

# Patterns of leisure time physical activity and its determinants among a sample of adults from Kielce region, Poland – the 'PONS' study

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## Abstract

The aim of the study was to evaluate the prevalence, socio-demographic patterns and behavioural characteristics of leisure time physical activity in a pilot group of respondents of the Polish-Norwegian Study (PONS).

**Materials and methods:** PONS is an open-ended prospective study set in Świętokrzyski Province with study cohort consisting of adults aged 45-64 years. The physical activity section of the questionnaire was based on the International Physical Activity Questionnaire.

**Results:** 43% of the respondents had not walked for at least 10 minutes in their leisure time during the last week. The majority did not engage in any moderate or vigorous physical activity (PA). Being physically active was more prevalent among residents of urban areas and among respondents with a higher level of education. Performing PA was also positively associated with higher net income per household member. On average, respondents had spent 47 hours in a sedentary position during last week. The majority of subjects reported watching TV for 6-20 hours per week. Not having enough time and lack of willingness were given as the main reasons for being inactive.

**Conclusions:** A significant proportion of participants were inactive in their leisure time, even activity less than 10 minutes during the last 7 days was common. Walking was the most popular form of PA in this domain. Urban residence, higher level of education and better financial situation were strongly associated with higher levels of PA.

## Keywords

leisure-time physical activity, physical activity, cohort study, health survey, Poland

## INTRODUCTION

According to the World Health Organization (WHO) physical inactivity is the fourth leading risk factor for global mortality and contributes to 6% of deaths globally, being the principal cause for approximately 21-25% of breast and colon cancers, and 27% of diabetes and 30% of ischemic heart disease [1]. Numerous epidemiological studies reveal a strong suggestion of an inverse and linear relationship between taking up regular physical activity (PA) and rates of all-cause mortality, total cardiovascular and coronary heart disease incidence and mortality, and incidence of type 2 diabetes mellitus [2,3]. Regular exercise training improves blood-lipid profile, resting blood pressure in borderline hypertensives, as well as body composition, bone density, glucose tolerance and insulin sensitivity [3,4]. Thus, individuals who regularly engage in PA are at less risk of

developing many non-communicable diseases (NCD), such as obesity, diabetes, hypertension, coronary heart disease (CHD), osteoporosis and metabolic syndrome [3,5]. PA is also a key determinant of energy expenditure, thus being a fundamental factor apart from diet, to energy balance and weight control [1,6,7]. Furthermore, it has a preventive role in such disease outcomes as anxiety and depression [3,4].

Since 1991, Poland has and is still witnessing changes in cardiovascular diseases mortality trends: after 30 years of increasing CHD mortality and morbidity, a significant and constant decline is being observed [7,8]. According to studies conducted with use of the IMPACT assessment model, an essential proportion (40%) of this decline is a result of changes in dietary patterns [8,9]. At the same time, about 10% of CHD mortality decrease determined between years 1991 - 2005 was attributable to positive changes in patterns of leisure-time PA in the Polish population [10].

Unfortunately, a significant proportion of societies in developed countries become increasingly inactive as a result of rapid technologic and economic development that has occurred in recent decades. Levels of energy needed for daily living-related activities are decreasing as for economical reasons sedentary

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work is preferred, public transportation is broadly available, and such private means of transport as cars are becoming more affordable [3,11]. These factors have contributed to profound individual lifestyle changes, particularly in developing countries and countries in transition [12,13]. In Poland and other Central and Eastern Europe countries physical inactivity is increasing, contributing to a rising prevalence of NCD and their risk factors, such as raised blood pressure, blood sugar and overweight. Thus, physical inactivity is becoming a key issue in the prevalence and control of these diseases, apart from still prevalent NCD risk factors such as tobacco use, alcohol abuse, and inappropriate dietary patterns.

This article is aimed at presenting and evaluating the prevalence, socio-demographic patterns and behavioural characteristics of leisure time physical activity among the pilot group of subjects participating in the PONS study.

## MATERIALS AND METHODS

The PONS study is an open-ended prospective study set in the south-eastern part of Poland (Świętokrzyski Province) with broad research aims. The main purpose of this project is to study the impact of lifestyle factors and biological risk factors on aspects of health, such as the incidence of chronic diseases and quality of life.

