Prevalence Rate and Individual Factors of Physical Inactivity and Sufficiently Physical Activity in China-the 2017 Chinese General Social Survey

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Abstract

Background: Under the influence of COVID-19, sedentary and home life has become a constant state of life, which affects people's health and needs to do more perfect research on physical activity.

Methods: This paper adopts the national data of Chinese General Social Survey (CGSS). This paper adopts multinomial logistic regression model with insufficient active as baseline, moreover, it divides the change of the degree of physical activity into two stages, i.e. the stage from "inactive" to "insufficiently active", and the stage from "insufficiently active" to "sufficiently active".

Results: It is found that the factors that promote the physical activity of "inactive" people are: having higher education, urban residents, self-rated health as health; having a good health as a result of self-evaluation. The factors to enhance the physical activity of "insufficiently active" people are: male, age, no religious belief, mental health, overweight.

Conclusions: The sets of the significant factors in the two transition stages are very various. A contrast between demographic characteristics and health status demonstrates that the impact of financial status is relatively slight. Adverse impacts come into force only in the second stage.

Recommendations: (1) Knowledge - promoting national policy and promoting education first. (2) Attitude - guiding the idea of activity and reasonable activity mode. (3) Practice - improve fitness facilities and improve the activity environment.

Introduction

Physical inactivity has been shown by researches to be one of the main factors leading to chronic diseases. Physical inactivity, which is defined as a major non-communicable disease, along with suicide, smoking and alcoholism by the World Health Organization (WHO), poses a great threat to public health [1]. In this context, enhancing physical exercises of the general public plays a significant role in achieving the goal of worldwide sustainable development. In particular, with the COVID-19 pandemic raging, the impact of physical inactivity has become more and more prominent. As the family quarantine policy limits activities, COVID-19 jeopardizes global public health, which further harms people's fitness [2]. In China, the proportion of lack of physical exercise in relation to the risk of major non-communicable diseases has been going up in recent years, which has caused a sharp increase in health care costs for chronic diseases. Therefore, it is necessary to carry out primary prevention campaigns, promote an active lifestyle, including conducting physical activity, and prevent non-communicable diseases among the elderly in China [3]. A survey implemented during the pandemics reveals that people's sedentary duration has significantly risen in the same period, while more than half of the respondents felt moderate level of stress. It also concludes a correlation between physical exercise, self-evaluation of health, and stress. In addition, the increase in sedentary duration has negative effects on quality of life with respect to physical fitness [4].

In dealing with physical inactivity among the broad masses of the people, in 2018 WHO launched the Global Action Plan on Physical Activity 2018-2030, which outlined 4 policy actions and 20 specific policies, recommendations and actions for Member States, international partners and WHO, aiming at strengthening sport activities globally. In 2019, the Active Living Toolkit was launched to address more specific technical guidance for the promotion of physical exercise, including policies that were adjusted and customized according to local culture and specificity, which has helped to popularize global physical activities. In addition, for the benefit of promoting Member States' physical fitness activities, WHO has vigorously established partnerships, embracing the cooperation with the United Nations Educational, Scientific and Cultural Organization (UNESCO), as well as, advancing and fine-tuning the Global Action Plan on Physical Activity 2018- 2030: More Active People for A Healthier World [5] and effectuating The Kazan Action Plan on physical education and physical activity [6]. In terms of facilitating the common agenda of Sports for Development and Peace, WHO has interacted with many other United Nations agencies, including with the International Olympic Committee and the International Sports Federation, the International Federation of Association Football (FIFA), and more, targeting to the promotion of health utilizing sport as a vehicle and universal participation in sports activities.

Actively responding to the call of the WHO, China has attached importance to civil health across the board. In 2016, China issued National Fitness Program for 2016-2020 to evaluate the effectiveness of the National Fitness Program. Based on the review of results, China introduced a performance evaluation index system for the public service in the area of fitness into the program for 2016. In the same year, the Healthy China 2030 planning outline was released, which has served as a magnificent blueprint and action plan to push forward the building of a healthy China and a national strategy to ameliorate the health conditions of the nation in an all-round manner and achieve the coordinated development of people's health and the economy and society.

