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Selected Determinants of Physical Activity of the Inhabitants of the Poznań Metropolis Based on the IPAQ Questionnaire[1]

Abstract. Low level of physical activity is one of the main problems of modern society's health. Research results suggest that Poland is a country characterised by low physical activity, with city dwellers being more active than villagers. So far, the research issues of physical activity of city dwellers have not included a context of a metropolitan area. Therefore, the aim of this research was to determine the level of physical activity of the inhabitants of the Poznań Metropolis and to analyse selected health, demographic, and socio-economic factors influencing such activity. A questionnaire survey was conducted from March to June 2016 on a group of 1584 inhabitants of the Poznań Metropolis. The survey was based on a short version of the International Physical Activity Questionnaires – IPAQ. The results showed that 33% of the inhabitants of the Poznań Metropolis showed sufficient, 48% – high level of physical activity, and only 17% of the respondents did not meet the WHO recommendation for physical activity. Statistical analysis based on the CHAID classification tree algorithm indicated the highest influence of age, gender, income, home location, and marital status on the level of physical activity of the inhabitants of the Poznań Metropolis. The analysis did not find statistically significant correlation between the Body Mass Index BMI and the level of physical activity.

Keywords: physical activity, IPAQ, health, BMI, socio-economic factors, demographic factors, Poznań Metropolis, classification tree

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1. Introduction

Physical activity is one of the main factors influencing health and quality of life of a contemporary people. It is also the key element of the healthy lifestyle [Aaranio et al. 2002: 360-364]. Numerous researchers all over the world have been interested in this issue for many years. The number of reports on correlation between physical activity and health is growing [Knapik et al. 2009: 17-21]. Regular physical activity allows to improve or maintain good physical, mental, and social health. Based on epidemiological studies, physical activity is currently recognised as an important factor affecting physiological capacity, motor abilities and skills, normal posture and physique, and ability of coping with stress and preventing many civilisation diseases: cardiovascular diseases, coronary heart disease, strokes, type-2 diabetes, osteoporosis, and colon, breast and prostate cancers [Gonçalves et al. 2014: 445-454; Langsetmo et al. 2012: 401-408; Schmid & Leitzmann 2014: 1293-1311; Warburton et al. 2010: 39; Pereira et al. 2014: 117-124; Thibaud et al. 2012: 5; Warburton, Nicol & Bredin 2006: 801-809].

Results of many research projects also proved that physical activity plays a key role in body weight reduction and prevents negative effects of excess fat tissue [Bensimhon, Kraus & Donahue 2006: 598-603; Jakcic & Otto 2005: 226-229; Wessel et al. 2004: 1179-1187; López-Gullón et al. 2011: 217-225; Kouvelioti, Vagenas & Langley-Evans 2014: 456-474; McArdle et al. 2007: 190-195].

However, low level of physical activity remains one of the main problems of public health in modern societies. International research has shown that the number of people in Europe engaging in sports classes has increased by 3% during last five years. Similar growth was reported from Poland [Special Eurobarometer 2014]. The results of the Eurobarometer research indicated that Poland is one of the low physical activity countries. According to this research only 27% of Poles is regularly active. This places Poland on one of last places in the European Union [Special Eurobarometer 2014: 16-23]. Moreover, all-Poland studies of the Institute for Structural Research conducted to the order of the Ministry of Sport and Tourism of the Republic of Poland showed that 39% of Poles was physically active during their free time at a level recommended by the World Health Organization. Physical activity is strongly connected to age and level of education. Young people are more active than older people and higher education also favours higher level of physical activity [IBN 2016: 8]. Low level of physical activity of Poles was also emphasised in the National Health Programme as one of the main causes of diseases and deaths in Polish society [NPZ 2016-2020]. A number of directives were elaborated on the level of the entire population concerning optimal level of physical activity preventing diseases [Blair, LaMonte & Nicha-

man 2004: 913-920; Pate et al. 1995: 402-407; *EU Physical Activity Guidelines* 2008].

Any intervention programmes aiming at increasing physical activity require proper diagnosis of reasons for physical passivity and factors encouraging physical activity in order to be successful. Therefore, the number of researches concerning determinants, and especially barriers of physical activity, in different social environments [Strawiński 2011: 57-67; Knapik et al. 2009: 17-21; Knapik et al. 2012: 64-65; Knapik et al. 2013: 333-340; Łysak et al. 2014: 549-553; Florkiewicz et al. 2011: 341-351] and selected conditions of physical activity of city dwellers [Biernat 2011; Drygas et al. 2005: 1-6; Lizak & Czarny 2015: 279-285; Misigoj-Durakovic et al. 2000: 428–432; Puciato et al. 2013: 649-657; Zhou et al. 2013: 1-7; Ribeiro et al. 2013: 664-670] is growing. However, the results of these analyses are not explicit as they show different impact of the studied variables on the physical activity.

It needs to be stressed, however, that there are no fully reliable studies concerning the level of physical activity (PA) of the adult part of the society reported from Poland. Sparse reports usually concerned only selected cities [Warsaw: Biernat 2011, Katowice: Puciato et al. 2013; Toruń: Drygas et al. 2001; Łódź: Drygas & Bielecki 2002; or regions of Poland [voivodeships of Poland: Drygas et al. 2005; region Tarnów: Lizak & Czarny 2015]. In the majority of available evidence and analyses conducted by research centres, the Central Statistical Office of Poland, and centres of public opinion research (CBOS Public Opinion Research Center), the type, frequency, and duration of PA physical activity were not assessed properly or different research tools making any comparisons very difficult. It is also noteworthy that the context of an agglomeration or metropolitan area has not been yet included in the analyses of physical activity of city dwellers.