**Sample and data collection.** It is assumed that in the first phase of the study 15,000 adults aged 45-64 will be recruited from the general population in 2 geographically defined regions: one city urban district – city of Kielce (200,000 residents) and one rural district – Kielce County (200,000 residents). All males and females aged 45-64 who are permanently resident in those 2 regions have been invited to take part in the study. Each person participating in the PONS study undergoes an interview (Health State Questionnaire - HSQ) covering a broad range of variables, including socio-economic status, demographic characteristics, pre-existing diseases and long-term medication, reproductive history (females), family history of diseases, psychological status, smoking and alcohol consumption, diet and physical activity. These data are being collected by a trained interviewer (a nurse) through face-to-face interview. The responses are entered on an electronic form, and after completion of the interview, the data are sent directly to a data server for processing and further management. Each study participant is a subject to medical check-up and anthropometrics. Blood and urine samples are collected from all respondents for long-term storage. This primary analysis concerns the results obtained from the first set of respondents participating in the PONS project, a sample of 3,862 subjects.

**Measurements.** The physical activity section of the PONS questionnaire was based on the long form of the International Physical Activity Questionnaire (IPAQ). This is designed to assess respondent's habitual PA during the past 7 days, covering the 4 domains of activity: 1) occupational, 2) transportations, 3) household/gardening, and 4) leisure time activities. This assessment is based on each person's self-reported data on the number of days per week (frequency) and the time spent each of these days (duration) performing 3 types of PA – walking, moderate-intensity activities and vigorous-intensity activities – in each of the 4 our above-

mentioned activity domains. Only those respondents who admitted to performing any of these activities for at least 10 minutes during last 7 days were subject to such detailed analysis.

Study participants were also asked 2 questions about the time spent sitting on a typical working day and during free days [14]. Detailed information on this questionnaire can be found on the IPAQ website ([www.ipaq.ki.se](http://www.ipaq.ki.se)). Aside from the IPAQ, the PONS study design team decided on adding one question determining the reasons for lack of physical activity -asked of those respondents who declared that they do not walk or use a bicycle for transportation purposes, and those who do not engage in physical activity in their leisure time, and one question on amount of time spent watching TV during a usual week, as an additional indicator of sedentary behaviours.

**Analytical approach.** This primary analysis is focused on presenting the data regarding 3 types of physical activity performed in leisure time: recreational walking, moderate-intensity and vigorous-intensity exercises. These patterns of PA were subject to cross-sectional analyses with reference to such socio-demographic factors as age in two age groups: 45-54 and 55-64, place of residence (urban/rural), level of education – 1) primary and vocational, 2) secondary and 3) higher (including incomplete higher), net income per household member per month: up to 700 PLN, 2/701-1375 PLN and 3/1376 PLN and higher, and gender. The indicators of sedentary behaviours and declared reasons for giving up the physical activity were analyzed in relation to gender.

## RESULTS

**General patterns of physical activity.** Primary results of the PONS study show that 33.3% of respondents had not engaged into any type of physical activity for at least 10 minutes in their leisure time during last week. Any activity was reported by 66.6% of subjects, while only 2.4% have admitted to performing all 3 types of PA in this reference period. The majority (56.5%) of PONS respondents declared that they have walked for recreational purposes. Other types of activity were performed by a significantly lower proportion of subjects: only 1 in 5 (19.9%) admitted to engaging in any vigorous intensity exercises (e.g. speed cycling, brisk walking, or aerobic exercises), moderate exercises (e.g. cycling), were performed only by 11.1% respondents (Table 1).

**Volume and socio-demographic characteristics of recreational walking.** The majority of the PONS subjects (43.9% of males and 43.6% of females) declared that they did not walk for recreational purposes, even for at least 10 minutes during the week preceding the study. About quarter of respondents (25.9% of males and 28.7% of females) declared a total amount of 150 or more minutes of such activity. The percentages of those who walked for a total amount of time of at least 61-149 minutes (13.5% of males and 14.6% of females), or of 10-60 minutes (16.8% and 13.0%, respectively) were significantly lower.

