

The Influence of Family Structure Differences on Physical Activity of Children and Adolescents in China — Taking Social Capital and Health Behavior as Mediating Factors

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Abstract

Background: This paper is based on the relationship between family structure and family health. **Methods:** This paper applies the method of empirical research to explore the impact of social capital investment and health behavior acquisition on the degree of completion of recommended amount of physical activity for children and adolescents under different family structures. **Results:** This paper finds that the 30-minute MVPA and 60-minute MVPA of children and adolescents in joint families and stem families are larger than those in other families, and the overall 60-minute MVPA participation is obviously insufficient. As for the influence of family structure and social capital on the recommended amount of physical activity for children and adolescents, compared with other families, greater expenditure on sports is related with better family-friend interaction, stronger sense of school belongingness, better campus friendship, better social trust, greater likelihood that the recommended physical activity is completed, and more social support for the physical activity of children and adolescents. **Conclusions:** Social capital and health behavior served as a way to improve the achievement rate of recommended physical activity for children and adolescents. But the effect of health behavior is not prominent.

Background

With the rapid economic development during the period of social transformation, issues such as health inequalities and imbalances caused by the differentiation of social family structure have attracted much attention from the society. With the continuous improvement of social production level and increase in life materials, people's medical burden and pressure of life and work have gradually become the focus of social topics, leading to the intensification of social competition, forcing social members of different family structures to resolve the current health crisis through healthy lifestyle and behavior habits.

In recent years, more and more scholars have begun to pay attention to the relationship between family structure and family health. Rahul [1] believes that the family structure is the interaction of family members, the state of mutual influence and the relatively stable mode of connection. On the dimension of family structure and family health, Xu Guangming believes that the impact of family structure on urban and rural residents is not statistically significant, that is, changes in family structure do not have a significant impact on mental health, while the significance of family function is very significant [2].

Yu Xiaowei believes that family conditions, economic conditions, living habits, medical decision-making, medical insurance and other factors affect the health of urban residents [3]. Yan Liping believes that the degree of education is an important factor influencing the health of residents. Factors as location, family size, and family income affect the health of residents in different degrees [4].

Although scholars have discussed the impact of family structure on family health from different roles, there is still a lack of empirical research on physical activity and family structure of children and adolescents in China. There is a lack of theoretical system construction, and researches on impact of social capital and health behavior on physical activity are even rarer. Therefore, this study hopes to investigate the differences in physical activity and physical behavior of children and adolescents under

different family structure levels by investigating social capital and health behaviors in the field of children and adolescents, and to verify the impact of social capital and health behavior on physical activity and further to explore the differences in family structure of physical activity of children and adolescents.

Methods

Global Recommendations on the Health of Physical Activity by World Health Organization proposes specific recommendations for the health of children and adolescents aged 5-17 years, and also proposed that children and adolescents aged 5-17 years should take health exercises in their families, schools and communities mainly to improve the health of heart, lungs, muscles and bones and to reduce the risk of chronic diseases and non-communicable diseases. It is suggested that daily activities should be more than 60 minutes [5]. The questionnaire includes question such as "how many days a week can your intensity of physical activity be more than Moderate Intensity while your physical activity lasts more than 60 minutes?" The questionnaires explained the Moderate Intensity and Vigorous Intensity, that is, Moderate Intensity is indicated as slight sweating, rapid breathing, and rapid heart beating, achieved through walking, cycling, etc. Vigorous Intensity is indicated as massive sweating, tachycardia, achieved through basketball, running, aerobics, etc. [6]. In this study, the recommended amount of physical activity is moderate to vigorous-intensity physical activity with daily activity greater than 60 mins (MVPA), and the dependent variable equals 0 when recommended amount of physical activity fails to meets the standard, and the dependent variable equals 1, when recommended amount of physical activity meets the standard.