Thus, the aim of the research presented here was to determine the level of physical activity of the inhabitants of the Poznań Metropolis and to analyse selected health, demographic, and socio-economic factors influencing such activity based on the International Physical Activity Questionnaires – IPAQ. The paper presents the following hypotheses:

1. Level of physical activity of the majority of the inhabitants of the Poznań Metropolis is sufficient.

2. Level of physical activity of obese inhabitants of the Ponań Metropolis is lower in comparison to those with normal body weight.

3. The key demographic variable resulting in different levels of physical activity of the inhabitants of the Poznań Metropolis is age.

4. The key socio-economic variable resulting in different levels of physical activity of the inhabitants of the Poznań Metropolis is income.

2. Material and methods

The survey was conducted on a group of 1584 inhabitants of the Poznań Metropolis from March to June 2016 (Table 1). Data obtained from the Statistical Office of Poznań concerning populations of individual communes on the date of 31.12.2015 divided by gender and age were used to determine sample's size and structure [http://poznan.stat.gov.pl]. In the research, a diagnostic survey method was used based on author's questionnaire comprising 29 questions prepared by the research team with an extended part concerning personal data. The first part of the questionnaire also included the short version of the International Physical Activity Questionnaires – IPAQ.[2] The survey was conducted in all the 22 communes of the Poznań Metropolis in different days of a week and at various times by recreational and sports facilities and open-access recreation sites, i.e., tourist trails, parks, and playgrounds. The respondents were chosen using the quota proportional representation format. The studied group modelled the total population of the Poznań Metropolis according to: population size, gender, and age. Trained interviewers received a detailed survey's instruction with the number of surveys to be carried out in each of the communes of the Poznań Metropolis. The survey's instruction contained information broken down by gender and age in each municipality (control variables). Before starting the study, interviewers asked filtering questions to the respondents to fullfill the the criteria of the sample selection. A minimum number of questionnaires was calculated based on a level of confidence of 95% ($\alpha = 0.05$) with maximum error of ±5% (0.05) and amounted to 1426 questionnaires.

The results were analysed using the SPSS software, in particular the following statistical tests were conducted: for quantitative variables – an analysis of the significance of differences between means based on the *t*-Student test and for the qualitative variables – comparison of column proportions using the Z-test to find statistically significant differences. In a case of quantitative variables divided into more than two groups the one-way ANOVA was used to show the significance of differences and the LSD test was used to make multiple comparisons. The results were based on the two-way tests with the level of significance of $p < 0.05$. In addition, to summarise the importance of individual demographic and socio-economic variables, the classification tree employing the tree growth model based on the CHAID algorithm was applied.

A classification of occupations and specialities for the labour market was implemented to process information on the respondents' occupations. The struc-

[2] The second part of the research tool concerned physical activity of the inhabitants of the Poznań Metropolis, migrations connected to recreation, and conditions of undertaking such activity and migrations.

Table 1. Number of respondents from individual communes of the Poznań Metropolis

Commune	*N*	%
Buk	19	1
Czerwonak	50	3
Dopiewo	34	2
Kleszczewo	9	1
Komorniki	35	2
Kostrzyn Wielkopolski	27	2
Kórnik	34	2
Luboń	44	3
Mosina	45	3
Murowana Goślina	17	1
Oborniki	53	3
Pobiedziska	32	2
Poznań	841	53
Puszczykowo	20	1
Rokietnica	22	1
Skoki	20	1
Stęszew	20	1
Suchy Las	22	1
Swarzędz	79	5
Szamotuły	50	3
Śrem	60	4
Tarnowo Podgórne	34	2
No data available	17	1
Total	1584	100

Source: own elaboration based on the conducted survey ($N = 1584$).

ture of the classification resulted from grouping individual occupations and specialities in basic groups, and those in more aggregated medium-sized, big-sized, and large-sized groups based on similarities between competencies required to exercise occupational responsibilities. The classification included four broad levels of competencies described in the International Standard Classification of Occupations (ISCO-08) and levels of education set in the International Standard Classification of Education – ISCED 2011 *Legal basis: Regulation of the Minister of Labour and Social Policy of 7 August 2014 on classification of occupations and specialities for needs in the labour market and the scope of its use*.[3]

[3] www.klasyfikacje.gofin.pl/kzis/6,0.html [access: 15.12.2017].

The level of physical activity was assessed based on the International Physical Activity Questionnaires – IPAQ [Biernat & Stupnicki 2005; Craig et al. 2003; Bergier 2013: 91-94; www.ipaq.ki.se/downloads.htm]. It included seven questions on all of the types of physical activity (connected to everyday life, work, and recreation). Activities conducted during work, at home, recreation, and exercising were taken into consideration, including time spent sitting, walking, and being physically active. The assessment of the level of physical activity only included activities lasting continuously for at least 10 minutes. The IPAQ is a method utilising the Metabolic Equivalent of Work (MET).

Based on the obtained results including the total of a week-long physical activity, the respondents were classified into three groups corresponding to the following levels of activity:

High level of physical activity: (HEPA active)[4] persons meeting one of the below two criteria:

– 3 or more days of intense physical activity, at least 1500 MET-min./week (Metabolic Equivalent of Work) in total;

– 7 or more days of any combination of activities (walking, moderate or intense activities) exceeding 3000 MET-min./week.

Sufficient level of physical activity (minimally active[5]; moderate): persons meeting the following criteria:

– 3 or more days of intense physical activities for at least 20 minutes a day;

– 5 or more days of moderate physical activities for at least 30 minutes a day;

– 5 or more days of any physical activity (intense, moderate activities, or walking) exceeding 600 MET-min/week.

