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BEHAVIOURAL FACTORS ENHANCING MENTAL HEALTH – PRELIMINARY RESULTS OF THE STUDY ON ITS ASSOCIATION WITH PHYSICAL ACTIVITY IN 15 TO 16 YEAR OLDS

CZYNNIKI BEHAWIORALNE WZMACNIAJĄCE ZDROWIE PSYCHICZNE – WSTĘPNE WYNIKI BADAŃ NAD JEGO ZWIĄZKIEM Z AKTYWNOŚCIĄ FIZYCZNĄ MŁODZIEŻY W WIEKU 15 DO 16 LAT

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Abstract

Introduction: *Reliable information on the influence of behavioural factors on adolescent mental health may help to implement more effective intervention programmes.*

Objective: *The objective of the study was to determine whether physical activity influences the variability of selected indices of mental health.*

Methods: *The study comprised 2,015 students aged 15-16, who were investigated as part of the HBSC survey (Health Behaviour in School-aged Children) in the 2013/14 school year. The dependent variable was the mental health index GHQ-12 (0-36 points) and its two domains (social dysfunction, anxiety and depression). Physical activity was measured with the MVPA (moderate-to-vigorous physical activity). Multivariable linear models were estimated, with overall GHQ index and partial indices as dependent variables.*

Results: *Adolescents reported a mean GHQ-12 score of 12.57 (± 7.06). In a multivariable analysis, the pressure with school work along with gender resulted to be the main GHQ-12 predictors. School achievements and a high level of physical activity were identified as strong protective factors. Taking into account other factors, the GHQ-12 index falls by 2.13 points when comparing adolescents with an extremely low and high MVPA. Protective effect of physical activity appeared to be stronger in small towns and villages than in big cities and was more visible in the domain of social dysfunction.*

Conclusions: *Physical activity remains an important predictor of mental health, even when the impact of sociodemographic and environmental factors as well as the respondents' school achievements are considered. Researches of such types, taking into account more complex determinants, wider behavioural factors' spectre as well as other outcome measures connected with teenagers' mental condition, should be continue.*

Key words: mental health, protective factors, physical activity, academic achievements, adolescents

Streszczenie

Wstęp: Rzetelna informacja na temat wpływu czynników behawioralnych na zdrowie psychiczne nastolatków może pomóc przy opracowaniu i wdrożeniu skuteczniejszych programów interwencyjnych.

Cel: Celem opracowania było określenie, czy aktywność fizyczna wpływa na zmienność wybranych indeksów zdrowia psychicznego.

Metody: Badaniem objęto 2015 uczniów w wieku 15-16 lat ankietowanych w ramach badań HBSC (Health Behaviour in School-aged Children) w roku szkolnym 2013/14. Zmienną zależną był ogólny indeks zdrowia psychicznego GHQ-12 (0-36 punktów) oraz jego dwie składowe, dotyczące zaburzeń funkcjonowania społecznego oraz niepokoju i symptomów depresji. Aktywność fizyczną mierzono przy pomocy wskaźnika MVPA (moderate-to-vigorous physical activity). Oszacowano wielowymiarowe modele liniowe dla ogólnego i cząstkowych indeksów GHQ.

Wyniki: Ankietowana młodzież uzyskała średni wynik GHQ-12 równy 12,57 ($\pm 7,06$). W analizie wieloczynnikowej głównymi predyktorami GHQ-12 okazało się obciążenie obowiązkami szkolnymi i płeć. Jako silne czynniki chroniące zidentyfikowano osiągnięcia w nauce i wysoki poziom aktywności fizycznej. Po skorygowaniu na wpływ innych czynników, indeks GHQ-12 obniża się o 2,13 punktów, przy porównaniu młodzieży o skrajnie niskim i wysokim MVPA. Ochronny wpływ aktywności fizycznej na zdrowie psychiczne silniej uwidacznia się w mniejszych miejscowościach niż w dużych miastach oraz jest lepiej widoczny w odniesieniu do zaburzeń w funkcjonowaniu społecznym.

Wnioski: Aktywność fizyczna pozostaje ważnym predyktorem zdrowia psychicznego nastolatków, nawet po uwzględnieniu wpływu czynników socjodemograficznych i środowiskowych, jak również osiągnięć w nauce. Należałoby kontynuować tego typu badania z uwzględnieniem bardziej złożonych uwarunkowań, szerszego spektrum czynników behawioralnych oraz innych zmiennych wynikowych odnoszących się do zdrowia psychicznego.