Walking in leisure time was significantly more often declared by older respondents: 59.9% of those aged 55-64 had performed this type of activity for at least 10 minutes during the last week, compared to 51.5% of subjects aged 45-

**Table 1.** Participation in physical activity in leisure time (for at least 10 minutes during 7 days preceding the study), by gender and type of activity

	Walking <sup>1</sup>				Moderate intensity exercises <sup>2</sup>				Vigorous intensity exercises <sup>3</sup>			
	Yes		No		Yes		No		Yes		No	
	Number.	%	Number.	%	Number	%	Number	%	Number	%	Number	%
Males	727	56.4%	563	43.6%	221	17.1%	1,068	82.9%	156	12.1%	1,133	87.9%
Females	1,453	56.5%	1,117	43.5%	547	21.3%	2,024	78.7%	273	10.6%	2,295	89.4%
Total	2,180	56.5%	1,680	43.5%	768	19.9%	3,092	80.1%	429	11.1%	3,428	88.9%

<sup>1</sup> Chi-square test value = 0.011 with  $p < 0.915$ ; <sup>2</sup> Chi-square test value = 9.192 with  $p < 0.002$ ; <sup>3</sup> Chi-square test value = 1.880 with  $p < 0.170$

54. Similar difference was found when residents of urban and rural areas were compared: while 52.3% of Kielce residents were engaging in recreational walking, a significantly higher percentage was determined among respondents living in rural districts – 58.3%. Subjects with higher or incomplete higher education declared walking more often (59.4%) than those with secondary (56.0%) or primary and vocational (53.4%) education. The proportion of persons engaging in walking in their leisure time was highest among those study participants who declared that their net household income per capita amounts to 1,376 PLN per month, or is higher (59.7%). In the lower socio-economic groups, this proportion was significantly lower (53.0%) among subjects with an income of 700 PLN per month or less, 51.9% in those declaring an income between 701 – 1,375 PLN per month.

**Volume and socio-demographic characteristics of moderate intensity PA.** A significant majority of respondents (82.9% of males and 78.7% of females) declared that during the last week they had not performed any moderate activities with a total duration of at least 10 minutes. Engaging into this type of activity for 150 or more minutes was reported only by 3.8% of males and 4.9% of females. The percentages of those who declared a total volume of 61-149 minutes (6.5% of males and 8.0% of females) or 11-60 minutes (6.7% and 8.3%, respectively) were slightly higher; however, these differences are not statistically significant.

The prevalence of those participating in moderate-intensity exercises is similar in respondents aged 45-54 and those aged 55-64 (20.2% and 19.7%, respectively). Place of residence and level of education were important predictors for this type of activity, as it was more often declared by respondents living in Kielce (22.2%) than those living in the surrounding rural area (14.6%). More than a quarter (28.7%) of respondents with higher education participated in moderate exercises, compared to 18.2% with secondary education and 11.2% of those with primary or vocational education. A similar pattern was determined when different socio-economic groups were compared: 27.8% of respondents with the highest level of household performed moderate intensity PA, while these percentages were significantly lower for subjects with an income of 700 PLN or less (13.8%) and for those in the middle income group (19.8%).

**Volume and socio-demographic characteristics of vigorous intensity PA.** Similar to the case of moderate intensity exercises, a great majority of PONS study subjects (87.9% of males and 89.4% of females) reported not performing exercises of vigorous intensity the week preceding the study, even for at least 10 minutes. A total amount of 150 or more minutes of such activity was declared only by 4.7% of males and 3.8% of females. On a similarly low level were the percentages of those who performed vigorous intensity PA for a total amount of time of at least 61-149 minutes (4.2% of males and 4.3% of females). Only 3.2% of males and 2.6% of females declared engaging in these types of activities for 10-60 minutes during the last week.

No significant differences were found when comparing the proportions of respondents engaging in vigorous activities in younger (12.6%) and older (10.2%) PONS subjects. The proportion of respondents engaging in these types of exercises was significantly higher among those living in Kielce (13.2%) than in residents of rural settings (6.4%). The study revealed a strong correlation between level of education and participating in vigorous PA: only 3.7% of respondents with primary or vocational education declared this type of activity, compared with 8.9% of those with secondary education, and 19.7% of subjects with higher or incomplete higher education. A similar correlation was observed when the level of net income per household member was analysed. Respondents of lower or medium socio-economic status engaged in vigorous exercises significantly less often (6.0% and 8.5%, respectively), than those achieving a net income per person of 1376 PLN or higher (16.4%).

**Characteristics of PONS subjects sedentary behaviours.** On average, the surveyed persons had spent 47 hours in a sedentary position during the last week. On working days, the respondents were sitting for an average of 32 hours. PONS subjects also declared spending an average number of 18 hours sitting during their free days. At the same time, the majority of respondents (55% of males and 58% of females) admitted that they spend 6-20 hours sitting down and watching TV during a typical week. The prevalence of devoting 21 or more hours to watching television in a typical week was also high – 29.5% of males and 23.9% of females declared such behaviour (Table 2).