Insufficient level of physical activity (inactive; low; insufficiently active): persons declaring no physical activity or not meeting the requirements for the suf-

[4] The name of the category proposed by IPAQ Research Committee. A separate category labelled HEPA' level, which is a more active category can be computed for people who exceed the minimum public health physical activity recommendations, and are accumulating enough activity for a healthy lifestyle. This is a useful indicator because it is known that higher levels of participation can provide greater health benefits, although there is no consensus on the exact amount of activity for maximal benefit. Also, in considering lifestyle physical activity, this is a total volume of being active which reflects a healthy lifestyle. It is at least 1.5-2 hours of being active throughout the day, which is more than the LTPA-based recommendations of 30 minutes. As Tudor-Locke and others have indicated, there is a basal level of around 1 hour of activity just in activity of daily living, and an additional 0.5-1 hour of LTPA makes a healthy lifestyle amount of total PA – hence, these new cut points are still consistent with the general LTPA based public health recommendations of at least half an hour per day of additional activity or exercise [*Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire IPQ – short version*, Version 2.0. April 2004; www.institutferran.org/documentos/scoring_short_ipaq_april04.pdf, access: 10.12.2017].

[5] "Minimally active" implies some physical activity but is not an optimal level of total HEPA, www.institutferran.org/documentos/scoring_short_ipaq_april04.pdf [access: 10.12.2017].

Table 2. Norms for BMI according to WHO

Value of BMI	Body weight category
< 18.5	underweight
18.6-24.9	normal weight
25.0-29.9	overweight
> 30.0	obesity (1st, 2nd, or 3rd degree)

Source: own elaboration based on WHO 1995; Kolimechkov 2014: 2.

ficient and high level of physical activity [Biernat, Stupnicki & Gajewski 2007: 47-54].

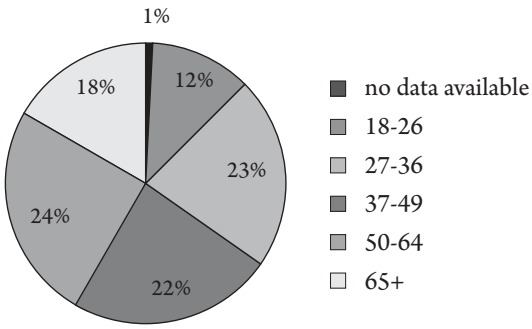
The Body Mass Index (BMI), which includes the height to body weight ratio, was calculated based on the formula and recommendations of the World Health Organization (WHO 1995).

3. Results

3.1. Description of the respondents

The survey included 1584 adult inhabitants of the Poznań Metropolis (Table 1), with the majority of women (51%). The vast majority of the respondents lived in cities and towns (75%) and less frequently in rural areas (24%). The majority of the surveyed inhabitants of the Poznań Metropolis were aged 50-64 (24%) or 27-36 (23%) and 22% of the respondents were aged 37-49. Groups of persons aged 18-26 or over 65 were the least numerous (Chart 1).

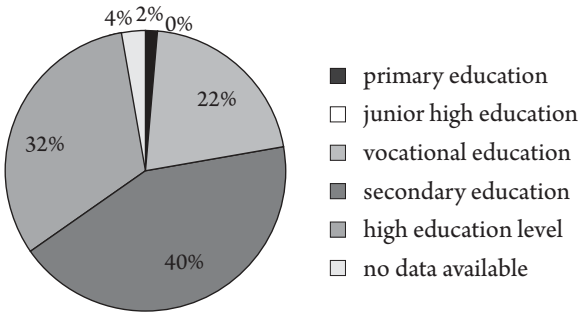
Chart 1. Age structure of the respondents



Source: own elaboration based on the conducted survey (N = 1584).

The majority of the inhabitants of the Poznań Metropolis declared secondary (40%) or higher education level (32%), and every fifth respondent declared vocational or primary education level (2%) (Chart 2).

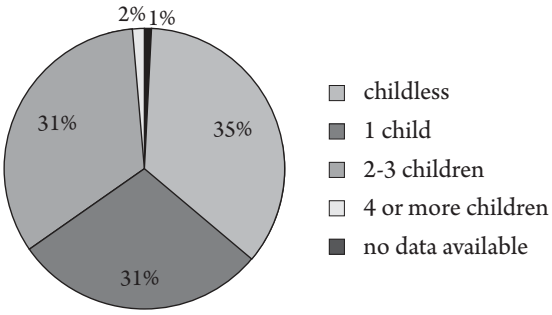
Chart 2. Education level of the respondents



Source: own elaboration based on the conducted survey (N = 1584).

Almost 64% of the respondents was married and 10% declared cohabitation or common-law relationship as their marital status. Every fourth respondent was single. Almost 65% of the inhabitants of the Poznań Metropolis participating in the survey declared having at least one child, while 35% was childless (Chart 3). Among those having children, 31% had 1 child, 31% had 2-3 children, and only 2% had 4 or more offspring.

Chart 3. Number of children of the respondents

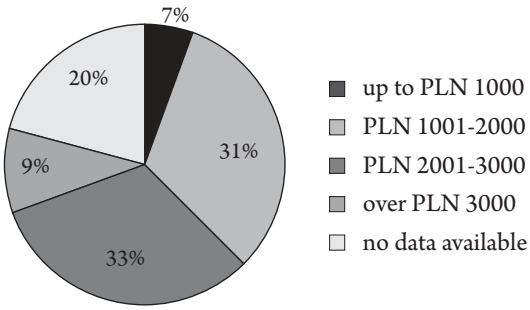


Source: own elaboration based on the conducted survey (N = 1584).

As it comes to the economic status, every third respondent declared the average net income per household member between PLN 2001 and 3001, and 31%

between PLN 1001 and 2000 (Chart 4). The least applicable were groups of respondents declaring the income of up to PLN 1000 per household member (7%) and over PLN 3000 per household member (9%).