Słowa kluczowe: zdrowie psychiczne, czynniki chroniące, aktywność fizyczna, osiągnięcia szkolne, młodzież

DEV PERIOD MED. 2016;XX,4:315-324

INTRODUCTION

The key public health issues of the second decade of human life include mental health disorders [1]. They are often undiagnosed, and without treatment they hinder the process of transition to adulthood. The risk factors include (apart from personal vulnerability) environmental factors, such as the those related to family (e.g. parents' divorce, difficult financial situation) and school (educational failures, peer rejection) [2].

Recent epidemiological studies have shown that 10-20% of adolescents worldwide suffer from mental health problems - girls more frequently than boys [3, 4]. The multi-level and complex structure of biological and psychosocial factors is usually accountable [5].

The focus on adolescent mental health caused the development of epidemiological studies oriented at risk and protective factors as well as implementation of the intervention programmes [6]. The perspective of Positive Youth Development is often adopted as the basis of programme design, which says that young people have a natural potential enabling them to hold the trajectory of normal development against periodical adversities [7]. Individual and external factors which may strengthen mental health as for depression, in example can include: a high level of social support, self-esteem, self-efficacy and control over one's life [8]. Behavioural factors are also important, even in face of some controversies among

researchers, the results of most studies have indicated the positive influence of physical activity on the mental health [9]. Attempts are made to implement programmes which educate through sports as well as programmes which combine physical activity with building health-enhancing resources [10].

The subject of this paper are the school and behavioural determinants of adolescent mental health. The impact of school and non-school factors on the variability of the general mental health index (by GHQ-12) had been previously identified by Helen Sweeting et al. [11], adopting an alternative – but located in similar areas – set of independent variables (economic factors, family relations, school perception, lifestyle, etc.) Conversely, the previous Polish studies had focused on family factors in the context of socioeconomic determinants [12]. The presented analyses are original because they consist in emphasising the significance of physical activity; they also consider school performance and the pressure with school work. The paper also discusses the issue of the place of living (usually omitted in foreign studies) as a factor potentially modifying the examined correlations.

Investigating this topic has important implications for public health and provides more arguments (aside from overweight and obesity prevention) for promoting physical activity. The importance of the lack of physical activity problem is confirmed by epidemiological data, collected in many countries including Poland [13]. A problem

which is widespread among adolescents and worsens with age, is the deficit of physical activity, co-existing with a greater intensity of psychosomatic disorders [14].

OBJECTIVES

The main objective of the paper was to identify if the level of physical activity of school-aged children influences the variability of the general mental health index and its components, having taken into account other recognised potential determinants, in particular those related to the school environment.

MATERIAL AND METHODS

The respondents

The sample comprised 2,015 students, 3rd grade of lower secondary schools (N=1,415) and 1st grade of upper secondary schools (N=600), investigated as part of the HBSC survey (*Health Behaviour in School-aged Children*) in the 2013/14 school year. The mean age of the respondents was 15.76 (SD=0.45) and the age range was 14.5-16.5. The study was conducted according to the international procedure, described in other reports [14,15]. A total of 104 schools of various types took part in the survey, randomly selected from all the provinces. The sample was balanced in terms of big city dwellers (population over 100,000) as well as smaller town and rural areas residents.

Measures

The dependent variable was the mental health index measured with David Goldberg's *General Health Questionnaire* in its GHQ-12 version, i.e. a scale of twelve questions with diverse categories of answers encoded in the Likert scale [16]. A general index was calculated, with scores from 0 to 36 points, where high score meant poorer mental health (reliability: Cronbach's $\alpha=0.897$). The two-factor structure of the GHQ-12 was taken into account in calculating two 6-item indices [17]: for social dysfunction (Cronbach's $\alpha=0.840$) and for anxiety and depression (Cronbach's $\alpha=0.901$).

Physical activity and school performance (protective factors) as well as the school stress (risk factor) were analysed as the main **independent variables**. The core analyses were adjusted for gender, age, place of residence and family affluence of the surveyed adolescents.