Wang Yuesheng [7] believes that the traditional family refers to the family type with complete family members and perfect functions, mainly including the Stem Family and the Nuclear Family. According to the commonly used method of sociological research, this study divides family types into Joint Family, Stem Family and Other families, with Other Families as the reference group. They are defined as "1 = Joint Family", "2 = Stem Family" and "3 = Other Families".

The sports environment climate under family structure needs the support of social capital and the cultivation of health behavior habits. It mainly includes six variables: family expenditure on sports, community support, family-friendly interaction, sense of school belongingness, campus friendship and social trust. They are all generated by Principal Component Analysis. Family expenditure on sports is mainly the parents' expenditure on sports activities for their children. The related problems are: Is family condition supportive of your needs of various sports and fitness consumption (1=not supportive 2=not supportive 3=general 4= supportive 5=very supportive) ? Are various recreational sports activities available in your neighborhood (1=never 2=seldom 3=about once a week 4=many times a week 5=every day) ? My friends often invite me to participate in fitness activities (1=never 2=seldom 3=about once a week 4=many times a week 5=every day)? I think I belong to this school. The school seems to be my home (1=very inconsistent 2= inconsistent 3=general 4=consistent 5=very consistent), I can ask for help from my friends in the school (1=very inconsistent 2= inconsistent 3=general 4=consistent 5=very consistent) ,The teachers in my school take good care of us and give us a lot of support (1=very inconsistent 2= inconsistent 3=general 4=consistent 5=very consistent). In addition to social capital, the

formation of healthy behavior habits is also crucial to the healthy development of children and adolescents' physique. In this study, dietary behavior, sleep behavior, decompression behavior and exercise behavior are selected as the main indicators of healthy behavior habits evaluation. Principal Component Factor Analysis (PCA) was used to analyze the health behavior variables. The related problems are: I have enough intake of protein, vegetables and fruits to maintain nutritional balance every day (1= very inconsistent, 2= inconsistent, 3=general, 4=consistent, 5=very consistent), I can punctually go to bed and get up every day and learn regularly (1=very inconsistent, 2=inconsistent, 3=general, 4 =consistent, 5=very consistent), I can respond positively to difficulties (1=very inconsistent, 2=inconsistent, 3 = general, 4 = consistent, 5 = very consistent), number of weekly fitness activities (1 = never participated, 2 = 1 - 2 times a week, 3 = 3-4 times a week, 4 = 5 times a week, 5 = once a day).

Based on the assignment of dependent and independent variables, the hypotheses of this study are put forward: (1) the family structure differences of physical activity among children and adolescents have shown a diversified development trend, (2) the more stable the family structure is, the better the family sports atmosphere will be, (3) the hierarchy of family structure has a positive effect on shaping children's adolescent health behavior, (4) the better the social capital is, the better the community sports atmosphere will be, and the higher the possibility of children and adolescents completing the recommended amount of physical activity will be.

In this study, the author conducted survey in 13 provinces and cities in China in 2018, such as Heilongjiang, Beijing, Liaoning, Shandong, Zhejiang, Henan, Hubei, Guangdong, Sichuan, Gansu, Yunnan, Guizhou, and Chongqing. The survey targets children and adolescents aged 7-18. With *National Student Physical Fitness and Health Survey Implementation Plan in 2014* as the data information collection benchmark [8], a three-stage sampling survey was conducted in 13 provinces and cities using the PPS sampling method. 1180 counties (districts and municipalities) of 13 provinces (cities) were used as primary sampling units, and cluster sampling was carried out according to the order of *Tabulation on the 2010 Population Census of the People's Republic of China by County*. In the first stage, 15 counties (autonomous regions and municipalities) in each county (city) were selected as samples for random sampling, and a total of 195 survey counties (districts and municipalities) were selected. In the second stage, the sample counties were screened in a small scale, and 4680 administrative classes were randomly selected from the first grade of primary school to the third grade of senior high school. In the third stage, a second random sampling was conducted in the selected classes. 20 samples were selected in each administrative class, and the final sample of 93600 students was obtained.