Upholding the philosophies of "precise poverty alleviation", China has formulated and implemented polices on the basis of analyzing, summarizing and sorting out the influences of social, economic and health factors on the intensity of physical exercise of citizens utilizing big data covering many corners of the nation. This paper enriches the theories digging into the promotion of physical exercise, and also renders more appropriate theoretical guidance for the popularization of national fitness exercises, working as a reference for the country to further explore the development of national fitness exercises. Especially against the backdrop of COVID-19, national fitness meets the up-to-date needs of normalized control of the disease. It is of great significance to safeguard the health of residents [7].

Methods

Data

The data used in this paper are drawn from the 2017 Chinese General Social Survey (CGSS). The CGSS is a nationwide large-scale random sampling survey project implemented by the National Survey Research Center at Renmin University of China, the data from which are widely quoted in academic researches. According to the National Library of China's latest bibliometric analysis report on the data output of CGSS, as of the end of December 2018, 2115 domestic Chinese journal papers and 355 international English journal papers were published based on data output from the CGSS. They included 241 papers published in SCI and SSCI, 565 domestic masters or doctoral theses, 80 international English doctoral theses and 25 monographs. [8]The study makes use of 3 modules of the 2017 CGSS questionnaire, namely core module A (containing demographic characteristics, state of health and economic status), module C for social network and network society, and module D for family questionnaire. The data released in the CGSS 2017 contain 783 variables, encompassing the data necessary to this research.

Variables and measurements

The dependent variable of this study is the degree of physical activities referenced to the scoring of International Physical Activity Questionnaire (IPAQ) – Short Form, with 2 being sufficiently active (having 150 minutes of moderate intensity physical activity per week), 1 being insufficiently active (having 20 - 150 minutes of moderate intensity physical activity per week), and 0 being inactive (having less than 20 minutes of moderate intensity physical activity per week).

Independent variables are mainly divided into three sections-demographic characteristics, state of health and economic status. The definition and measurement of specific variables are shown in **Table 1**. Regional factors are also relatively common components affecting the frequency of physical activity, but since different studies deal with these factors differently; this study will take regional factors as dummy variables to test the robustness of the model.

Table 1: Definition and measurement of variables.

Dependent variable	Intensity of physical exercise	2=sufficiently active; 1=insufficiently active; 0=inactive
Independent variable		
Demographic characteristics	Gender	1=male; 0=female
	Age	The actual age of the subject
	Minority	1=Yes; 0=No
	Religious belief	1=the presence of religious belief; 0=the absence of religious belief
	Education background	1=College degree and above; 0=High school and below
	Registered Permanent residence	1=urban areas; 0=rural areas
	Marital status	1=married; 0=unmarried
	Having a son/sons	1=Yes; 0=No
	Having a daughter/ daughters	1=Yes; 0=No
Health status	Self-rated health	1=healthy; 0=subhealthy or unhealthy
	Mental health	1= rarely or never felt depressed in the past four weeks; 0=often or always felt depressed in the past
	Underweight	1=Yes (BMI<18.5); 0=No
	Overweight	1=Yes (BMI>24); 0=No
Economic status	High income	1=Yes (total annual income>twice per capita incomes of local residents); 0=No
	Low income	1=Yes (total annual income <half of the per capita income of local residents); 0=No
	Floor area	1 = Floor area is greater than or equal to 100 square meters; 0 = Floor area is less than 100 square meters
	self-owned residence	1=Yes; 0=No