Physical activity was defined as "any activity that increases your heart rate and makes you get out of breath some of the time". MVPA indicator (*Moderate-to-Vigorous Physical Activity*) [18] was assessed by asking: "On how many days in the past week were you physically active for 60 minutes or more". Response categories ranged between "0 days", "1", "2", etc. up to "7 days. This item has been shown to have a good reliability and validity when compared with accelerometer data [19]. A score of 7 or more days per week classified respondents as meeting the MVPA guidelines. Young people were asked to indicated on a visual scale the number of days in the past week which involved at least 60 minutes of moderate physical activity, summing up all the activities during

one day. According to the experts' guidelines, the level of MPVA=7 days is recommended.

While answering the question about school performance, the students specified whether they are perceived by their teachers as: *very good, good, average, and worse-than-average* students compared with the other students in their class. Independent validation studies showed that that question correlates with more objective measurements of school performance [20]. Among others, the link with results of external tests and with self-assessment of one's position in the class on a visual scale, was examined. The second question related to the school was about the pressure with school work (sometimes called as school stress) in a four-item scale from *not at all* to *very much*. In earlier research it was underlined that excessive school stress is one of the main reasons of intensity of teenagers' subjective complaints .

Three categories of place of living have been taken into consideration: rural areas, small towns and big cities (over 100 000 citizens). In Poland, the division for rural regions and cities, has administrative character which is rooted in historical tradition of granting the municipal rights. In some analyses two categories of place of living linking small towns with rural regions treated as similar areas according to living conditions and cultural factors, have been taken into account.

The socioeconomic status of participants was assessed using the most recent version of the HBSC Family Affluence Scale (FAS). Given the known difficulties of asking young people to accurately detail their parents occupation, FAS was developed within the HBSC study to assess the participants' SES reflecting the material resources of the family [21]. Currently, it has a range of 0-13 points, and its inclusion in the HBSC survey was preceded by quantitative and qualitative validation studies [22]. The FAS has been used and validated since its development and findings confirm that it is a valid indicator of young people's material circumstances for use in cross-national surveys [23]. In the present form this scale consists of six items including family car ownership, whether children and adolescents have their own bedroom, number of holidays spent with their parents per year, family computer ownership and having a dishwasher. The obtained scores were recoded in a 4-point ordinal scale representing very low, low, average and high level of family affluence.

The distribution of the independent variables is shown in the initial columns of Table I and Table II.

Statistical analysis

The Mann-Whitney and Kruskal-Wallis non-parametric tests were used, taking into account the distribution of the GHQ indices. The deviation of the distribution from the normal one was considered acceptable due to low skewness and kurtosis scores; the next step was a step-wise linear regression. Ridit scoring was used with regard to the majority of independent ordinal variables [24]. Place of living was encoded into two dummy variables, representing the effect of big cities and rural areas. The interaction between the place of living and physical activity was presented graphically as marginal means obtained from the general linear model. The SPSS package v.17 (PS Imago) was used for statistical analyses.

Table I. Mean values of general and partial GHQ-12 indices by gender, grade, place of living and family affluence.

Tabela I. Średnie wartości ogólnego i cząstkowych indeksów GHQ-12 według płci, klasy szkolnej, miejsca zamieszkania oraz zamożności rodziny.

	N (%)	Total index Ogólny indeks		Social dysfunction Zaburzenia funkcjonowania społecznego		Anxiety and depression Niepokój i symptomy depresji	
		mean±SD średnia±SD	p*	mean±SD średnia±SD	p*	mean±SD średnia±SD	p*
Gender/Płeć							
boys/chłopcy	913 (45.3)	10.77±6.16	<0.001	6.04±2.73	<0.001	4.73±4.48	<0.001
girls/dziewczęta	1102 (54.7)	14.06±7.41		7.17±3.33		6.89±4.99	
Grade/Klasa szkolna							
III - lower secondary school III gimnazjum	1415 (70.2)	12.38±7.15	0.009	6.58±3.11	0.079	5.80±4.99	0.015
I - upper secondary school I ponadgimnazjalna	600 (29.8)	13.02±6.84		6.83±3.15		6.19±4.63	
Place of living/Miejsce zamieszkania							
large cities** duże miasta	712 (35.4)	12.89±7.32		6.81±3.22		6.08±5.02	
small towns małe miasta	581 (28.8)	12.57±7.08	0.460	6.71±3.12	0.164	5.86±4.73	0.629
rural areas obszary wiejskie	729 (35.8)	12.25±6.78		6.45±2.95		6.79±4.87	
Family affluence/Zamożność rodziny							
very poor bardzo biedna	330 (16.8)	13.25±7.70		7.04±3.50		6.21±5.09	
rather poor raczej biedna	573 (29.2)	13.05±7.35	0.028	6.96±3.28	0.001	6.09±4.98	0.330
average/przeciętna	771 (39.3)	12.33±6.74		6.50±2.91		5.84±4.83	
rich/bogata	289 (14.7)	11.50±6.33		6.07±2.77		5.43±4.56	