Before the investigation, every researcher has been trained in strict data input requirements, so that they can understand the source and use of data in the process of investigation. In the process of data input, the working procedure of two-person input and verification is adopted to ensure the accuracy and rigor of data input, eliminate the data deviation caused by personal factors, and strictly conduct rigorous checks on the logicity and rigor of data. The control variables mainly include: gender (1 = male, 2 = female), family type is divided into ("1 = Joint family", "2 = Stem family", "3 = other families). Social capital and health behavior include six variables: family expenditure on sports, community support, family-friend interaction, sense of

school belongingness, campus friendship and social trust, which are generated by principal component analysis.

Based on the basic characteristics of physical activity of children and adolescents, this paper used multi-level logistic regression model to verify the research hypothesis. To differentiate the intra-group and inter-group variations of the model, a zero-model is established to analyze the significance of the difference of social capital to dependent variables, to judge whether the multi-level model is valid, and to analyze the influence of the change of social capital on dependent variables. Regression equation significance test was used to test the fitting degree of the model. The significance level was below 0.05. Pearson significance P value was observed.

Results

Table 1 Basic Characteristics of Physical Activities of Children and Adolescents

It is found that the family structure differences of physical activity among children and adolescents have shown a diversified development trend. Hypothesis 1 is consistent with this result. Children and adolescents from Joint Families and Stem Families had higher 30-minute MVPA and 60-minute MVPA than other families, and the overall participation of 60-minute MVPA was obviously insufficient.

Table 2 Regression Model of Family Structure and Social Capital

In this study, factor of expenditure on sports, factor of community support, factor of family-friend interaction, factor of sense of school belongingness, factor of campus friendship, factor of social trust are adopted as the as the dependent variables; family structure is adopted as independent variable; gender, household registration are adopted as control variables to build a linear regression model (shown as in Table 2). Table 2 shows that higher expenditure on sports in the joint family and the stem family compared with other families will be related with higher community support for the physical activity of children and adolescents, more interaction between relatives and friends, stronger sense of school belongingness, better campus friendship, and the better social trust. The level of family structure has a positive impact on the creation of family sports atmosphere, that is, the more stable the family structure is, the better the family's sports atmosphere will be, and the hypothesis 2 is verified.

Table 3 Regression Model of Family Structure and Health Behavior

Regression models were constructed with dietary behavior, sleep behavior, decompression behavior and exercise behavior as dependent variables, family structure as independent variable, and gender and household registration as control variables (as shown in Table 3). Table 3 shows that a more stable family structure is related with a more standardized dietary behavior of children and adolescents, a more regular sleep behavior, a better decompression behavior, and more exercise behaviors. The level of family structure has a positive impact on shaping the health behaviors of children and adolescents. The more stable the family structure is, the better the health behavior of children and adolescents will be, and the hypothesis 3 is verified.

Table 4 Zero-model of Achievement Rate of Physical Activity

In this study, 60-min MVPA per day was selected as the dependent variable to construct the zero-model. The results are shown in Table 4. The inter-school variation chi-square test showed that there was a significant difference in the recommended amount of physical activity between children and adolescents in different schools. The coefficient of influence of inter-school coefficient of variation on the total coefficient of variation was 0.244, that is, only 24.4% of the differences in physical activity among children and adolescents come from schools, 75.6% come from different family structures.

Table 5 MVPA Random Intercept Model for Children and Adolescents

The multi-level logistic regression model construction was continued on the basis of the zero model. The results are shown in Table 5. Among them, the independent variable of model 1 is family structure, the control variables are gender and household registration, and in model 2, six independent variables are added based on model 1: factor of expenditure on sports, factor of community support, factor of family-friend interaction, factor of sense of school belongingness, factor of campus friendship, factor of social trust. In model 3, four independent variables are added based on model 1: such as dietary behavior, sleep behavior, decompression behavior, and exercise behavior. Model 4 covers the above dependent variables and independent variables.