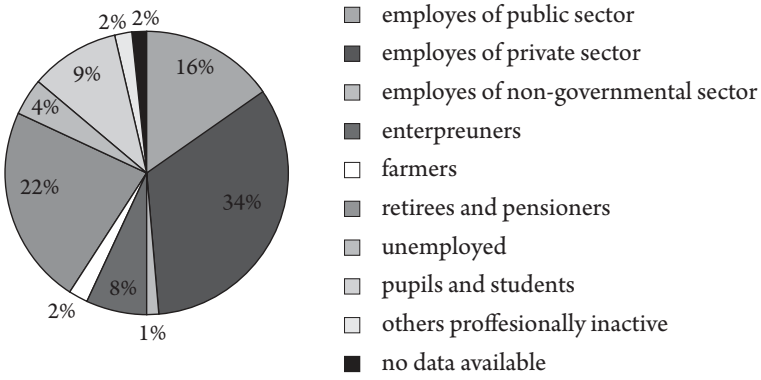
Chart 4. Net income per household member of the respondents



Source: own elaboration based on the conducted survey (N = 1584).

Employees of private sector (34%), retirees and pensioners (22%), and employees of public sector (16%) predominated among the studied inhabitants of the Poznań Metropolis (Chart 5).

Chart 5. Occupational status of the respondents



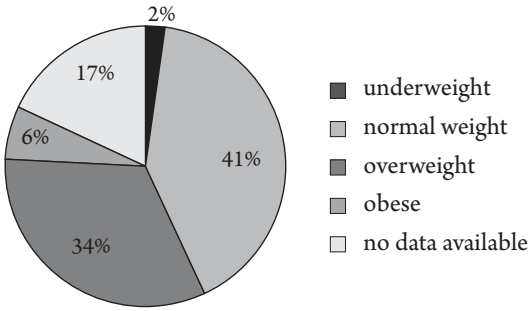
Source: own elaboration based on the conducted survey (N = 1584).

Whereas only every tenth respondent was a pupil or a student, 8% of the respondents were entrepreneurs, 4% – unemployed persons, 2% – farmers or others professionally inactive persons, and 1% worked in the non-governmental sector.

3.2 Physical activity of the inhabitants of the Poznań Metropolis: health aspects

Health aspects was the first focus of the analysis of the physical activity of the surveyed group. In order to do that, basic morphological features were included – the height (from 139 to 196 cm) and the body weight (from 41 to 146 kg) and the height to body weight ratio expressed as the BMI. The obtained results were presented in Chart 6.

Chart 6. The Body Mass Index of the respondents

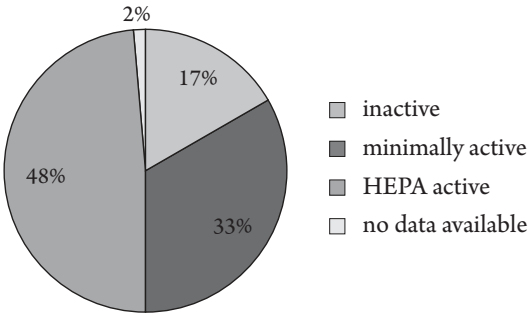


Source: own elaboration based on the conducted survey (N = 1584).

The results showed that the BMI values of 41% of the respondents indicated normal weight. However, every third respondent was overweight and 6% were obese. Only 2% were underweight.

Next, the level of physical activity of the inhabitants of the Poznań Metropolis was assessed. According to the International Physical Activity Questionna-

Chart 7. The level of physical activity of the respondents based on IPAQ



Source: own elaboration based on the conducted survey (N = 1584).

ires – IPAQ the respondents were classified groups corresponding to the three levels of activity (Chart 7). Almost half of the studied group of respondents were classified to the high level of physical activity group based on their declarations. Whereas every third respondent was classified to the sufficient level of physical activity group. Participation in physical activity of only every fifth respondent was classified as insufficient.

Then, differences between the levels of physical activities in relation to the BMI were statistically analysed. It turned out that the highest percentage of the inhabitants having normal weight (50.3%) and overweight (50.5%) engaged in physical activity at a high level, as did almost every second obese respondent (Table 3).

Table 3. Physical activity of the respondent in relation to the BMI

Level of physical activity according to IPAQ	BMI category				
	underweight	normal weight	overweight	obesity	no data available
	% of *N* in a column				
Insufficient	6.7	15.0	15.7	20.0	27.9
Sufficient	50.0	34.1	32.2	30.0	30.5
High	36.7	**50.3**	**50.5**	**45.6**	37.9
No data available	6.7	0.6	1.7	4.4	3.7

Source: own elaboration based on the conducted survey ($N = 1584$).

Notes: The results were based on the two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni's adjustment for all the comparisons of the pairs within each internal sub-table.

Similar percentages of obese (30%), overweight (32.2%), and respondents of normal weight (34.1%) is characterized by sufficient level of physical activity. Although, no statistically significant difference was found between the level of physical activity and the BMI, it is noteworthy that in comparison to all the other persons, higher percentage of obese inhabitants of the Poznań Metropolis was insufficiently physically active (20%).

3.3. Physical activity of the inhabitants of the Poznań Metropolis: demographic aspects

The next stage of the analysis considered the influence of basic demographic variables on the physical activity of the Poznań Metropolis. The first analysed factor was participant gender (Table 4).

Table 4. Physical activity of the respondents in relation to the gender (in %)

Physical activity level according to IPAQ	Gender		
	Female (A)	Male (B)	no data available
Insufficient	16.5	18.8	9.1
Sufficient	**37.6 B**	27.8	36.4
High	44.6	**51.3 A**	36.4
No data available	1.3	2.1	18.2

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni's adjustment for all the comparisons of the pairs within each internal sub-table.

The results showed that high level of physical activity was more frequent among men (over 50%) than women (37.6%) (statistically significant difference). However, sufficient physical activity was significantly more frequent among women than men. No statistically significant difference was found between genders in the group of insufficient level of physical activity.