Mann-Whitne or Kruskal-Wallis test/test Manna-Whitneya lub Kruskala-Wallis;

**above 100 000 inhabitants/powyżej 100 000 mieszkańców

RESULTS

The distribution of the GHQ-12 index in adolescent population

The mean general GHQ-12 index in the investigated sample was 12.57 (SD=7.06). Mean scores were obtained for two subscales: social dysfunction - 6.66 (SD=3.13) as well as anxiety and depression - 5.91 (SD=4.89). It was found that 25.2% of the respondents exceeded the level qualifying them for expert consult; however, attention should be drawn to the absence of unambiguous criteria [25].

Table I shows the diversity of the general index and the partial indices according to sociodemographic characteristics. Girls scored significantly worse than boys. Secondary school students obtained slightly lower

scores in both anxiety and depression. No statistically significant difference were found with regard to the place of living. The factor which diversifies mental health condition is family affluence. In poor and rather poor families the mean GHQ-12 scores were higher, and so was their dispersion (SD). Moreover, family affluence shows higher correlation with social dysfunction.

Table II shows a comparison of the mean GHQ-12 indices according to the previously mentioned main predictors. The students who showed very good and good school performance, experienced fewer mental health issues, while the GHQ-12 index scores got particularly worse where school performance was below average. Very high GHQ-12 scores were obtained also in the case of high school stress.

Table II. Mean values of general and partial GHQ-12 indices by the level of selected risk and protective factors for mental health.

Tabela II. Średnie wartości ogólnego i cząstkowych indeksów GHQ-12 według poziomu wybranych czynników ryzyka i chroniących zdrowie psychiczne.

	N (%)	Total index Ogólny indeks		Social dysfunction Zaburzenia funkcjonowania społecznego		Anxiety and depression Niepokój i symptomy depresji	
		mean±SD średnia±SD	p*	mean±SD średnia±SD	p*	mean±SD średnia±SD	p*
School achievements/Osiągnięcia szkolne							
very good bardzo dobre	263 (13.1)	11.08±6.81		5.97±3.04		5.11±4.79	
good dobre	671 (33.6)	11.74±6.49	<0.001	6.35±2.93	<0.001	5.38±4.59	<0.001
average przeciętne	957 (47.8)	13.22±7.09		6.95±3.07		6.28±4.92	
below average poniżej przeciętnej	110 (5.5)	16.16±8.76		7.90±4.17		8.26±5.56	
Pressure with school work/Stres szkolny							
not at all wcale	331 (16.5)	10.15±6.97		6.02±3.14		4.13±4.75	
a little niewielki	880 (43.7)	11.25±5.96	<0.001	6.24±2.59	<0.001	5.01±4.43	<0.001
some spory	515 (25.6)	13.72±6.85		6.87±3.14		6.84±4.58	
a lot duży	286 (14.2)	17.40±7.98		8.27±3.92		9.13±5.09	
Physical activity**/Aktywność fizyczna**							
MVPA 0 to 1 MVPA 0 do 1	314 (15.7)	14.48±7.45		7.53±3.46		6.95±4.94	
MVPA 2 to 4 MVPA 2 do 4	936 (46.6)	12.98±6.77	<0.001	6.87±3.07	<0.001	6.11±4.80	<0.001
MVPA 5 to 6 MVPA 5 do 6	430 (21.4)	11.65±6.58		6.22±2.79		5.43±4.74	
MVPA 7 days MVPA 7 dni	326 (16.3)	10.79±7.01		5.79±3.09		5.00±5.07	

*Kruskal-Wallis test/test Kruskala-Wallisa; **MVPA – moderate-to-vigorous physical activity/aktywność fizyczna intensywna do umiarkowanej

Those adolescents who had been following the guidelines for physical activity scored much lower on the GHQ-12 index than their less active peers. Both in terms of the general mental health index and the two partial indices, a linear fall in scores was noted alongside an improvement in physical activity.

