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ORIGINAL ARTICLE

Izabela Tabak
A,C,D,E,F
Joanna Mazur
A,B,E,G
Hanna Nałęcz
B,E,F

Family and individual predictors and mediators of adolescent physical activity

BACKGROUND
In recent years, many reviews of research have demonstrated that the correlations between the physical activity of children and their parents are not as obvious as was once believed. Family factors constitute determinants of children's physical activity; however, this influence can be mediated by other factors. The aim of the analyses was to examine the mechanisms of the relationships between parental and individual factors: to examine whether parental modelling of physical activity and parental support are direct and indirect predictors of children's physical activity and whether self-efficacy is a mediator of these relationships.

PARTICIPANTS AND PROCEDURE
Data from 1,287 Polish adolescents aged 14 to 18 were analysed. The study used questions and scales regarding perceived parental modelling of physical activity (perceived parental physical activity and joint activities), received parental support, and self-efficacy, moderate-to-vigorous physical activity (MVPA) and vigorous physical activity (VPA) of adolescents. Statistical analyses included partial correlations, regression analyses and structural equation modelling.

RESULTS
It was found that self-efficacy, support, gender and parental modelling are independent predictors of physical activity in adolescents; the strongest predictors are self-efficacy and support. Support was a mediator of the relationship between modelling and physical activity and between modelling and self-efficacy. Self-efficacy was a mediator of the relationship between support and physical activity.

CONCLUSIONS
Parental physical activity, as well as parents' engagement in joint activity and children's activity, strengthens self-efficacy in adolescents and predisposes young people to maintain physically active behaviour.

KEY WORDS
family; physical activity; modelling; support; self-efficacy

ORGANIZATION – Department of Child and Adolescent Health, Institute of Mother and Child, Warsaw, Poland
AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation · F: Literature search · G: Funds collection
CORRESPONDING AUTHOR – Prof. Joanna Mazur, Department of Child and Adolescent Health, Institute of Mother and Child, 17 A Kasprzaka Str., 01-211 Warsaw, Poland, e-mail: joanna.mazur@imid.med.pl
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BACKGROUND

The promotion of healthy behaviours, including physical activity, depends on three basic groups of factors: predisposing factors (e.g. beliefs, values, attitudes), enabling factors (e.g. abilities, availability, quality of an offer), and enforcing factors (e.g. social norms, social acceptance) (Green & Kreuter, 2006). For children and adolescents the family serves as the source of these factors (Davison, Cutting, & Birch, 2003; Erkelenz, Kobel, Kettner, Drenowatz, & Steinacker, 2014; Gustafson & Rhodes, 2006). Parents pass on to their children certain beliefs, values and attitudes towards physical activity (positive or negative). Parents also teach children basic abilities that enable them to take up sports (for instance, skiing or cycling), serve as role models, help overcome barriers, provide access to sports facilities (or not), and promote their children's activity by encouraging, praising and supporting their efforts (Hamilton, Hatzis, Kavanaght, & White, 2015; Leggett, Irwin, Griffith, Xue, & Fradette, 2012; Sallis, Prochaska, & Taylor, 2000).

FAMILY FACTORS

Family members (especially parents) are perceived as important persons for promoting physical activity in children, in particular through the mechanisms of modelling, joint participation and support (Golan, 2006; Pearson, Timperio, Salmon, Crawford, & Biddle, 2009). Modelling consists of learning certain behaviours by observing the behaviour of other, significant persons, such as parents and other role models. It is more than imitation, because it provides a child with an observable pattern of behaviour, which they can later adjust to the requirements of a particular situation. It means that children who observe their parents' physical activity become more physically active. Studies primarily indicate the effectiveness of the modelling of physical activity by fathers (Ferreira et al., 2006; Jose, Blizzard, Dwyer, McKercher, & Venn, 2011).

Taking part in sports with other family members plays a significant role in the promotion of physical activity among children and adolescents (Brooks, Smeeton, Chester, Spencer, & Klemera, 2014; Cleland et al., 2011), and can also be treated as an element of modelling and/or support (Dunton et al., 2013). Joint participation in physical activities (joint pursuit of sports, walks, active games with parents) constitutes an exemplary model to be followed, demonstrating the parents' positive attitudes to physical activity, teaching positive behaviours and promoting the formation of the habit of staying active, as well as the need to stay active. Children who pursue physical activity with their parents can gain a positive emotional attitude towards physical activity.