The next analysed independent variable was the age (Table 5).

Table 5. Physical activity of the respondents in relation to the age (in %)

Physical activity level according to IPAQ	Age					
	18-26 (A)	27-36 (B)	37-49 (C)	50-64 (D)	65+ (E)	no data available
Insufficient	13.6	14.2	11.7	16.1	**33.9 ABCD**	18.2
Sufficient	21.6	25.8	**38.5 AB**	**35.1 A**	**40.7 AB**	27.3
High	**62.3 CDE**	**59.1 CDE**	**47.5 E**	**47.0 E**	23.6	45.5
No data available	2.5	0.8	2.3	1.8	1.8	9.1

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni's adjustment for all the comparisons of the pairs within each internal sub-table.

The above-presented data indicated that high level of physical activity is the most common in a group less than 36 years old (statistically significant differences when compared to all other age groups). While the insufficient level of physical activity was mainly declared by respondents over 65 years old (statistically significant differences when compared to all other age categories). It is, however, worth noticing that over 40% of the surveyed seniors declared a sufficient level of physical activity.

The last analysed independent variable was the home location of the respondents (Table 6).

Table 6. Physical activity of the respondents in relation to home location (in %)

Physical activity level according to IPAQ	Home location		
	Town/City (A)	Village (B)	no data available
Insufficient	18.1	16.4	0.0
Sufficient	**35.2 B**	26.0	20.0
High	45.3	**54.1 A**	80.0
No data available	1.3	3.4	0.0

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

As indicated by data presented in table 6, the highest percentage of villagers (over 54%) and city dwellers (over 45%) showed high level of physical activity. Statistically significant differences between different home locations were found in groups of sufficient and high level of physical activity.

3.4. Physical activity of the inhabitants of the Poznań Metropolis: socio-economic aspects

Characterisation of physical activity of the inhabitants of the Poznań Metropolis also included the influence of socio-economic variables.

It seemed interesting whether the education level influenced the level of physical activity of the studied population. The findings are presented in Table 7.

Table 7. Physical activity of the respondents in relation to the education level (in %)

Physical activity level according to IPAQ	Education level					
	Primary (A)	Lower-secondary (B)	Vocational (C)	General upper-secondary (D)	Higher (E)	no data available
Insufficient	22.5	50.0	**23.1 E**	18.2	12.9	14.3
Sufficient	32.5	0.0	36.8	32.3	31.2	32.1
High	42.5	50.0	38.3	**48.5 C**	**54.2 C**	41.1
No data available	2.5	0.0	1.8	1.0	1.8	12.5

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

The obtained data suggests that level of physical activity of persons with higher education was the most beneficial for health. The majority of this group was classified to the group of high level of physical activity (54.2%) and the lowest percentage engaged in physical activity at an insufficient level (almost 13%). Whereas the level of physical activity of persons with vocational education was the least frequently classified as high. Statistically significant differences were found between the respondents with higher and vocational education and between secondary and vocational education.

Next analysed aspect was the influence of marital status on physical activity of the inhabitants of the Poznań metropolis (Table 8).

Table 8. Physical activity of the respondents in relation to the marital status (in %)

Physical activity level according to IPAQ	Martial status			
	married (A)	in a common-law relationship/ cohabitation (B)	single (C)	no data available
Insufficient	**20.7 BC**	10.5	12.2	14.3
Sufficient	34.3	27.6	31.2	35.7
High	42.9	**61.2 A**	54.9	50.0
No data available	2.1	0.7	1.7	0.0

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

The analysis of the influence of the marital status showed that the level of physical activity of the respondents living in common-law relationships or cohabitation was the most beneficial for health. They comprise the biggest part of the group of high level of physical activity (over 60%). Comparison with married respondents let to finding a statistically significant difference. The lowest level of physical activity was demonstrated by married persons – the level of physical activity of over 20% of them was classified as insufficient (comparison to singles and persons living in common-law relationships or cohabitation showed statistically significant differences). No statistically significant difference was found between singles and persons in common-law relationships or cohabitation.

The next determinant of physical activity connected to marital status was the number of children (Table 9). It was found that the level of physical activity of persons having no children was high significantly more frequently than the level of the respondents having 2-3 children. However, the difference between the respondents having no children and having 4 or more children was statistically insignificant, despite big difference in actual percentages (A – 52.4%, D – 36.7%).

Table 9. Physical activity of the respondents in relation to the number of children

Physical activity level according to IPAQ	Number of children				
	no children (A)	1 child (B)	2-3 children (C)	4 or more children (D)	no data available
Insufficient	13.7	17.2	**21.0 A**	**36.7 A**	25.0
Sufficient	31.4	32.5	35.7	26.7	25.0
High	**52.4 C**	48.7	41.9	36.7	50.0
No data available	2.5	1.6	1.5	0.0	0.0

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

Moreover, it was noticed that respondents having 2 or more children declared insufficient level of physical activity significantly more frequently than respondents having no children.

The influence of income on the level of physical activity of the inhabitants of the Poznań Metropolis was also analysed (Table 10). The results indicated that the surveyed inhabitants of the Poznań Metropolis declaring higher income per household member, statistically significantly more frequently presented high level of physical activity while the inhabitants with lower income more often engaged in physical activity at an insufficient level. About every second respondent declaring a net income per household member between PLN 2001 and 3000 and over PLN 3000 showed high level of physical activity.