Multivariable analysis

Table III shows independent predictors of mental health issues in the order in which they were introduced to the model. Place of living analysis indicated significant negative differences to the disadvantage of big cities. The school stress resulted to be a dominating factor, explaining 9.4% of the variability of the GHQ-12 index. The entire model shown in Table 4 explains 15.6% of that variability.

If we take into account two separate models for the GHQ-12 partial indices, then the impact of physical activity becomes much more visible in the first model (social dysfunction) as the protective factor against the deterioration of mental health. The correlation with family affluence is also stronger. The negative effect of living in a big cities was visible only in this model. Those factors explain 10% of the variability in the first model and 14.2% in the second one; the difference is influenced by the much stronger impact that school stress has in the second model (Table IV).

Interaction with the place of residence

Figure 1 shows the marginal means of the general GHQ-12 index, estimated in the general linear model,

Table III. Estimation* of linear regression model with general GHQ-12 index as dependent variable.

Tabela III. Estymacja* modelu regresji liniowej z ogólnym indeksem GHQ-12 jako zmienną zależną.

Independent variables** Zmienne niezależne**	ΔR^2	B	SE(B)	Beta	p
Pressure with school work <i>Stres szkolny</i>	0.094	6.549	0.559	0.252	0.000
Gender (1-boys; 0-girls) <i>Płeć (1- chłopiec; 2 – dziewczyna)</i>	0.029	-2.305	0.311	-0.163	0.000
School achievements <i>Osiągnięcia szkolne</i>	0.019	-3.269	0.561	-0.124	0.000
Physical activity <i>Aktywność fizyczna</i>	0.009	-2.132	0.538	-0.086	0.000
Family affluence <i>Zamożność rodziny</i>	0.004	-1.664	0.522	-0.068	0.001
Place of living (1-large cities; 0 – small towns and rural areas) <i>Miejsce zamieszkania (1 – duże miasta; 0-małe miasta lub obszary wiejskie)</i>	0.002	0.614	0.309	0.042	0.047

*B – unstandardized coefficient of regression, Beta – standardized coefficient of regression, ΔR^2 – change in coefficient of determination/B – współczynnik regresji niestandardyzowany, Beta – współczynnik regresji standaryzowany, ΔR^2 – zmiana współczynnika determinacji

**dichotomous or recoded into ridits/zmienne dichotomiczne lub poddane transformacji ridit

Table IV. Estimation of linear regression models with two partial GHQ-12 indices as dependent variables.

Tabela IV. Estymacja modelu regresji liniowej z dwoma cząstkowymi indeksami GHQ-12 jako zmiennymi zależnymi.

Independent variables * Zmienne niezależne*	Dependent variable: Social dysfunction Zmienna zależna: Zaburzenia funkcjonowania społecznego			Dependent variable: Anxiety and depression Zmienna zależna: Niepokój i symptom depresji		
	ΔR^2	Beta**	p	ΔR^2	Beta**	p
Pressure with school work <i>Stres szkolny</i>	0.040	0.151	0.000	0.099	0.268	0.000
Gender (1-boys; 0-girls) <i>Płeć (1- chłopiec; 2 – dziewczyna)</i>	0.026	-0.118	0.000	0.025	-0.156	0.000
School achievements <i>Osiągnięcia szkolne</i>	0.012	-0.111	0.000	0.013	-0.107	0.000
Physical activity <i>Aktywność fizyczna</i>	0.013	-0.121	0.000	0.003	-0.050	0.022
Family affluence <i>Zamożność rodziny</i>	0.007	-0.084	0.000	0.002	-0.043	0.045
Place of living (1-large cities; 0 – small towns and rural areas) <i>Miejsce zamieszkania (1 – duże miasta; 0-małe miasta lub obszary wiejskie)</i>	0.002	0.045	0.037	-	-	-
Total R ² Ogólny R ²	0.100			0.142		

*dichotomous or recoded into ridits/zmienne dichotomiczne lub poddane transformacji ridit

**standardized regression coefficient – współczynnik regresji standaryzowany

taking into account the same predictors. This time, physical activity was encoded as a dichotomous variable (1 for MPVA=7 days).

It was shown that the inclusion of the interaction between the place of living and physical activity influences the whole conclusion. The interaction is statistically significant ($p=0.019$); however, the main effect of the MPVA stops being significant. This means that the place of living is a moderator of the relationship between the MPVA and the GHQ. The above effect of interaction becomes more visible in the model where social dysfunction is the dependent variable ($p=0.002$) than in the case of anxiety and depression ($p=0.179$).