**Table 2.** Average number of hours spent watching TV during a typical week, by gender

	On average, how much time per week do you spend at home, watching TV?											
	Up to 5 hours		6-10 hours		11-20 hours		21-30 hours		31 hours or more		Total	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Males	192	15.0%	236	18.5%	466	36.6%	302	23.7%	73	5.7%	1,269	100.0%
Females	462	18.1%	503	19.6%	979	38.2%	518	20.2%	94	3.7%	2,556	100.0%
Total	654	17.1%	739	19.3%	1,445	37.7%	820	21.4%	167	4.4%	3,825	100.0%

Chi-square test value = 29.6 with  $p < 0.0001$

**Table 3.** Reasons for giving up physical activity in leisure time, by gender

	What are the reasons for which you do not exercise or choose not to exercise?												Total	
	I do not have time		I do not feel like doing it		I do not have such a need		My health state does not allow me to		I am working hard physically		Do not know/hard to say			
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	N	%
Males	327	25.5%	473	37.0%	174	13.6%	119	9.3%	90	7.0%	97	7.6%	1,280	100.0%
Females	554	21.8%	1,124	44.1%	236	9.3%	325	12.8%	102	4.0%	206	8.1%	2,547	100.0%
Total	881	23.0%	1,597	41.7%	410	10.7%	444	11.6%	192	5.0%	303	7.9%	3,827	100.0%

Chi-square test value = 55.4 with  $p < 0.0001$

**Declared reasons for giving up physical activity in leisure time.** 37% of males and 44.4% of females declared that they are not active in their leisure time because they 'do not feel like doing it'. The second most prevalent answer was 'Due to lack of time'. 13.6% of males and 9.3% of females stated that they do not have the need to be physically active, while 9.3% and 12.9%, respectively, declared that they are inactive due to their state of health. 7.0% of males and 4.0% of females declared that they gave up PA due to the fact that they work hard physically. About 1 in 10 respondents (7.6% of males and 8.1% of females) could not specify their reasons for being inactive in leisure time (Table 3).

## DISCUSSION

The prevalence of engaging in physical activity determined among the first set of the PONS population is significantly low; this especially concerns such types of PA as exercises of moderate or vigorous intensity. These results seem to be in accordance with data obtained in other studies on physical activity conducted in Poland in recent years. According to the study on sports and physical activity conducted in 2008 by the Polish Central Statistical Office, approximately half of Polish adults (aged 15+) are physically inactive in their leisure time [11]. 53% of respondents declared that they had not performed any vigorous physical activity during the last week, and 40% claimed that they had not engaged into any moderate physical activity during the same reference period [11]. Furthermore, in the Eurobarometer study on sport and physical activity conducted in 2009, 49% of Polish adults (15+) declared that they never exercise or play sport, and about two-fifths (36%) claimed that they never (or seldom) engage in any physical activity outside sport (such as cycling or walking from one place to another, dancing or gardening) [15]. 26% of the Eurobarometer study respondents reported that they exercise or play sport regularly, or with some regularity [15]. Among the PONS subjects, only 19.9% performed moderate-intensity exercises and 11.1% had engaged in vigorous PA during the last 7 days. Such low percentages may result from the older age of the PONS study participants (45-64-years-old). The observation that older age is negatively correlated with physical activity is consistent with results of the above-mentioned Eurobarometer study. According to the European Commission report on the results of the latter study, physical activity decreases with age, especially among those respondents who did not formed a regular exercise pattern in their early life [15]. The socio-demographic characteristics of PONS respondents physical activity are also consistent with the conclusions of the 2009 Eurobarometer study: participation in exercises during leisure time is positively correlated with a better financial situation and higher level of education.