According to the results of the intercept model of Table 5, the family structure has a significant positive correlation with achievement rate of physical activity of children and adolescents. The physical activity of children and adolescents in the stem family is 1.505 times that of the joint family ($e^{0.409}=1.505$). However, there is no significant difference between the completion of the physical activity recommendation of the children and adolescents in the joint family and other families. Social capital has a positive impact on the recommended amount of physical activity for children and adolescents. Greater expenditure on sports is related with higher community support, better family-friend interaction, better community support, stronger sense of school belongingness, better campus friendship, better social trust and greater likelihood that the recommended physical activity is completed. Comparing Model 1 and Model 2, a conclusion can be drawn that after the social capital factor is added, the influence of family structure on whether children and adolescents complete the physical activity recommendation is no longer significant.

Health behavior has little effect on achievement rate of physical activity of children and adolescents. Only diet behavior has a significant negative correlation. Compared with children and adolescents attending rural schools, urban children have lower achievement rate of physical activity. Comparing Model 1 and Model 3, it is known that after adding the factor of health behavior, the family structure is still significant for achievement rate of physical activity of children and adolescents. At the same time, after adding the family structure, social capital and health behaviors and control variables, it can be seen from Model 4 that the family structure has no significant effect on achievement rate of physical activity of children and adolescents. Only dietary behavior has significant influence on health behavior, but influence is relatively small. The factor of social capital still has significant influence on achievement rate of physical activity of children and adolescents.

By comparing model 1 and Model 4, it can be seen that there are differences in family structure in the cultivation mode of physical activity recommendation of children and adolescents. Achievement of recommended physical activity via family structure is achieved through social capital and health behavior. There are differences in the family structure influencing the factors of social capital, that is, the more stable the family structure is, the better the social capital is, the better the community sports atmosphere is, and the higher the possibility that the children and adolescents reach the recommended amount of physical activity, and the hypothesis 4 is verified. Therefore, social capital and health behavior played an important role and served as a way to improve the achievement rate of recommended physical activity for children and adolescents. But the effect of health behavior is not prominent.

Discussion

Compared with the developed countries, China has completed the reforms in the past 30 years which take the developed countries over a hundred years to complete. China's social structure and social stratification are also constantly developing and changing, leaving the coexistence of diversity, transition and parallelism during the social development. Based on whether the recommended amount of physical activity of children and adolescents meets the standard, this study verifies whether there is a family structure difference on the impact of social capital on children's and adolescents' health behaviors.

The study shows that the family structure difference of physical activity of children and adolescents in China has begun to take shape, but it has not formed a stable structural habit. The specific manifestations are as follows: 1) The hierarchy of family structure stability helps increase the recommended amount of physical activity to a certain degree: The more stable the family structure is, the more the children and adolescents participate in physical activity; 2) In terms of whether the children and adolescents reach the recommended amount of physical activity, there is no significant difference between children and adolescents in the joint families and other families; the physical activity of children and adolescents in the stem families reach the vigorous intensity to a larger degree, and the probability of reaching the recommended amount is 1.505 times that of other families. Therefore, the input of social capital and the shaping of health behavior habits under different hierarchies of family structures are worthy of in-depth consideration and discussion.

Physical activity of children and adolescents shows differences in family structure. Studies have shown that adolescents raised by single-parent families have poorer physical and mental health status than those raised by their parents together. Some scholars believe that children and adolescents under the shackles of traditional education of their ancestors are more likely to have emotional problems, behavioral disorders and personality defects [9]. Scholars' researches have fully demonstrated that there exist some problems in raising children in single-parent families and joint families and it is not beneficial to the growth of children and adolescents. Families with different structures have different attention and input to the physical activity of children and adolescents, and it will cause difference in the degree of completion of recommended amount of physical activity for children and adolescents, which will ultimately lead to different physical health statuses in different family structures. Based on the investigation and analysis of

the family structure in the recommended amount of physical activity for children and adolescents, the study finds that the degree of completion of the recommended amount in different family structures is consistent with the research conclusions of previous scholars. It is concluded that the family structure difference of physical activity of children and adolescents has shown a diversified development trend, which verifies the correctness of Hypothesis 1.