As indicated by previous studies, there are correlations between parental support for physical activity and their children's physical activity (Sallis et al., 2000). The support can be emotional, instrumental and/or material. Emotional support consists of passing on positive emotions reflecting care, which is demonstrated mostly as encouraging children to be active. Instrumental support encompasses providing tools and ways of behaving. Parental support in planning and organising sporting events proves to be a significant factor for enhancing the pursuit of physical activity. Material support is, in particular, in-kind and financial support, such as paying the fees for sports classes, buying the necessary equipment (shoes, rackets, balls, etc.), as well as providing transport to classes, which is especially important in the case of young children.

An important theoretical distinction in the support literature has been drawn between an individual's perception of support and the actual support that he/she receives (Barrera, 1986; Lakey & Cohen, 2000). Whilst both measures of support usually reflect an individual's perceptions of support provision, received support describes the actions actually performed by others when offering assistance. Perceived support may be best seen as a stable, individual characteristic (the perception that one is adequately supported) (Goodwin, Cost, & Adonu, 2004; Kohl & Murray, 2012). Both kinds of support are significantly correlated with self-esteem (Goodwin et al., 2004) and sport performance (Freeman & Rees, 2008), although in adult groups stronger correlations are observed with perceived support. For adolescents, received social support (especially from parents) is an important factor associated with physical activity level (Mendonça, Cheng, Melo, & Junior, 2014).

In recent years, many review articles have been published, demonstrating that the correlation between the physical activity of children and their parents is not as obvious as was once believed. In a review of 108 studies (including 54 on adolescents) from the years 1970 to 1998, Sallis et al. (2000) stated that parental physical activity was one of the most frequently analysed determinants of children's physical activity; however, most studies revealed a lack of, or only an average, correlation between the variables. The results of the analyses concerning parental support for children's physical activity were, in turn, clear and revealed the great significance of parental encouragement and support (including financial) for their children's active lifestyle.

Gustafson and Rhodes (2006) analysed 34 studies from the years 1985 to 2003 concerning this subject and, similarly to Sallis et al. (2000), they concluded that, even though the correlations between parental support for their children's physical activity and the level of this activity are positive and strong (18 out of

19 of the analysed studies), the analyses of the correlations between parental activity and children's activity do not provide clear results. Six of the analysed studies revealed positive correlations, seven studies showed a lack of correlation, and one study showed a negative correlation. It was also revealed that physically active parents encouraged their children more to be active and this encouragement served as a mediator of the relationship between parental activity and children's activity.

The most recent meta-analyses conducted by Yao and Rhodes (2015) included results of 115 studies from the years 1970 to 2014 and summarised seventeen review papers. Three out of 12 reviews examining the relationship between parent and child physical activity confirmed the correlation between them, whereas the remaining reviews did not provide grounds to confirm this relationship. Similarly to previous meta-analyses, the correlations between support for physical activity and its level were clearer, but the effect size was at an average level (r = .38).

Studies undertaken so far demonstrate that family factors constitute determinants of children's physical activity. However, this influence does not always occur and it can be mediated by other factors, for instance, at the individual level. The analyses of Trost et al. (2003) reveal that the influence of modelling is solely indirect, through support for physical activity. The influence of support can be both direct and indirect, through improving self-efficacy. Conversely, the analyses conducted by Cheng, Mendonça, and Júnior (2014) demonstrate that modelling can have both a direct and an indirect (through support) effect on the level of children's activity. They also reveal that the positive influence of parental support for the physical activity of children and adolescents can be mediated by reinforcing the self-efficacy of the children.

