	112 min/person/day	0.03	15400€	5%	14600€
11km	0.5%	1	125 min/person/day	0.002	960€	5%	914€
12km	1.6%	3	136 min/person/day	0.006	2880€	5%	2740€

Mortality is monetized using Value of statistical life (VSL) of 506039.23 euros/death. The Value of statistical life is derived from willingness to pay. VSL is not the value of an identified person's life, but an aggregation of individual values for small changes in risk of death. This value is different for every country and is obtained by a specific formula that derives the country specific values in local currency for the year 2015.

Mortality rate is a measure of the number of deaths in a particular population scaled to the size of death population, per unit of time. The mortality rate for a population is the weighted average of the mortality rate in the exposed population or the so called assessed population and the unexposed population or population that doesn't walk. Mortality rate depends on the contrast in mortality risk between the two groups as well as the size of the groups.

Based on the HEAT criteria, maximal distance that a pedestrian could walk is 12 km, so consequently to this, all of our respondents that gave answers that surpassed this requirement were excluded from the study. Only respondents that met the criteria were included in the study.

Regarding the distance passed on a daily basis, 158 people were walking less than recommended or more than 4/5 from the assessed population. Forty-one person or 21.4%, which is the highest number of respondents, answered they were walking 2 km per day. With the HEAT calculation, it was found that 0.3 premature deaths were prevented, and the economic benefit was calculated to be 13400 euros.

The majority of respondents, 41 of them, said they were walking 2 km per day. If these 41 people walked 7.62 km per day, 0.08 premature deaths would have been prevented, and the total economic impact for 1 year assessment would have been 39400 euros and the total economic value with annual discount of 5% would have been 37500 euros. The difference in economic value between walking 2 km and 7.62 km would be 24100 euros.

The total economic impact of full assessment for 1 year was higher from the total economic value for 1 year. This is due to annual discount rate of 5%, which is ensured by HEAT; the tool gives an opportunity to change this value if the country in which the research is being conducted has another value and these values are usually available by government agencies.

Discussion

Besides WHO4 and CDC (Center of disease control) recommendations6, American Heart Association (AHA)[7] also recommends at least 30 minutes of moderate physical activity daily, at least 5 days a week, minimum 150 minutes per week moderate physical activity or at least 25 minutes for 3 days a week or 75 minutes of intensive physical activity in a week.

In this study,22.5% participants answered they were walking less than 150 minutes per week and 77.5% were walking more than 150 minutes per week as recommended by CDC[6].

The World Health Organization recommends 10,000 steps per day[8].We used a converter (Kyle's converter) for steps to kilometers and 10,000 steps correspond to 7.62 km[9].

If the assessed 191 participants hypothetically walked 7.62 km, there would have been0.4 premature deaths prevented per year, the total economic impact for 1 year assessment would have been 183,000euros and total economic value with 5% annual discount would have been 175,000 euros. These numbers would make a tremendous impact on both, the health system and the economy.In economic terms, this impact would be 66191.2 euros.

The highest noted economic benefit was27,900 euros (Table 3). Logically, it imposes the question "why"? The reason behind this is that respondents that said they were walking more than 5km, individually per answer werefewer than those that walked 5km.

On the other hand, as is to be expected, the least economic benefit would be from persons who walk 200 m or 0.2 km and that would be 32.8 euros, resulting in prevention of 0.00007 premature deaths.

A systematic review of the economy analysis for the active transport interventions in 2016 leads to a conclusion that evidences are insufficient[10].

A study in Palermo made an assessment of their city population of 470,000. The assessment consisted of the economic benefit from these people walking on average 10 minutes per day. They found that if these 470,000 people walked 10 minutes a day for ten years, there would be an economic benefit of 2.2 billion euros and 810 premature deaths would be prevented[11]. In our study, the average time spent walking was 65 minutes. If all of the participants in our study spent 65 minutes walking, there would be 1.83 million euros of economic benefit for ten years with 4 premature deaths prevented.