An interesting finding in the results obtained from the first set of the PONS study participants is that residents of the rural district were less active in their leisure time than the study subjects living in Kielce. This concerns such types of PA as vigorous and moderate exercises. The difference probably results from the fact that persons living in rural areas have more often declared being physically active within domains other than leisure time. Performing vigorous-intensity activity in professional work was declared by 20.1% of rural residents, compared to 10.1% of respondents living in Kielce. A similar pattern (39.6% and 25.1%, respectively), was determined for performing moderate-intensity activities at work. 15.3% of PONS subjects living in rural areas declared that they were cycling to shops, work or office, while for urban residents this percentage was significantly lower (3.9%). Residents of Kielce County were also more often engaged in PA within domestic work. 27.6% performed vigorous activities in their household or garden, while 50.9% declared performing moderate-intensity activities within these domains. Among residents of urban areas these percentages were significantly lower (10.5% and 17.0%, respectively). These findings suggest that both populations require a different analytical approach in assessing their levels of risk factors related to physical activity and inactivity. Separate recommendations should be prepared for residents of urban and rural regions, taking into consideration the lifestyle differences between both groups.

5% of respondents reported being inactive in their leisure time due to performing hard physical work. Data collected from the first set of PONS respondents show that 13.4% of subjects performed vigorous PA at their workplace (19% of males and 9.7% of females); moderate PA within this domain was reported by 29.8% of respondents (36.6% of males and 25.3% of females). The correlation between occupational PA and state of health of middle-aged Poles should be a subject of an in-depth analysis in future studies. Such analyses should take into consideration the fact that the characteristics of this relation is debatable. Manual labour is usually related with performing such actions as heavy lifting, prolonged standing, working with the hands lifted to shoulder height or higher, and working with the back twisted or bent forward, while exercises performed in leisure time are characterized by dynamic contractions of large muscle groups increasing whole-body metabolism and cardiac output, with ability to rest when fatigue demands it [16]. Furthermore, occupational PA is often related with high levels of job stress, as physical workers are often exposed to such stressors as highly repetitive, monotonous tasks, excessive job demands, pressure of time, or environmental exposures (e.g. constant background noise, or heat). Such working conditions can contribute to an elevated risk of cardiovascular diseases (CVD). Epidemiological studies have found that particularly among males, the impact of job strain on CVD is stronger and consistent among blue-collar workers than among men in jobs related with higher

economic status [17]. According to recent findings, high levels of occupational PA increase the risk of long-term sickness absence, which suggests that occupational PA and leisure-time PA present opposing effects on global health [16].

The reasons for being inactive declared by the PONS subjects are consistent with the results of other studies on physical activity in Poland. The most prevalent reasons determined in the study conducted by the Polish Central Statistical Office were: lack of time, lack of interest in active forms of spending leisure time, state of health, and age [11]. About two-fifths of PONS subjects declared that their main reason for giving up PA in leisure time was 'not feeling like doing it'. This is consistent with data collected in the 2009 Eurobarometer study – 52% of adult Poles participating in this study agreed with the phrase 'Being physically active does not really interest me – I would rather do other things with my spare time' [15].

One of the main purpose of this primary analysis was to assess the reliability of the study tools used in the PONS project. The results obtained through the Health State Questionnaire seem to confirm the general observations from other studies assessing the physical activity in the Polish population [11, 15, 18, 19]. At the same time, it has to be taken into consideration that the PONS study is based on a specific methodological approach: only middle-aged adults are participating in this project, and the study sample is not designed to be representative on a national basis. Further limitations of these first analyses result from the fact that it concerns only data collected from first set of 3,862 participants who served as the baseline population. The mean age of the participants in this sample was 57 years. Furthermore, females were over-represented in this group (67% of respondents).

Further analyses of the physical activity of PONS subjects will require a more in-depth approach, especially with respect to the fact that methods such as the questionnaire used in the PONS study is based on information self-reported by the respondents. Therefore, the use of more objective methods, such as pedometer monitoring or the get-up-and-go test could be considered as an additional source of information on respondents' habitual activity and fitness. Such methods could be implemented in a random sample of PONS respondents.

The PONS seems to be a study project of vast importance as it presents the possibility of conducting an in-depth analysis of physical activity and inactivity patterns among representatives of very specific population (older adults). The PA of middle-aged Poles have seldom been the subject of in-depth analysis in other epidemiological studies which have usually focused on other NCD risk factors, such as inappropriate dietary patterns, obesity and overweight, tobacco smoking and overweight. The PONS study, based on a standardized methodological approach, can potentially serve as a valuable tool for assessing the importance of PA in the prevention of NCD burden in middle-aged Poles, and thus be an important source of information for health-policy makers.