SELF-EFFICACY

The above results are justified by the main assumptions of the Social Cognitive Theory of Bandura (1997), which refers to the reciprocal determinism of the behaviours of an individual, and the psychosocial and environmental factors. Self-efficacy, defined as the belief in one's ability to realise plans, reach goals, and set and fulfil tasks, plays a key role in this theory. The self-efficacy of an individual also determines whether (and how much) effort will be put into taking up and pursuing actions, despite obstacles or failures. As the Health Action Process Approach model indicates, a feeling of self-efficacy is important at the stage of initiating an activity (by determining the intention), in maintaining the behaviour (by aiding the planning process), and at the stage of recovery (facilitating resumption of a behaviour after a setback) (Luszczynska & Schwarzer, 2005; Schwarzer, 2008). Self-efficacy is shaped mostly in childhood and adolescence, but it is a quality that can be altered throughout life. According to Bandura's (1977) theory, self-efficacy has four main sources: mastery experiences, in particular early successful experiences; vicarious experiences arising from the observation of other, successful people, which provide ready patterns of effective actions; verbal persuasion, feedback from the surrounding environment concerning an individual and personal considerations on this feedback (self-persuasion); and emotional arousal, that is, the psychophysical experience of stress when faced with a task (Warner, Schüz, Knittle, Ziegelmann, & Wurm, 2011; Warner et al., 2014).

Self-efficacy is believed to be one of the key individual factors determining the initiation and change of healthy behaviours in a person, including physical activity (Dishman et al., 2004; Dwyer et al., 2012; Wienert, Kuhlmann, & Lippke, 2015; Zhou, Sun, Knoll, Hamilton, & Schwarzer, 2015). Due to the fact that one of the most significant sources of self-efficacy is a person's own early, positive experiences of activity (mastery experiences), observing the success of significant persons (vicarious experiences/modelling) and feedback obtained from them (verbal persuasion), it is the influence of parents that plays a key role in shaping self-efficacy in children. Parents help build self-efficacy in children, for example, with regards to physical activity, by leading by their own example, encouraging them to act, and praising, supporting and monitoring the entire process of a child struggling with a task, so that the child can reach the goal.

CURRENT STUDY

Taking into consideration discrepancies in the literature and also the unquestionable influence of parental behaviour on children's physical activity, the aim of the analyses was to examine the mechanisms of the relationships between family and individual factors. Establishing the associations between parents' behaviour and the level of their children's physical activity (and the mediators of this relationship) seems to be crucial for conducting effective interventions with regard to the promotion of health and preventative treatment of non-communicable diseases (diseases of civilisation related to life style), including obesity. Based on the literature reviewed above, it was hypothesized that perceived parental modelling of physical activity (understood as perceived physical activity of parents and joint activity with them) and received parental support would be direct and indirect predictors of children's physical activity. It was assumed that parental modelling of physical activity and parental support would be significant predictors of self-efficacy associated with children's physical activity. It was hypothesized that self-efficacy would

be a mediator of the relationship between modelling and parental support and children's physical activity. Hypothesized mediation effects of social support between parental modelling and adolescents' self-efficacy was based on previous analyses conducted by Trost et al. (2003).

PARTICIPANTS AND PROCEDURE

SAMPLE AND STUDY PROCEDURE

Data from two cross-sectional surveys conducted in Poland in 2013/2014 were used. The first survey was conducted on behalf of the Polish Ministry of Sport and Tourism, while the second one was part of the international Health Behaviour in School-aged Children (HBSC) studies. Anonymous auditorium surveys were conducted in schools following a procedure consistent with the international HBSC protocol. The surveys were preceded by obtaining the approval of the local Bioethics Committee at the Institute of Mother and Child, as well as the informed consent of directors of the schools, adolescents and the parents of the participating adolescents. This paper employs data obtained from 1,287 adolescents (708 girls, 579 boys) aged 14 to 18 (M = 15.87, SD = 0.64), who filled out an extended questionnaire containing key variables regarding family conditions of physical activity. Missing data for analysed variables were below 5%.

VARIABLES AND INDICATORS

This study used questions and scales regarding:

1. Parental modelling of physical activity. Four questions were used in the study: two concerning perceived physical activity of each parent and two concerning his or her joint activity with a child. In order to measure parental physical activity, the following question was used: "How often do your parents/caregivers take part in physical activity/sports?". The original version of this question (regarding both parents together) comes from a survey which is part of the European Union (EU) ENERGY project (Brug et al., 2010). For the purposes of this study the question was modified so it could separately measure the physical activity of mothers and fathers; the 4-point response scale ranging from *never* (0) to *often* (3) was used. In order to measure the joint physical activity of a family, the following question was used: "How often within the last two months have you taken part in playing sports together with your family?". The original version of this question comes from the HBSC survey (Sweeting & West, 1998) and it was modified to provide separate information concerning mothers and fathers; the 4-point response scale ranging from *never* (0) to *3 or more days a week* (3) was used. On the basis of four questions, the summary index was constructed and due to easier interpretation converted to a 0-100 scale [(result/max)*100], showing the percentage of the maximum assessment. The scale of 'modelling' was homogeneous and reliable (Cronbach's α = .72).
2. Received support. In order to measure received support, four questions based on the EU ENERGY project were used, concerning parental support for adolescents with regard to physical activity. Three questions, with the categories of answers from *never* (0) to *always* (3), concern instrumental support ('My parents/caregivers help me plan physical activities…'), material support ('…help me if I need something for my sports') and permitting physical activity ('If I indicate that I like a certain activity/sport, my parents/caregivers allow me do it'). The fourth question, with the categories of answers from *definitely disagree* (0) to *definitely agree* (3), regards emotional support ('My parents encourage me to be physically active/do sports') (Timperio, van Stralen, & Brug, 2013). The summary index was constructed and converted to a 0-100 scale. The scale of 'support' was homogeneous and reliable (Cronbach's α = .74).
3. The physical activity self-efficacy scale by Schwarzer and Renner (2015) was applied. This tool comprises five statements, describing situations that can impair the realisation of plans connected with physical activity. When answering, participants need to evaluate, on a scale from *very uncertain* (0) to *very certain* (3), how certain they are that they would persist with their decision… 'even when I have worries and problems, I feel saddened, I am tense, I am tired, I am busy'. The summary index was constructed and converted to a 0-100 scale. The scale of 'self-efficacy' was homogeneous and reliable (Cronbach's α = .87).
4. Physical activity in adolescents:

- The moderate to vigorous physical activity (MVPA) index measures moderate to vigorous physical activity. This index allows the identification of the number of days within the last seven days when adolescents were physically active for at least 60 minutes a day. This question was adapted to the needs of HBSC from the screening test by Prochaska, Sallis, and Long (2001). It was preceded by a short definition of moderate physical activity, which contained the provision that PE classes at school can also be included. The adolescents answered by indicating the correct number of days on a scale from zero to seven days. The index was converted to a 0-100 scale.
- The vigorous physical activity (VPA) index measures vigorous physical activity (causing breathlessness or sweating) in spare time, outside

school. In order to measure VPA, two questions that had been used in the survey up until 1985 HBSC (Bucksch, Inchley, Iannotti, Roberts, & Tynjälä, 2014) were employed: adolescents were asked how many times and how many hours a week they were involved in vigorous exercise. The summary index was created (Cronbach's α = .76) and converted to a 0-100 scale.

STATISTICAL ANALYSES

The statistical analysis of the data included χ^2 and Student's *t* tests for evaluation of the differences associated with the gender and age of the samples, as well as partial correlations and a linear regression analysis with the forward method for evaluation of the relationships between family variables, individual variables and physical activity (SPSS v.17). A path model was also established using the AMOS 19.0 software. The statistical significance of mediation was evaluated with Sobel's test (Hayes, 2009), with adherence to the normal theory (NT) method proposed by Frazier, Tix, and Barron (2004). Path analyses were conducted with the maximum likelihood method. The following likelihood indicators were chosen: normed fit index (NFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) and χ^2/df. Good likelihood between the theoretical model and the collected data is demonstrated by their values: NFI, TLI between 0.90 and 1.00, RMSEA below 0.05, and χ^2/df between 1.00 and 2.00 (Hu & Bentler, 1995). To handle missing data, the multiple imputations, full-information maximum likelihood (FIML) imputation method was used.

RESULTS

PARENTAL PHYSICAL ACTIVITY AND SUPPORT

The results indicated that while more than 35.00% of parents never took part in any physical activity, one in nine mothers and one in seven fathers practised sports often (Table 1). More than 60.00% of adolescents pursued physical activity with their mothers but only 13.70% did this regularly (at least once a week). In the case of the fathers, a form of physical activity was undertaken jointly with 63.65% of adolescents.

Parents most often support the adolescents by granting permanent permission to practise their favourite sport (57.42%), giving material support by buying the necessary equipment or transport to classes (47.86%), and encouraging them to pursue physical activity (38.46%). Parents rarely participate in planning events associated with physical activity; only half of parents ever help in this way, and only one in seven adolescents can always depend on such help.