DISCUSSION

Results in the survey comprising over 2,000 of Polish adolescents, showed that the population is significantly troubled with mental health issues. A greater intensity of this kind of problems in girls than in boys was confirmed, which is compliant with other reports [26]. Due to the widespread differences mentioned above, different GHQ norms for both genders have been suggested by some researchers [27].

Apart from the sociodemographic factors, a correlation among the most important predictors of mental health disorders and the functioning at school and physical

activity as a behavioural factor was investigated. Many authors emphasise the unambiguous correlation among physical activity and this kind of disorders. In our sample, following corrections for other factors, respondents who reported extremely low levels of physical activity scored on average 2.13 points worse on the GHQ-12 than their peers who meet the MPVA criteria of recommended physical activity (Table IV). Physical activity potentially protects more against social dysfunction than it does against the intensification of depressive symptoms. Similar results were obtained by other researchers with regard to the VPA (vigorous physical activity) indicator [28].

The literature mentions numerous attempts which were made to explain the mechanisms of the examined association [29, 30]. Physical activity may be conducive to driving the attention away from the stressors existing in the environment (e.g. low family affluence, school stress), that is alleviate the risk factors, at the same time changing the so-called internal cognitive vulnerability [8, 31]. Conversely, intensive physical activity enhances the mood, increasing the production of endorphins, called the "natural opiates" [32]. Physical activity strengthens personal resources and, as a consequence, alleviates depressive states. Its correlation with such resources as high self-esteem and self-efficacy clearly is bilateral in nature [33, 34].

Research results have confirmed that the school environment may become one of the most important

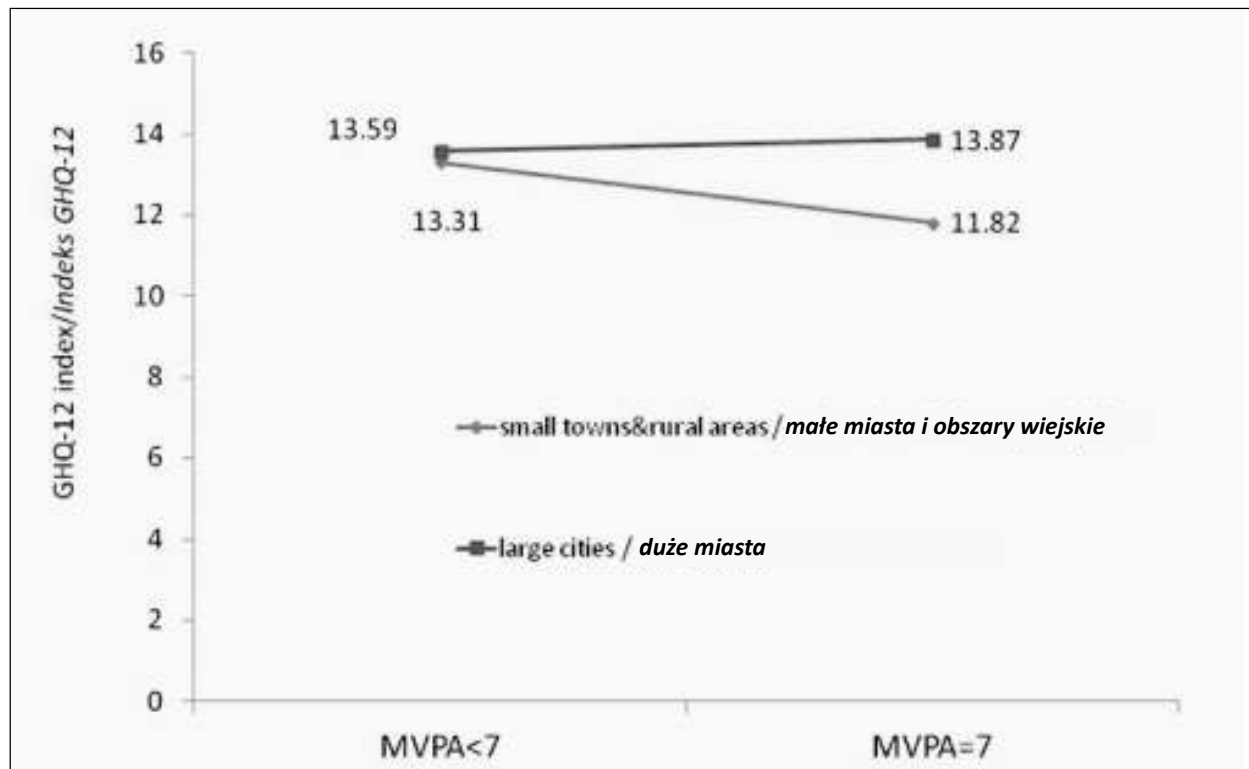


Fig. 1. GHQ-12 index by place of living and level of physical activity (marginal mean from general linear model adjusted for gender, family affluence, academic achievements and being pressured with school work).