Another study realized in Aydin, Turkey, made an assessment project very similar to ours. They recruited 260 people for their research, and found that their average walking distance was 2.52 km and applied the HEAT tool. Their results showed that there would be 350,000 euros economic benefit per year and 2,848,000 euros benefit for 10 year assessment[12]. On the other hand, the average walking distance in our study was 4.1 km. Applying HEAT in 191 people with the average walking distance of 4.1 km would make an economic benefit of 128,000 euros per year, and 1,040,000 euros per ten years with 3 premature deaths prevented over 10 years. The difference between the economic benefit would probably be due to the difference in recruited population as well as the Value of statistical life which is different in both countries.

A similar type of study was conducted in Catalonia. The results obtained demonstrated that there would be 124,216,000 euros saved for men and 84,927,000 euros would be saved for women in one year if people who did not follow daily recommendations for physical activity walked for 20-30 minutes, the distance they normally drove for 5 minutes[13]. In our study, 16 participants walked below daily recommendations. If these 16 people walked for 30 minutes a day, there would be 7,290 euros of economic benefit per year and 72,900 euros per 10 years.

Nonetheless, walking as well as cycling are useful for decreasing levels of noise, air pollution and parking expenses[14], decreasing carbon emission, pollution of urban territory and traffic10. In addition to these benefits, the established and proven economic validity from investing in infrastructure for walking and cycling is to be emphasized, too. Furthermore, the goal of achieving safer pavements and convenient recreational grounds will be more approachable if active transport is actively promoted. According to a study in Norway, every car-driven kilometer incurs cost of 0.11 euros, while walking incurs gain of 0.37 euros[15].

By presenting the example in Barcelona, it is visible that increasing walking for 26.7% and cycling for 72.55% in the interval of 2009-2013, the pedestrian injury rate decreased for 26.7%.

As a result, the average economic benefit was estimated to be 47.3 million euros[16].

Data from the Republic Council on Road Traffic Safety, which is an advisory body of the National Assembly of the Republic of North Macedonia, state that pedestrians are the largest group of vulnerable traffic participants. The number of pedestrians dying from road accidents in 2012 compared to 2001 decreased for 50%, but yet the absolute number of pedestrian victims in road accidents is disproportionally high. In 2002, direct and indirect expenses of fatal injury as a result of a traffic accident were 8 million euros, and in 2009 this number went up to 10.6 million euros for accidents that included serious injuries[17]. In 2018, 27 pedestrians lost their lives in traffic accidents, of whom 14 were over 65 years old and 861 pedestrians were seriously injured[18]. 25-30% of deaths in traffic accidents are assigned to pedestrians[19]. This is why it is necessary to support safety measures, through proving separate walking tracks in both urban and rural environments. It has to be mentioned that car transport is increasing more and more when compared to active transport, which creates a pressure to expand the urban environment and road investing, but on the other hand it makes active transport less safe, less attractive and less practical.

In a study conducted in 2008, it was found that physical inactivity was responsible for 9% of premature deaths[20].

Another study examined risk reduction in differently active groups associated with BMI, physical activity and waist circumference. The study suggested that the greatest reduction in risk of premature deaths occurred when comparing inactive and moderately active groups, estimated by combining activity at work and recreational activity. The authors estimated that 20 minutes of walk burns 90-110kcal in people that have similar BMI, and they succeeded in calculating these numbers just by taking one person from the inactive group and transferring that same person to moderately active group and reducing their risk of premature death by 16-30%. They observed the highest impact amongst individuals with a normal BMI. In our study, respondents that walked below the recommended amount of 7.62km as said above, we hypothetically considered to be inactive. We divided them in groups by their BMI according to WHO examples[21]. Depending on BMI level there were75 participantswith BMI in the range of 18.5-24.9 or normal weight, 67 in the range of 25-29.9 that were overweight, 13 participantsin the range of 30-34.9 that were obese, 2 had BMI over 35 and 6 wereunderweight.According to these results, if applied that study to these 163 people, the highest impact of reducing the risk of premature death is expected to be in the 75 people with normal weight. By avoiding all inactivity, theoretically itreduces all-cause mortality by 7.35%[22].

Of the 191 respondents, 23 had hypertension, 7 of them had diabetes mellitus type 2, 7 had heart failure, and 8 respondents had chronic pulmonary disease.