Significant gender differences were indicated for joint physical activity with fathers (boys more often than girls, χ^2 (2, N = 1287) = 22.34, p < .001) and parental instrumental support (boys received more often than girls, χ^2 (2, N = 1287) = 14.56, p = .001). Age differences were found only for joint physical activity with fathers (younger adolescents more often than older adolescents, χ^2 (2, N = 1287) = 18.02, p = .001). Significant gender or age differences in parental modelling or support scales were not found (Table 2).

ADOLESCENTS' PHYSICAL ACTIVITY AND SELF-EFFICACY

The MVPA index for boys indicated that they had physical activity for at least 60 minutes a day on average on 4.03 days a week (*SD* = 2.25), while for girls it was 3.11 (*SD* = 1.98) days. Both MVPA (t(1278) = 7.61, p < .001, d = .04) and VPA (t(1271) = 9.61, p < .001, d = .07) were significantly higher in boys (Table 2). The level of physical activity recommended by the World Health Organization (2010), a minimum of 60 minutes every day, was observed in only 22.80% of boys and 7.50% of girls. Also self-efficacy was higher in boys (t(1285) = 8.36, p < .001, d = .05). The age of the participants had an effect only on MVPA, i.e., younger adolescents more often engaged in moderate physical activity: t(1278) = 3.65, p < .001, d = .01.

CORRELATIONS BETWEEN ADOLESCENTS' PHYSICAL ACTIVITY, SELF-EFFICACY AND PARENTAL MODELLING AND SUPPORT

All of the analysed family and individual variables were significantly positively correlated to physical activity in adolescents (Table 3). However, correlations between physical activity and modelling were weak (0.17-0.24). The moderate correlations (0.35-0.43) were observed between the self-efficacy and physical activity (both MVPA and VPA), as well as between support and VPA. A stronger relationship was determined between modelling, support, self-efficacy and VPA, rather than MVPA.

PREDICTORS OF ADOLESCENTS' PHYSICAL ACTIVITY – MULTIVARIABLE ANALYSES

The results of the stepwise forward regression analysis demonstrate that self-efficacy, support, gender and modelling are independent predictors of physical activity in adolescents, irrespective of intensity (see Table 4). Age was included only in the estimated model for

Table 1

Frequencies of parental physical activity and support (%)

		Total (N = 1287)	Gender		p	Age		p
			Boys (n = 579)	Girls (n = 708)		14-15 years (n = 595)	16-18 years (n = 592)	
Mother's PA	Never	38.49	38.31	38.61		38.22	35.87	
	Sometimes*	50.29	53.01	48.47	.172	52.26	50.35	.083
	Often	11.22	8.67	12.92		9.52	13.78	
Father's PA	Never	35.05	33.76	35.94		33.22	34.48	
	Sometimes*	49.37	50.77	48.40	.335	48.04	50.19	.322
	Often	15.58	15.46	15.66		18.74	15.33	
Common PA with mother	Never	62.23	63.79	61.18		62.10	62.39	
	Sometimes**	24.06	21.73	26.20	.280	22.53	25.83	.107
	1-7 days/week	13.70	14.49	12.62		15.37	11.78	
Common PA with father	Never	63.65	**59.17**	**66.84**		**62.60**	**64.81**	
	Sometimes**	21.69	**20.78**	**22.34**	**< .001**	**19.38**	**24.25**	**.001**
	1-7 days/week	14.66	**20.05**	**10.82**		**18.02**	**10.94**	
Instrumental support	Never	48.97	**43.16**	**53.73**		49.49	48.37	
	Sometimes/often	37.93	**42.28**	**34.38**	**.001**	36.20	39.97	.206
	Always	13.09	**14.56**	**11.89**		14.31	11.66	
Material support	Never	13.62	11.59	15.29		13.20	14.09	
	Sometimes/often	38.52	41.35	36.18	.060	39.61	37.29	.663
	Always	47.86	47.06	48.53		47.19	48.63	
Emotional support	Don't agree	12.04	11.50	12.52		12.30	11.81	
	Not sure***	49.50	48.23	50.63	.439	48.68	50.56	.782
	Totally agree	38.46	40.29	36.91		39.12	37.63	
Parents allow	Never	11.53	10.92	12.03		12.05	10.79	
	Sometimes/often	31.04	33.98	28.65	.126	30.04	32.02	.649
	Always	57.42	55.11	59.31		57.91	57.19	