Multinomial logistic regression model analysis

The dependent variable of this study is measured using the duration of moderate intensity physical activity per week (the degree of physical activity: 2 = sufficiently active; 1 = insufficiently active; 0 = inactive) rather than dichotomous variable (physically inactive vs others) or self-rated intensity of physical activity. As a result, the designed dependent variable can help us to explore the mechanism of different stages, i.e. the transition from inactive to sufficiently active, as well as, from insufficiently active to sufficiently active. Despite the dependent variable being an ordinal variable, some studies usually apply the Ordinal Logistic Regression Model. Since the data of this study failed to pass the Test of Parallel Lines (prerequisite condition of ordinal logistic regression model), the paper will employ the Multinomial Logistic Regression Model to analyze the factors affecting the physical activity of residents in different transition stages. Multinomial regression allows for independent variables with more than one option. It can also be regarded as a Multinomial Logistic Regression Model of the Logistic Regression Model, making it a combination of both multinomial regression and the logistic regression model. The only difference is that one of the categories of the dependent variable is set as the reference group (C), which in this study, is "insufficiently active"; and the other categories are taken as the comparative groups, which are "sufficiently active" (A) and "inactive" (I), thus forming three categories of dependent variables. The regression coefficient can be taken as the increase in the probability of dependent variable A or I relative to dependent variable C when the independent variable goes up by one unit. This study takes "insufficiently active" as the reference group because it examines the influencing factors between "sufficiently active" and "insufficiently active", and at the same time assess the influencing factors between "insufficiently active" and "inactive". The factors involved in these two models are different, and this sta-

tistical method is rarely used in similar research. In this study, "inactive" to "insufficiently active" is defined as the first stage of physical activity, while "insufficiently active" to "sufficiently active" is defined as the second stage. Therefore, Multinomial Logistic Regression Model can differentiate the sets of significant factors in different transition stages.

Results

Descriptive and variance analysis

Table 2 has provided data with the relevant variables listed. Primarily, most of the respondents are inactive with respect to physical exercise frequency (about 54.4%). The proportions among inactive middle-aged and elderly people (63.1%) correspond with the researches concerning Shenzhen. [9] Nevertheless, the low ratio achieved in this study was due to the fact that samples were collected from all over China. Those who are insufficiently active and sufficiently active account for 21.7% and 23.9% respectively. The variables introduced are all significantly related to physical exercise resulting from the large number of samples in the study. The sensitivity of the relevant statistical analysis will see the introduction of the Hierarchical Multinomial Logistic Regression on the existing basis in order to obtain a more comprehensive analysis result. Among the demographic characteristics, males account for 47.2% of the total with a high percentage of "sufficiently active" physical exercise (49.8%). As regards health status, self-rated healthy interviewees account for 53.8% of the total with a relatively high proportion of being insufficiently active (68.8%). As it relates to financial status, accounting for 33.0% of the overall proportion, the relative needy (i.e., "income<average income of local residents/2") show a relatively high proportion (39.1%) of inactive physical exercise. As for 25.0% of the respondents who are relatively wealthy (ie "income> average income of local residents × 2"), 33.9% are insufficiently active in physical exercise.

Table 2: Descriptive and variance analysis (the intensity of physical exercise as the dependent variable).

	Intensity of physical exercise			Total	P value
	Inactive	Insufficiently active	Sufficiently active		
n	6,443	2,565	2,825	11,833	
Prevalence rate	54.4%	21.7%	23.9%		
Demographic Characteristics					
Male	0.458	0.479	0.498	0.472	0.0016
Age	52.907	42.590	53.757	50.873	<0.0001
Married	0.762	0.697	0.753	0.746	<0.0001
Minority	0.083	0.052	0.073	0.074	<0.0001
No religious belief	0.106	0.078	0.115	0.102	<0.0001
Higher education degree	0.115	0.419	0.210	0.203	<0.0001
Urban resident	0.349	0.615	0.613	0.470	<0.0001
Having son(s)	0.717	0.514	0.654	0.658	<0.0001
Having daughter(s)	0.596	0.424	0.551	0.548	<0.0001
State of health					
Self-rated health	0.464	0.688	0.571	0.538	<0.0001
Mental health	0.583	0.677	0.719	0.636	<0.0001
Under weight	0.112	0.099	0.068	0.098	<0.0001
Over weight	0.330	0.309	0.395	0.341	<0.0001
Economic status					
Floor area > 100 m^2	0.516	0.450	0.438	0.483	<0.0001
Self-owned residence	0.478	0.408	0.490	0.466	<0.0001
Full-time work	0.280	0.534	0.315	0.344	<0.0001
Income <average income of local residents / 2	0.391	0.235	0.278	0.330	<0.0001
Income> average income of local residents × 2	0.227	0.339	0.224	0.250	<0.0001

Table 3: Analysis results of physical exercise degree based on Multinomial Logistic Regression Model ("insufficiently active" as the control group)[1].