A significant proportion of studied respondents did not perform any physical activity in their leisure time, even for at least 10 minutes during the last 7 days. Walking was the most popular form of PA in this domain. A significant majority of respondents did not engage in any form of moderate intensity or vigorous exercise. Baseline assessment results show that living in urban areas, higher level of education and higher net income per person per month in a household are associated with a higher prevalence of PA in leisure time. The PONS study results confirm the observation that a significant proportion

of Polish adults are physically inactive and therefore at higher risk of developing various non-communicable diseases.

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## REFERENCES

1. World Health Organization: Global recommendations on physical activity for health, World Health Organization, Geneva 2010.
2. Rankinen T, Bouchard C. Dose-response issues concerning the relations between regular physical activity and health 3. President's Council on Physical Fitness and Sports Research Digest 2002:1-8.
3. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association, *Med Sci Sports Exerc* 2007;39(8):1423-34.
4. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, et al. Physical activity and public health - a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine, *JAMA* 1995;273:402-7.
5. Drygas W, Kwaśniewska M, Kaleta D, Pikala M, Bielecki W, Głuszek J, et al. Epidemiology of physical inactivity in Poland: Prevalence and determinants in a former communist country in socioeconomic transition. *Public Health* 2009;123(9):592-7.
6. World Health Organization: A guide for population-based approaches to increasing levels of physical activity: implementation of the WHO global strategy on diet, physical activity and health. World Health Organization, Geneva 2007.
7. Rywik SL, Piotrowski W, Rywik TM, Broda G, Szczesniwska D. Is the decrease of cardiovascular mortality in Poland associated with the reduction of global cardiovascular risk related to changes in life style? *Kardiol Pol* 2003;58(5):344-55.
8. Zatonski W, Willett W. Changes in dietary fat and declining coronary heart disease in Poland: population based study. *BMJ* 2005;331:187-8.
9. Zatonski W, Campos H, Willett W. Rapid declines in coronary heart disease mortality in Eastern Europe are associated with increased consumption of oils rich in alpha-linolenic acid. *Eur J Epidemiol* 2008; 23(1): 3-10.
10. Bandosz P, O'Flaherty M, Drygas W, Koziarek J, Wyrzykowski B, Rutkowski M et al. Explaining the decline in coronary heart disease mortality in Poland between 1991 and 2005. *Eur J Epidemiol* 2010;31 (Abstract Suppl.):167.
11. Central Statistical Office of Poland, Participation of Poles in sports and physical recreation, Central Statistical Office of Poland, Warsaw 2009. (In Polish, available from URL: [http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL\\_kts\\_Uczestnictwo\\_po\\_w\\_sporcie\\_w\\_2008r.pdf](http://www.stat.gov.pl/cps/rde/xbcr/gus/PUBL_kts_Uczestnictwo_po_w_sporcie_w_2008r.pdf))
12. World Health Organization: The world health report 2002: reducing risks, promoting healthy life. World Health Organization, Geneva 2002.
13. World Health Organization: Diet, nutrition and the prevention of chronic diseases. WHO Technical Report Series 916, World Health Organization, Geneva 2003.
14. Guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ) - Short and Long Forms. IPAQ Web site. [http://www.ipaq.ki.se/dloads/IPAQ%20LS%20Scoring%20Protocol\\_Nov05.pdf](http://www.ipaq.ki.se/dloads/IPAQ%20LS%20Scoring%20Protocol_Nov05.pdf) (published November 2005).
15. European Commission, Sport and Physical Activity. Special Eurobarometer 334 (Wave 72.3). TNS Opinion & Social. Brussels, EU 2010. Available from URL: [http://ec.europa.eu/public\\_opinion/archives/ebs/ebs\\_334\\_en.pdf](http://ec.europa.eu/public_opinion/archives/ebs/ebs_334_en.pdf)
16. Holterman A, Hansaen JV, Burr H, Sogaard K, Sjogaard G. The health paradox of occupational and leisure-time physical activity, *Br J Sports Med* 2011 (Apr 1.). [Epub, ahead of print].
17. Landsbergis PA, Schnall PL, Belkić KL, Baker D, Schwartz J, Pickering TG. Work stressors and cardiovascular disease, *Work* 2001;17(3):191-208.
18. Kaleta D, Jegier A. Predictors of inactivity in the working-age population. *Int J Occup Med Environ Health* 2007;20(2):175-182.
19. Kaleta D, Makowiec-Dąbrowska T, Jegier A. Physical activity and self-perceived health status. *Int J Occ Med Environ Health* 2006;19(1):61-69.