Note: Bold indicates significant differences; **from time to time* or *rare; **less than once a week; ***neither agree nor disagree/rather agree.*

Table 2

Participant characteristics – M (SD) of used scales

	Total (N = 1287)	Gender		p	Age		p
		Boys (n = 579)	Girls (n = 708)		14-15 yrs (n = 595)	16-18 yrs (n = 592)	
MVPA	50.32 (30.82)	**57.52 (32.22)**	**44.48 (28.34)**	**< .001**	**53.21 (30.74)**	**46.95 (30.51)**	**< .001**
VPA	48.93 (27.02)	**56.75 (26.81)**	**42.60 (25.64)**	**< .001**	49.22 (27.13)	48.60 (27.07)	.684
Modelling	27.05 (23.84)	28.27 (24.90)	26.06 (22.83)	.110	27.54 (24.33)	26.50 (23.20)	.445
Support	59.54 (26.51)	60.94 (25.63)	58.38 (27.14)	.088	59.83 (26.40)	59.21 (26.66)	.683
Self-efficacy	51.63 (25.10)	**58.02 (25.93)**	**46.41 (23.20)**	**< .001**	52.07 (24.74)	51.13 (25.79)	.503

Note. Bold indicates significant differences; MVPA – moderate-to-vigorous physical activity; VPA – vigorous physical activity.

Table 3

Partial correlations adjusted for gender and age between adolescents' physical activity, self-efficacy and parental modelling and support (unadjusted values in brackets)

	MVPA	VPA	Modelling	Support
VPA	.50 (.52)			
Parental modelling	.17 (.18)	.24 (.24)		
Support	.24 (.24)	.35 (.34)	.36 (.37)	
Self-efficacy	.35 (.38)	.43 (.47)	.12 (.14)	.27 (.26)

Note. For all correlations $p < .001$; MVPA – moderate-to-vigorous physical activity; VPA – vigorous physical activity.

Table 4

Linear regression models (forward selection) for predictors of adolescents' physical activity

Independent variable	R^2	ΔR^2	*B* (95% CI)	β	*p*
MVPA					
Self-efficacy	.14	.14	0.36 (0.30 to 0.43)	.30	< .001
Support	.16	.02	0.14 (0.08 to 0.21)	.12	< .001
Gender	.18	.02	−4.24 (−5.85 to −2.64)	−.14	< .001
Age	.19	.01	−2.69 (−4.26 to −1.12)	−.09	.001
Parental modelling	.19	.00	0.11 (0.04 to 0.18)	.09	.002
VPA					
Self-efficacy	.22	.22	0.39 (0.34 to 0.45)	.36	< .001
Support	.27	.05	0.21 (0.15 to 0.26)	.20	< .001
Gender	.30	.03	−4.41 (−5.72 to −3.10)	−.16	< .001
Parental modelling	.31	.01	0.13 (0.07 to 0.19)	.11	< .001

Note. All variables are continuous, except gender (1 – boys; 2 – girls); MVPA – moderate-to-vigorous physical activity; VPA – vigorous physical activity.

MVPA; however it explains less than 1.00% of variances. The estimated models explain 19.30% of variance in MVPA and 30.90% of variance in VPA. Self-efficacy (13.90% of variance in MVPA and 22.00% in VPA) and support (2.00% and 5.20%, respectively) proved to be the strongest predictors of physical activity.