Table 10. Physical activity of the respondents in relation to net income per household member (in %)

Physical activity level according to IPAQ	Net income per household member				
	up to PLN 1000	PLN 1001-2000 (B)	PLN 2001-3000 (C)	over PLN 3000 (D)	no data available
Insufficient	**24.1 CD**	**18.4 C**	11.6	9.5	27.3
Sufficient	24.1	38.1	11.6	9.5	27.3
High	46.1	41.8	**53.8 B**	**55.8 B**	43.8
No data available	5.6	1.6	1.2	0.7	2.5

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

The last analysed independent variable was the occupational status of the studied inhabitants of the Poznań Metropolis (Table 11). The least beneficial level of

Table 11. Physical activity of the respondents in relation to the occupational status (in %)

Physical activity level according to IPAQ	Employment status									
	employee of a public sector (A)	employee of a private sector (B)	employee of a non-governmental sector (C)	private entrepreneur (D)	farmer (E)	pensioner, retiree (F)	unemployed (G)	pupil, student (H)	other professionally inactive person (I)	no data available
Insufficient	15.7	11.6	20.0	8.0	15.8	**35.7 ABDGHI**	12.5	13.8	2.7	27.3
Sufficient	**40.3 E**	**31.6 E**	**50.0 E**	24.0	2.6	**37.4 E**	**44.6 E**	23.9	29.7	43.8
High	**43.1 F**	**55.6 F**	30.0	**65.6 AFG**	**76.3 AFG**	25.1	39.3	**60.9 AF**	**64.9 F**	27.3
No data available	0.8	1.3	0.0	2.4	5.3	1.7	3.6	1.4	2.7	2.5

Notes: The results were based on two-way tests with the level of significance of 0.05. Statistical significance is marked with bold font and capital letters. The tests were adjusted using the Bonferroni adjustment for all the comparisons of the pairs within each internal sub-table.

physical activity was shown by the group of retirees and pensioners of which almost 36% declared insufficient level of physical activity. The tests confirmed statistically significant differences in this aspect between retirees and pensioners and employees of public sectors, employees of private sector, entrepreneurs, pupils and students, unemployed persons, and other professionally inactive persons. The occupational groups showing significantly highest participation in physical activity included farmers – 76.3%, professionally inactive persons – 64.9%, entrepreneurs – 65.6%, and pupils and students – 60.9%, also, employees of a public and private sector.

3.5. Physical activity of the inhabitants of the Poznań Metropolis: the influence of selected variables

In order to verify the influence of individual demographic and socio-economic variables on the level of physical activity of the inhabitants of the Poznań Metropolis, a statistical analysis using the classification tree based on the CHAID algorithm was performed. As a method, classification trees are one of the most frequently used Data Mining techniques [Drejerska, Chrzanowska & Pomianek 2014: 33]. A classification tree is a way of segmenting and predicting being an alternative of classic statistical techniques. A tree is a graphic representation of dividing a set of objects Ω into disjoint subsets. If a feature y is nominal then the developed model is represented by a classification tree (a discriminatory tree). If a feature y is continuous then the model is represented by a regressive tree (Gatnar 2001: 26-29).

A sequence of variables in a tree results from the "power" with which they divide the observations into classes. The higher the discriminative power of a variable is, the higher its position on a graph is. In each node of the tree we can find percentage shares of units being a part of each class. This value is calculated based of historic data and we can interpret it as a probability of being a member of a certain class [www.allgomine.pl].

The dependent variable included in the analysis was the level of physical activity of the inhabitants of the Poznań Metropolis expressed as the three categories: insufficient, sufficient and high. While independent variables included a health factor: the BMI; demographic factors: age, gender, and home location; and socio-economic factors: education, marital status, number of children, and net income per household member. Occupational status included high number of categories (9 categories) that is why this variable was removed from further analysis. The results of the analysis is shown on a classification tree presented