Ryc. 1. Indeks GHQ-12 według miejsca zamieszkania i poziomu aktywności fizycznej (średnie brzegowe z ogólnego modelu liniowego skorygowane na płeć, zaamożność rodziny, osiągnięcia szkolne i stres szkolny).

stress-inducing factors for adolescents, while the sources of stress may include: abnormal social relations; the risk of a lack of achievements; and an excessive burden of duties [35]. Conversely, positive school perception and one's role as a student is an important protective factor against worsening mental health [36, 37]. Supportive school environment may shape the abilities to cope with the burden and stress, normal interpersonal relations and the capacity to solve problems [38]. An excessive burden of school duties with a simultaneous lack of satisfactory school achievements may result in a lower self-esteem and giving up taking on new challenges.

A significant part of the paper is devoted to comparing the urban and rural populations. Currently, it seems more justified to combine small towns and villages in one category instead of the traditionally used comparison between all the cities and rural areas. The correlation between the place of residence and mental health (where big cities score worse) manifests itself only in multivariable analyses. It is likely that young people from big cities are at risk from additional sources of stress, other than the burden of studying. The physical activity of adolescents from urban and rural areas may have different qualitative and social dimension [39]. According to studies by other authors, physical activity in a natural environment may have additional qualities; rural areas are conducive to that [40].

Some results of this paper should be interpreted in the light of the study limitations, such as the cross-sectional nature of research and drawing upon self-descriptive data. With study design, it is difficult to talk about a proven cause-effect correlation as well as an objective measurement of physical activity. Limitations include also the adopted set of independent variables – excluding, for example, family determinants - as well as focusing on selected (although dominating) mental health issues. The strength of the paper include a large representative sample of adolescents, using a standard international questionnaire and complex methods of analysis, including the effect of interaction among selected independent variables. It should be underlined that all analyses have been adjusted not only for demographic factors (gender) but also the place of living and family wealth.

Further analyses should feature an extended set of explaining variables and take into account an analysis of direct and indirect correlations. It would be worthwhile to search for other interactions which would explain how individual factors influence mental health, such as the link between physical activity and school determinants or between family affluence and other analysed factors [41, 42].

The limitation of this paper results also from the two-factor GHQ scale chosen as a main dependent variable. In such way the attention has been paid only to selected aspects of mental health. Our results can be treated as preliminary model of analysis that should be widened not only because of different determinants but also because of other outcome measure linked with mental health. Biological mechanisms that explain the impact of behavioural factors on mental health are worth attention. Not only lack of physical activity

but also lack of sleep or excessive screen time or even inadequate (restrictive) diet can disturb physiological processes leading to worsening of subjective well-being.

CONCLUSIONS

1. School factors strongly influence the variability of selected indices of adolescent mental health. The school stress is an important risk factor, while school achievements are a protective factor.
2. After including the school and sociodemographic factors, a significant protective influence of physical activity on adolescent mental health persists, in particular in the area of social dysfunction.
3. An improvement of the mental health in physically active adolescents is more visible in small towns and rural areas than in big cities.
4. Family affluence remains an important predictor of adolescent mental health.
5. Analysed factors in different way influence social dysfunctions and depressive symptoms. It shows the advisability of leaving behind too general measurements of mental health and coming back to research oriented at different subjective symptoms and various dysfunctions in everyday life.

Acknowledgements

Analyses funded by the National Science Centre, no 2013/09/B/HS6/03438.

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Author's contributions/Wkład Autorów

According to the order of the Authorship/Według kolejności

Conflicts of interest/Konflikt interesu

The Authors declare no conflict of interest.

Autorzy pracy nie zgłaszają konfliktu interesów.

Received/Nadesłano: 04.09.2016 r.

Accepted/Zaaceptowano: 28.09.2016 r.

Published online/Dostępne online

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