Walking at least 10,000 steps a day contributes to an increased glucose tolerance in population with diagnosed diabetes mellitus[23]. In our study, 6 out of 7 diagnosed participants, walked less than 10,000 steps a day Those 6 people, according to their answers walked as a form of doing some daily activity or form of recreation and just one person answered he was walking as a form of sports activity. Seven participants had diabetes, and 4 of themhad BMI less or equal to 24.9; 2 had BMI of 32 and 33 and 1 person had BMI of 46. Six of the participants did not practice any form of sports, only 1 person answered he was practicing sports activity.

Increasing physical activity among adults at risk for, or with cardiovascular disease (CVD) can help prevent and manage the disease, and walking is an easy way for most adults to avoid inactivity and increase physical activity levels.The prevalence of walking among people at various degrees of CVD risk is unknown[24].

The variance in daily physical activity in heart failure (HF) patients is considerable. In a study that measured daily physical activity of patients with heart failure was found that 44% were active less than 30 minutes a day, whilst 56% were active more than 30 minutes a day25. Eightof our respondents had heart failure, 5 of them said they were walking less than 30 minutes and 3 of them over 30 minutes. In one study, 85% were walking less than 10,000 steps a day, and only 15% were walking more than 10000 a day[25]. In our study, all of theparticipants were walking less than 10000 steps a day. Approximately 65% of the patients with heart failure were overweight or obese[26]. Regarding their BMI, 3 patients were overweight, 2 were obese, 1 was underweight and 2 had normal BMI.

Hypertension is the leading cause of premature deaths and invalidities from cardiovascular diseases[27]. Ten thousand steps a day can significantly decrease blood pressure[28], irrespective ofthe intensity of the exercises[29]. Among our participants 23 answered that they had hypertension. Of these 23 people, 19 answered that they were walking less than 10,000 steps, 4 were walking more than 10,000 steps.Hypertension increases when BMI is increasing[30]. Of the 23 people, 9 had BMI less or equal to 24.9, 9 had BMI less or equal to 29.9, 4 had BMI less than 34.9.It is well known that exercising has hypotensive effect. It can prevent or decrease effects of metabolic and cardiovascular diseases, including arterial hypertension. But in our study, only 3 people gave positive answer for doing sports.

One study examined walking as a form of training and changes in quality of life and exercise in people with chronic obstructive pulmonary disease (COPD) and the results showed a small but significant decrease in dyspnea[31]. In our study, 7 of 8 participants were walking less than the recommended distance. Participants that were walking 1 and 2 km also had comorbidities and were older than 70 years. It imposes the question, if these people walked more frequently and longer distance, would their symptoms decrease? Another study also examined the correlation between physical activity and symptoms of COPD. They found that physical activity can lead to improvements in symptoms such as dyspnea and fatigue[32].

Our study has its flaws and downsides. Participants had a subjective perception of the distance passed on a daily basis and the time spent walking. There were different numbers of participants for the distance passed per day (number of participants per each kilometer) so we couldn`t chose comparative approach for certain matters such as mortality rate. There were no previous studies that can be used to compare economic benefits of the walking in our country. In general, there are insufficient papers world wide discussing this issue. Another limitation is that majority of the recruited participants was in the age range of 20-35 years; when compared to the age group of 66-73 years, it was 7 times higher.

Conclusion

Walking is and should be an important element of life. There are numerous studies that show its benefit on health overall. This study demonstrated that our population does not follow the recommended amount of daily walking. It has to be emphasized that in this period of pandemic it is even more important to promote walking, since people are in their homes and do not conduct physical activities. Our assessed population was relatively young; the average age was 35 years; it was a healthy population and still the results obtained are not satisfying. The accrued financial benefit, specifically through the 108808.8 euros can be reassigned in other aspects of the health system or be redeployed in other social segments. Walking should be promoted from the earliest ages in order to create a behavioral model that should be practiced throughout lifespan. The benefits from walking should be promoted by teachers, health care providers, by public health experts and especially by media, social networks, different campaigns on local and national levels. Of course, the state is duty-bounded as well as the local authorities to create that safe, comfortable and pleasant environment for walking.

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