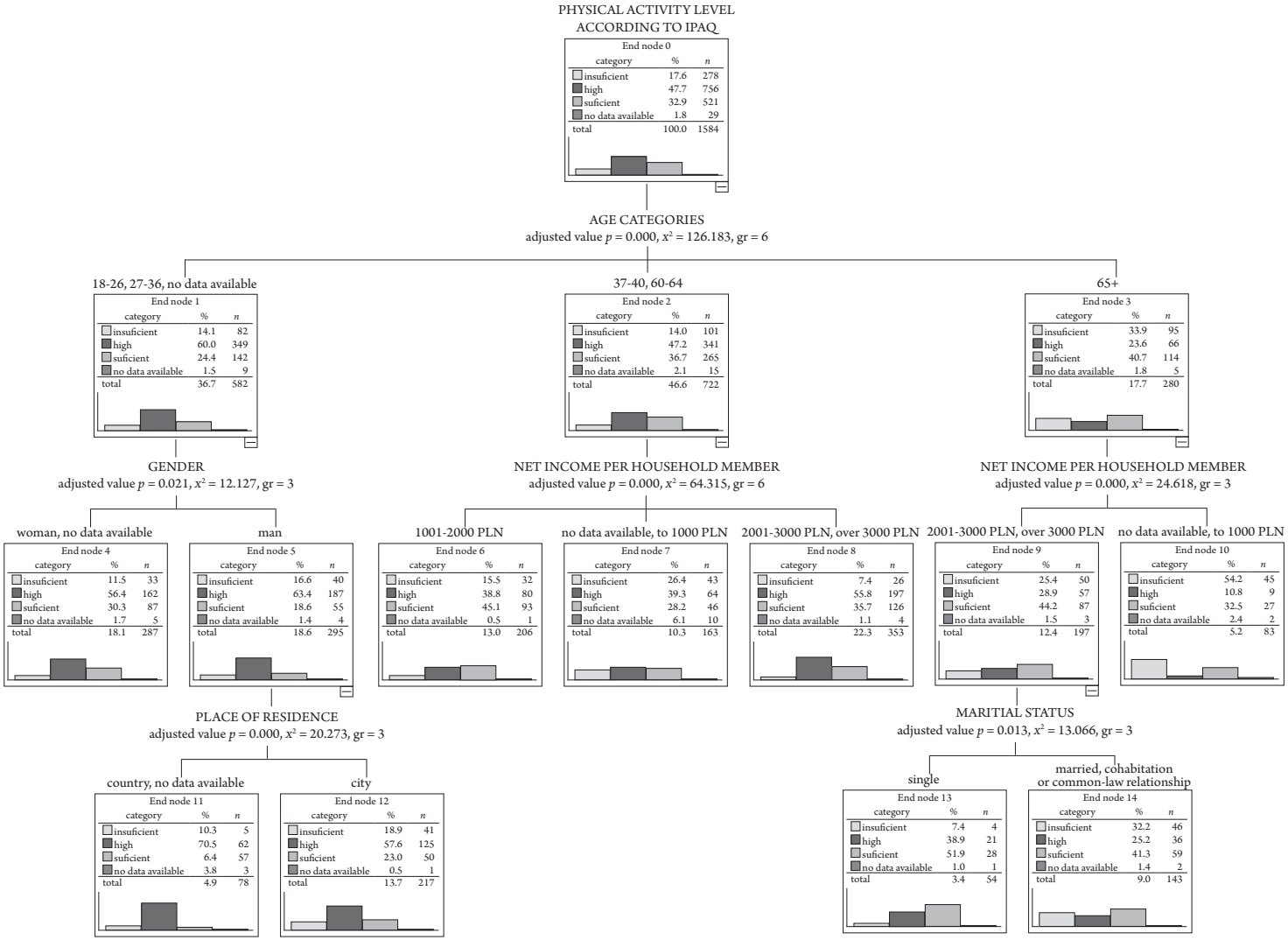


Figure 8. Classification tree – summarised influence of selected variables on the level of physical activity of the inhabitants of the Poznań Metropolis

Source: own elaboration based on the conducted survey ($N = 1584$).

in Figure 8. The tree shows different levels of influence of explanatory variables on the level of physical activity of the inhabitants of the Poznań Metropolis. The generated tree had 9 end nodes.

The following factors had the highest influence on the level of physical activity of the respondents, respectively: 1) age, 2) gender, 3) net income per household member, 4) home location, and 5) marital status (Fig. 8) (risk assessment: 0.47; standard error: 0.013). The influence of age on differentiation of the level of physical activity of the inhabitants of the Poznań Metropolis was the highest, as a result of the classification analysis, three age classes emerged. Persons aged 18-26 and 27-36 were characterised by the highest level of physical activity, next group was created by persons aged 37-49 and 50-64. In the last, the least physically active group comprised of persons aged 65 or more. The next variable differentiating physical activity of the studied inhabitants was gender. The level of physical activity of the surveyed men was higher than this of women of the Poznań Metropolis. Another factor of high discrimination power was the net income per household member. The inhabitants with the net income over PLN 2000 per household member were more physically active than persons with lower income. The last factors influencing differentiation of the level of physical activity of the inhabitants of the Poznań Metropolis were home location and marital status.

Other factors analysed in the tree model: BMI, number of children, and education level had much lower impact on physical activity of the inhabitants of the Poznań Metropolis.

4. Discussion

Nowadays, it seems extremely important to monitor the level of physical activity as well as factors that influence such activity. It is justified by the prevalence of civilisation diseases: cardio-vascular, musculoskeletal, metabolic diseases or even tumours or mental disorders as hypokinesia – a shortage of physical activity – is one of the main causes of such conditions.

Unfortunately, Polish research has lacked similar analyses of metropolitan areas and analyses focusing on urban (Warsaw, Katowice, Toruń, Łódź) or regional (the Tarnów region) environments are also sparse. That is why it is very difficult to make any comparisons. Here presented survey on physical activity using the IPAQ questionaire indicated that the population of the Poznań Metropolis is characterised by higher level of physical activity in comparison to the entire population of Poland. Almost 33% of the respondents participated in physical activity at a sufficient level, and level of physical activity of almost every second person was high (48%). Thus, the hypothesis that the level of physical activity

of the majority of the inhabitants of the Poznań Metropolis is sufficient was not confirmed.

The data of the Institute for Structural Research collected in similar period (first half of 2016) suggested that 50% of Poles showed no physical activity (during free time) while according to this research only 17% of the inhabitants of the Poznań Metropolis were physically inactive. This means that only 39% of Poles were active during their free time at a level recommended by the WHO (sufficient and high activity) [IBS 2016: 19] while in the Poznań Metropolis people physically active comprised 81% of the respondents.

Data reported from other researches of the Central Statistical Office of Poland – Participation of Poles in Sports and Physical Recreation [2017], the Eurobarometer [2014], and the PolSenior research indicated that the percentage of Poles regularly exercising or practising sports is low and amounted to 40% [*Diagnoza społeczna* 2015: 261-262; Rowiński & Dąbrowski 2012: 535] 46% [GUS 2017: 35], and 48% [Special Eurobarometer 2014: 7-8].

The reasons of discrepancies between the results of those studies can be found, for instance, in different methodological approaches. However, the main reason seem to be the fact that the survey of the Institute for Structural Research concerned physical activity during free time while here presented research included all the physical activity, including the activity at work or during moving from one place to another. High level of the inhabitants of the Poznań Metropolis participation in physical activity (48% – high level, 33% – sufficient level) might have resulted from the time (March to June) and localisation of the survey (by recreational and sports facilities, open-access recreation sites, tourist trails, and green areas). Moreover, the other reasons of high level of physical activity of respondents may be the type of the work – physical work or frequent walking. On the other hand, such methodological conditions and support of trained interviewers emphasises reliability of the collected material as regards to how the respondents classified their activity, e.g. types of physical activities.