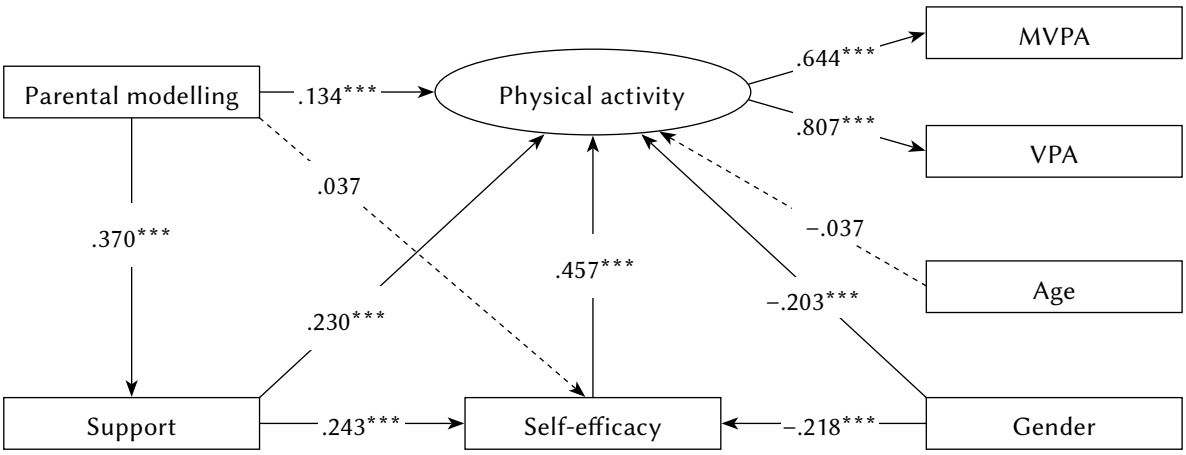
A path model of relationships between family and individual variables and physical activity in adolescents was estimated (Figure 1). The model, including parental modelling, support, adolescents' self-efficacy, age, gender and both types of physical activity, demonstrated good parameters: NFI = 0.98, TLI = 0.97, RMSEA = 0.03.

Modelling was a direct predictor of support and physical activity, but the path between modelling and self-efficacy was statistically insignificant. However, the effects of mediation were revealed: support was a mediator of the relationship between modelling and physical activity ($Z = 6.54$, $p < .001$) and between modelling and self-efficacy ($Z = 7.18$, $p < .001$). Self-efficacy was, in turn, a mediator of the relationship between support and physical activity ($Z = 7.24$, $p < .001$).

Ultimately, modelling explained 28.00% of variance of the latent variable physical activity (14.00% directly and 14.00% indirectly), support 34.00% (23.00% directly and 11.00% indirectly), and then self-efficacy remained the strongest (direct) predictor of physical activity (46.00%).

DISCUSSION

The conducted cross-sectional study included 1,287 Polish adolescents and aimed to discover the social and individual determinants of their physical activity, as well as the mechanisms of the relationships between these factors. Establishing the association between parental behaviour, the level of their children's physical activity and the mediators of this relationship was the main focus, with the goal of explaining the discrepancies appearing in the available literature concerning this matter (Gustafson & Rhodes, 2006; Sallis et al., 2000; Yao & Rhodes, 2015). Both family (parental modelling and support)



Note. Reported are standardized path coefficients; gender: 1 – boys, 2 – girls; ***$p < .001$.

Figure 1. Results of the path analysis for physical activity.

and individual (self-efficacy) variables were included in the presented analysis of the predictors of physical activity. It was demonstrated that all the analysed variables were significant predictors of physical activity in adolescents. A mediatory role of self-efficacy in the relationship between the family influence and adolescents' physical activity was confirmed (Cheng et al., 2014; Petersen, Lawman, Fairchild, Wilson, & Van Horn, 2013; Trost et al., 2003). Moreover, a mediatory role of support in the relationship between parental modelling and children's physical activity was also confirmed (Gustafson & Rhodes, 2006; Trost et al., 2003; Welk, Wood, & Morss, 2003).

The results of the present study demonstrated that modelling is a significant predictor of adolescents' physical activity, both direct and indirect. Many authors of previous studies called into question the importance of modelling (Aarnio, Winter, Kujala, & Kaprio, 1997; Anderssen, Wold, & Torsheim, 2006; Gustafson & Rhodes, 2006; Sallis et al., 1992). However, recent publications analysing path models have confirmed our results. Modelling (including joint participation) is a direct predictor of adolescents' physical activity, even though a vast share of its influence is mediated by other variables, such as the perceived competences and the attractiveness of a particular activity (Määttä, Ray, & Roos, 2014), or self-efficacy (Cheng et al., 2014).