As is pointed out in the evaluation system and evaluation methods for physical activity of children and adolescents, the sports environment that parents create for their children, their daily companionship and participation are important reference indicators [10]. The difference in family economic status is one of the reasons for the difference in the health status of adolescents and parents raised by a single parent or parents together, and stress is put on the importance of economic status in the family structure to the physical activity of children and adolescents [11]. As the children's first teachers, parents, whether in the strong support of sports concepts or good performance in participation behavior, will have a positive impact on children and adolescents [12]. Scholars believe that the community sports environment and the parents' companionship will affect the degree of completion of physical activity of children and adolescents. As is mentioned in Hypothesis 2 & 3, the more stable the family structure is and the more capital the society inputs, the more positive impact it will have on the degree of completion of the recommended amount of physical activity for children and adolescents, which proves the convergence of this study. In short, the more stable the family structure is, the higher the achievement rate of recommended physical activity for children and adolescents is.

In recent years, the achievement rate of recommended physical activity for children and adolescents has aroused wide attention from the society. Numerous studies have shown that unhealthy dietary behaviors, inadequate physical activity, sedentary activity and smoking are important factors affecting the health of children and adolescents [13]. For example, scholars believe that 60% of each person's health and longevity depends on their behavior and lifestyle, including the daily diet, physical exercise, etc. The formation of healthy lifestyles is crucial for the growth of children and adolescents [14]. However, some scholars have criticized that we should examine the achievement rate of recommended physical activity for children and adolescents from a systematic and continuous perspective rather than over-analyzing individual factors unilaterally. Parenting style is an important factor affecting the participation in physical activity of children and adolescents. Parents' companionship, demonstration, guidance, intervention and the acquisition of health behavior habits of children and adolescents are more conducive to the healthy growth of children and adolescents [15]. In short, scholars and experts believe that the completion of the recommended amount of physical activity for children and adolescents is the cultivation and acquisition of a habit and an academic issue that needs comprehensive consideration. The hierarchy of family structure and the acquisition of health behaviors are important factors that affect the completion of recommended amount of physical activity for children and adolescents, which verifies Hypothesis 4. As a tentative study, this paper also has certain limitations. First of all, this study is based on the scholars' discussion and questioning of different angles. It lacks the literature tracking and questioning of health behaviors under different family structures. Secondly, the selection of evaluation variables of health behaviors is not enough, and it lacks deep excavation of internal variables. Although the research above has certain

limitations, which need to be further filled from the research perspective, this paper believes that the establishment of random interception model is rigorous mathematical interpretation of independent variables, dependent variables and control variables, and the accuracy and direction of the conclusion remain reliable.

Conclusion

(1) This paper finds that the family structure differences in physical activity among children and adolescents in China have shown a diversified development trend. The 30-minute MVPA and 60-minute MVPA of children and adolescents in joint families and stem families are larger than those in other families, and the overall 60-minute MVPA participation is obviously insufficient.

(2) As for the influence of family structure and social capital on the recommended amount of physical activity for children and adolescents, compared with other families, greater expenditure on sports is related with better family-friendly interaction, stronger sense of school belongingness, better campus friendship, better social trust, greater likelihood that the recommended physical activity is completed, and more social support for the physical activity of children and adolescents.

(3) Social capital and health behavior played an important role and served as a way to improve the achievement rate of recommended physical activity for children and adolescents. But the effect of health behavior is not prominent.

Declarations

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It is confirmed that this article has not been submitted simultaneously to other journals in other countries. I accept the liability of the scientific integrity of the manuscript contents.

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Authors' Contributions:

Jingtao Wu conceived of the study, drafted the paper, co-authored the paper and analyzed the data; Defa Zhang helped to draft the paper, co-authored the paper and contributed to data analysis; Bei Lyu co-authored the paper and contributed to data analysis; Yanchao Yang and Hui Chen co-authored the paper. All authors contributed to the writing up of the paper. All authors read and approved the final manuscript.