	Insufficiently active → Inactive	Insufficiently active → Sufficiently active
	B (S.E.)	B (S.E.)
Demographic characteristics		
Male	0.053 (0.054)	0.143 (0.060)*
Age	0.022 (0.002)**	0.029 (0.003)**
Married	-0.056 (0.068)	-0.057 (0.075)
Minority	0.231 (0.123)	0.200 (0.136)
No religious belief	0.123 (0.095)	0.285 (0.104)**
Higher education degree	-0.780 (0.070)**	-0.498 (0.077)**
Urban resident	-0.701 (0.063)**	0.157 (0.072)*
Having a son/sons	0.183 (0.066)**	0.056 (0.074)
Having a daughter/daughters	0.165 (0.061)**	0.048 (0.069)
Health status		
Self-rated health as healthy	-0.377 (0.059)**	-0.044 (0.067)
Healthy Mental state	-0.071 (0.057)	0.326 (0.066)**
Underweight	0.256 (0.090)**	-0.163 (0.109)
Overweight	0.008 (0.057)	0.177 (0.063)**
Economic status		
Low income	-0.030 (0.057)	-0.048 (0.064)
High income	-0.009 (0.056)	-0.029 (0.063)
Floor area exceeds or is equal to 100 m^2	0.149 (0.069)*	-0.048 (0.078)
Having self-owned residence	-0.088 (0.066)	-0.102 (0.075)
Having a full-time job	-0.108 (0.065)	-0.337 (0.073)**
Nagelkerke R^2	0.225	

* p<0.05, ** p<0.01, [1]Note: Provincial dummy variables used to control regional factors.

Analysis of multinomial logistic regression model

According to the analysis of Multinomial Logistic Regression Model in **Table 3**, demographic factors are decisive towards the involvement of physical exercise, health status serves as a secondary factor, while financial condition has the least impact on physical exercise of individuals. With the comparison of regional dummy variables introduced before and after, sensitivity analysis is carried out in this study. Merely pecuniary condition (including low income and full-time job) and ethnic minorities are related to variables concerning regions. When significant factors (prior to the introduction of regional dummy variables) are turned to insignificant factors (after the introduction of regional dummy variables), other significant factors are not greatly affected. On condition that Nagelkerke R^2 equals to 0.230, this model is regarded as a relatively stable one.

Compared with the control group (with the intensity of exercise defined as insufficiently active), the factors that increase the frequency of inactive physical exercise are: having a higher education degree, urban residents, self-assessed health as healthy; while the factors decreasing inactive activities are: age, having a son/sons, having a daughter/daughters, and underweight.

When "insufficiently active" is deemed a control group, on one hand, the factors that raise the chances of sufficiently active physical exercise are: male, age, no religious beliefs, mental health, overweight; on the other hand, the influencing factors diminishing sufficiently active physical exercise are: having a higher education degree and being engaged in a full-time job.

Conclusion

Minorities and low income, as significant factors, have evolved less markedly in the first stage. The factors that promote physical exercise in the first stage are broadly reflected in the demographic characteristics and health status, while the stimulation of physical exercise in the second stage is mainly manifested as demographic characteristics and health status. Nevertheless, by comparison with the first stage, full-time work plays a negative role in driving physical fitness activities. In the first stage, positive factors include: having a higher education degree, urban residents, and self-evaluation of health as healthy; while negative ones are as below: age, having a son/sons, having a daughter/daughters, and underweight. The segments playing a favorable role in the second stage comprise male, age, the absence of religious belief, mental health, overweight; whilst obstacles contain a higher education degree and being engaged in a full-time job. A contrast between demographic characteristics and health status demonstrates that the impact of financial status is relatively slight. Adverse impacts come into force only in the second stage.