The analysed areas of family influences include both direct and indirect determinants of adolescents' physical activity (Beets, Cardinal, & Alderman, 2010; Moore et al., 1991). However, an internal factor – self-efficacy – appeared to be the strongest predictor. In many previous studies analysing the psychosocial conditions of physical activity this factor was also considered. Research teams chose different tools, general or specific, regarding the regulatory processes in different stages of action. Irrespective of the tool employed, self-efficacy proved to be of key importance (Anderson-Bill, Winett, & Wojcik, 2011; Rovniak, Anderson, Winett, & Stephens, 2002). The scale used for the purposes of our research regards the ability to conquer the barriers deterring people from regular physical activity, which classifies it in the category of domain-specific tools, referring to coping self-efficacy. A scale of this kind strongly correlates with general self-efficacy and specified self-efficacy (Schwarzer & Renner, 2000).

Studies concerning the determinants of physical activity in children and adolescents differ with regard to the definition of the main dependant variable. Objective measurements of physical activity, for example using an accelerometer, are conducted relatively infrequently and with smaller samples (Trost, Pate, Ward, Saunders, & Riner, 1999). More often data are collected using surveys and questionnaires containing questions validated with objective measurements, such as the questions concerning MVPA and VPA. Kavanaugh, Moore, Hibbett, and Kaczynski (2015) indicated that the definition of the outcome variable can affect the conclusions. In their studies, the influence of self-efficacy and physical activity enjoyment was demonstrated only in the model of MVPA determinants obtained from a questionnaire, whereas it was not significant as a determinant of physical activity measured with an objective method. The advantage of our study is the fact that it employed a latent variable, which combines information regarding MVPA and VPA.

The obvious advantage of the present study is the large sample evaluated and the regional variety. The study enables thorough analysis of the relationship between family and individual determinants of physical activity. However, it is based solely on subjective data provided by adolescents. It concerns physical activity both in parents and adolescents. The lack of information about parental physical activity provided by the parents themselves can be viewed as a limitation of this study. It means that we are unable to evaluate on this basis the scale of the phenomenon, which includes the real engagement of adults

in physical activity, because it might be overlooked by their children. Another possible limitation of the study is the use of data only about parental physical activity, omitting the role of other family members (siblings, grandparents, uncles/aunts, etc.). In Poland, 62.00% of families are nuclear (consisting only of parents and children) (Central Statistical Office, 2014).

Moreover, the study did not collect information on concurrent negative behaviour patterns, such as parental sedentary behaviours, which also demonstrate modelling effects. However, the subject literature indicates the lack of a direct relationship between the time spent passively and physical activity. Thus, these behaviours are thought to be distinct or marginally correlated (Bucksch, Inchley, Hamrik, Finne, & Kolip, 2014; Lee, 2014; Pearson, Braithwaite, Biddle, van Sluijs, & Atkin, 2014). From the perspective of the modelling mechanism, a subjective evaluation of its two most significant aspects from a child's perspective, i.e., parents' individual level of physical activity and parent-child co-activity, seems to be of the highest importance. A recently published paper by Canadian authors analyses this type of correlation using multilevel modelling, as an analysis of data embedded in families (child-parent dyads), and the conclusions confirm the importance of modelling (Bélanger-Gravel, Gauvin, Lagarde, & Laferté, 2015).

In the present study the joint activity of parents with children formed a part of parental modelling. The subject literature, however, is not clear as to how to understand joint participation; some authors treat it as modelling (Dunton et al., 2013), and some as support (Gustafson & Rhodes, 2006). Additional factor analyses (data not presented) clearly demonstrated that joint activity constitutes a construct consistent with parents' activity and not support. The meta-analysis by Pugliese and Tinsley (2007) reveals various categories of parental behaviour having an influence on children's physical activity, generally treating all analysed behaviours in our study referred to as modelling and support as an element of the family socialisation of children.

Summarising the results of the analyses, it can be demonstrated that perceived parental physical activity, as well as parents' engagement in joint activity and children's activity, encouraging participation, agreeing to the activities that adolescents enjoy, and providing material or logistic support all strengthen self-efficacy in adolescents. Consequently, supporting adolescents to gain their own experiences (mastery experiences) is a factor which strongly predisposes them to maintain physically active behaviour.

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Izabela Tabak,
Joanna Mazur,
Hanna Nałęcz