Ethics approval and consent to participate

All participants consented to their study participation. The study received approval from Research Ethics Board for Youth of Tibetan and Qiang Minority in Sichuan.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1

Basic Characteristics of Physical Activities of Children and Adolescents

Family stratum	30min MVPA	60 min MVPA	Vigorous Intensity	Physical Activity Factor	Achievement rate of physical activity (%)
Joint Family	3.28	2.27	1.27	-0.07	2.61
Stem Family	3.57	2.01	1.45	0.04	2.28
Other Families	3.12	1.37	1.03	0.27	4.08
Total	3.61	1.88	1.49	0.03	2.37

Table 2

Regression Model of Family Structure and Social Capital

Variable	Family Expenditure on Sports	Community Support	Family-friend Interaction	Sense of School Belongingness	Campus Friendship	Social Trust
Joint Family (Reference to Other Families)	0.038***	0.017***	-0.023***	0.045***	0.011***	0.042***
Stem Family (Reference to Other Families)	0.248***	0.341***	0.287***	0.375***	0.284***	0.291***
Gender (Reference to Female)	0.047***	0.217***	0.153***	-0.027***	0.346***	0.017***
Household Registration (Reference to Rural Area)	0.176***	0.083***	0.071***	0.129***	0.274***	0.341***
Intercept term	-0.245***	-0.237***	-0.348***	-0.268***	-0.346***	-0.413***
Sample size	70200	70200	70200	70200	70200	70200
Adj.R ²	0.048	0.029	0.071	0.081	0.037	0.049

Note: *P<0.05, **P<0.01, ***P<0.01

Table 3

Regression model of family structure and health behavior

Variable	Dietary Behavior	Sleep Behavior	Decompression Behavior	Exercise Behavior
Joint Family (Reference to Other Families)	0.027***	0.194***	0.234***	0.126***
Stem Family (Reference to Other Families)	0.364***	0.324***	0.286***	0.162***
Gender (Reference to Female)	0.027	0.216***	0.134	0.327***
Household Registration (Reference to Rural Area)	0.841***	0.261***	-0.231***	0.164***
Intercept term	-0.924***	-1.217***	-2.057***	
Cut1 cons				-1.284***
Cut2cons				-0.812***
Cut3cons				0.342***
Sample size	60841	59617	61542	59417

Note: *P<0.05, **P<0.01, ***P<0.001

Table 4

Zero-model of Achievement Rate of Physical Activity

Fixed effects	Coefficient	Standard Error	Degree of freedom	Z	P
Intercept	-3.721	0.0427	1208	-68.87	0.000
Random Effect	deviation value	standard deviation	degree of freedom	chi-square	P
Family structure variation	1.064	0.064	1208	672.798	0.000

Table 5

MVPA random intercept model for children and adolescents

	Model 1	Model 2	Model 3	Model 4
nily (Reference to Other Families)	0.452	0.248***	0.327***	0.341***
mily (Reference to Other Families)	0.409***	-0.023	-0.013	-0.121
(Reference to Female)	0.816***	0.345***	0.627***	0.724***
ld Registration (Reference to Rural Area)	0.216***	0.245***	0.314***	0.421***
ure on sports		0.652***		0.273***
ity support		0.752***		0.314***
riend interaction,		0.637***		0.218***
' school belongingness		0.227***		0.267***
friendship		0.341***		0.341***
ust		0.637***		0.227***
oehavior (Reference to Rural Area)			-0.127***	-0.271*
havior(Reference to Rural Area)			0.037***	-0.137
ression behavior (Reference to Rural			-0.018	-0.142*
behavior (Reference to Rural Area)			0.027	0.018
t term	-4.271***	-4.165***	-4.682***	-4.619***

Note: *P<0.05, **P<0.01, ***P<0.001