Regional differences in sports activity and high availability of sports and recreational infrastructure in communes of the Poznań Metropolis may have also been the reason for higher level of physical activity of the inhabitants of the Poznań Metropolis in comparison to entire population of Poland. The results of the studies conducted within the Social Project 2012 indicated that the highest percentage of physically active inhabitants was found in the following voivodeships: lubuskie (50%), wielkopolskie (51%), and dolnośląskie (51.3%) while the lowest percentage was characteristic for the voivodeships of the so-called Eastern Poland [2012: 20-21]. Moreover, the highest percentage of active persons (51.7%) was found among the inhabitants of metropolitan areas of over 500 000 people. This is probably connected to socio-economic profile of such metropolitan areas and better sports infrastructure in cities [2012: 19].

However, the results indicating high participation of the inhabitants of the Poznań Metropolis in physical activity are similar to the all-Poland results obtained by E. Biernat and M. Piątkowska [2012: 19] showing as many as 78% of Poles responding yes to a question whether they undertake any kind of recreational activity (including 77.9% in the age of 15-24, 75.6% – in the age of 25-39, 84% – in the age of 40-54, and 75.4% – in the age of 55-69). It needs to be stressed, however, that this recreational physical activity mainly included walking. Therefore, an important empirical demand would be to perform extended statistical analysis of the percentage of individual types of the activity: moderate, intensive, walking in the overall structure of physical activity of the inhabitants of Poznań.

The results indicated that physical activity of about 20% of obese inhabitants of the Poznań Metropolis was insufficient. The obtained results correspond with the results of the Social Diagnose research showing that 21% of obese Poles declared no physical activity [*Diagnoza społeczna* 2015: 253-262]. It is worth noticing that 41% of the surveyed inhabitants of the Poznań Metropolis had normal BMI values. However, every third respondent was overweight and 6% were obese. In comparison to the all-Poland survey these results look better for the inhabitants of the Poznań Metropolis as in the all-Poland about 36.3% of Poles was overweight and 17.4% was obese.

It is noteworthy that the obtained results confirmed also the tendency showed in the above-cited all-Poland studies concerning the influence of the analysed health, demographic, and socio-economic factors on the level of physical activity of the inhabitants of the Poznań Metropolis. The key demographic variable resulting in different levels of physical activity of the inhabitants of the Poznań Metropolis was age and among the socio-economic variables the net income per household member showed the highest significance. The analysis did not found statistically significant correlation between the BMI and the level of physical activity.

5. Conclusion

The Act on Public Health [Journal of Laws 2015, item 1916] adopted in Poland on 11th September 2015 provides for creation of the next version of the National Health Programme. The National Health Programme for 2016-2020 aims to increase life expectancy, improve health, and reduce social health inequalities. Tasks specified in the Programme include, for instance, reduction of health inequalities resulting from socio-economic conditions and increase in the level of physical activity of the society. Most of these tasks are to be executed by local government units and non-governmental organizations because it is important to create conditions for healthy lifestyle close to people's homes, so on a local level.

The results of this research are highly applicable because they enable classification of the inhabitants of the Poznań Metropolis into specific groups and identification of groups in danger of insufficient level of physical activity or completely physically passive. The inhabitants of the Poznań Metropolis in danger of hypokinesia belong to the following groups: persons aged 50-64 or over 65 years old; with primary, lower-secondary or vocational education; living in urban or rural areas; married; having more than 3 children; and retirees, pensioners or persons working in a non-governmental sector. Moreover, such persons are more frequently overweight or obese and their net income is lower than PLN 1000 per household member. These groups especially need financial, organizational, infrastructural, and educational support in the field of promotion of physical activity. That is why, in authors' opinion, these groups should be the recipients of actions like complex and long-term local physical activity or health promotion programmes combining many different aspects (e.g., education, free recreational activities, and workouts aiming at health improvement). Implementation of such programmes may decrease expenditures of communes, towns, and cities for health care related to diseases caused by insufficient physical activity by increasing the level of physical activity of local communities.

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Wybrane determinanty aktywności fizycznej mieszkańców Metropolii Poznań na podstawie kwestionariusza IPAQ

Streszczenie. Niski poziom aktywności fizycznej jest jednym z większych problemów zdrowia publicznego współczesnego społeczeństwa. Wyniki badań wskazują, iż Polska należy do krajów o niskiej aktywności fizycznej, przy czym bardziej aktywni są mieszkańcy miast niż wsi. Do tej pory problematyka badań aktywności fizycznej mieszkańców miast nie była analizowana w kontekście metropolitalnym. W związku z tym celem badań jest określenie poziomu aktywności fizycznej mieszkańców metropolii Poznań, jak również analiza wybranych czynników zdrowotnych, demograficznych i społeczno-ekonomicznych różnicujących tę aktywność. Badania ankietowe przeprowadzono wśród 1584 mieszkańców metropolii Poznań w okresie od marca do czerwca 2016 r. na podstawie krótkiej wersji Międzynarodowego Kwestionariusza Aktywności Fizycznej – IPAQ. Wyniki ujawniają, że 33% mieszkańców metropolii Poznań cechuje wystarczający, a 48% – wysoki poziom aktywności fizycznej, tylko 17% respondentów nie spełnia minimalnych zaleceń WHO w zakresie aktywności fizycznej. Analiza statystyczna oparta na algorytmie drzewa klasyfikacyjnego CHAID ujawniła największy wpływ wieku, płci, dochodu, miejsca zamieszkania i stanu cywilnego na poziom aktywności fizycznej mieszkańców metropolii Poznań. Badania nie potwierdziły istotnej statystycznie zależności między wskaźnikiem BMI a poziomem aktywności fizycznej.

Słowa kluczowe: aktywność fizyczna, IPAQ, zdrowie, BMI, czynniki społeczno-ekonomiczne, czynniki demograficzne, metropolia Poznań, drzewo klasyfikacyjne