Discussion

Three suggestions will be put forward under the KAP framework, i.e. the factors can be grouped into three domains including Knowledge, Attitude and Practice. Authentic knowledge and positive attitudes are the foundation of behavior in terms of health. This theoretical model has been productively employed in health education and health promotion. It acts as a guide for health educators to permeate health knowledge and aid in updating health perception to service objectives, so that information receivers will learn reliable health knowledge and be more willing to take proactive measures [10]. As a guideline, the system is workable in the area of energizing physical exercise. The suggestions abided by the theory will be more pertinent.

Knowledge - publicizing national policies as a priority

The above results reveal that self-evaluated health matters significantly in the first stage, but it is less evident in the second stage, which is possibly affected by Moral Hazard [11]. This group of interviewees doesn't maintain continuous physical exercise, which is contributed to the influencing factor of age. There is a large age gap among the subjects. Generally speaking, the older the people are, the less active physical exercise they may be engaged in. It is more difficult to for them to get rid of their previous habits rather than participating in exercise. With regard to young people, generally they are involved in more activities [12], among which physical exercise is their op-

tion. Therefore, in the process of implementing national fitness program in the future, relevant departments should enhance the promotion of the public health system, so as to arouse the general public's awareness of the importance of uninterrupted physical exercise. Those who are not religious have more accesses to being sufficiently active, which is attributed to the fact that most religious activities tend to be static. Men are also more potential to be sufficiently active. The government may think over propagating scientific knowledge that is more appropriate to women. For example, more exercise is conducive to slowing down aging [13], which is also in line with the precise service advocated by the country in recent years.

The publicity of national policies and scientific knowledge as a priority is a feasible measure. As physical exercises of the elderly cast positive social effects, the country has proposed a combination of a positive population aging strategy and a healthy China strategy, which means that with more active involvement of physical exercise of the elderly, they will not only improve their physical functions and optimize their mental state to a certain extent, but also more energetically play their part in the social participation. The policy navigates and encourages more elderly persons to participate in sport activities, accelerating the realization of the goal of active aging. From this perspective, it has laid a solid foundation of the building of active aging. The state advocates national fitness by means of national fitness activities, in order to realize the enhancement of the people's physique. It is a stead fast prerequisite of achieving a moderately prosperous society in an all-round way, which goes through the whole process of its realization. It is necessary to popularize the knowledge that physical exercise is a realistic step proposed by the state.

Attitude - to guide the public to develop awareness of strengthening exercise in a scientific fashion

Attitude plays a gigantic role on this issue. The article's research results show that respondents with a bachelor's degree are fonder of taking exercise in the first stage, however, the education background hampers enthusiasm physical exercise in the second stage. Obviously, those questioned with a higher academic qualification are aware of the significance of physical exercise to their health,[14] but at the same time, they worry that "excessive" physical exercise will arouse a negative impact on their fitness, such as muscle strain and other health concerns. The factor affected by attitude is self-evaluation of health. The respondents may shift their exercise behavior from inactivity to insufficient activity, which can be explained by the fact that physical exercise improves mental health. Researches on relevance of physical exercise to mental health are abundant, which have a amply proven that appropriate physical exercise gives impetus to mental health [15].

Generally speaking, people who are overweight are more aware of latent health risks than those who are underweight, however, being underweight is harmful as well [16]. In view of this, with respect to subsequent physical education, it is advisable to update the public's knowledge and advocate for more appropriate physical exercise methods. Especially for people who blindly pursue slimming, they should be conscious of the fact that regular and scientific exercise is a more reasonable practice. As for inhabitants who are overweight, exercise is an effective way to promote a healthy lifestyle, optimize body composition and strengthen health management.

Practice - to improve fitness facilities and the exercise environment

When knowledge and attitudes are formed, they affect related behavior. The research results show that sons or daughters have shown a negative impact on parents' physical exercise. Full-time job also leads to a significantly negative impact on respondents who are engaged in daily physical exercise in the second phase. The possible explanation is that the respondents' willingness to exercise is affected by their own living or working environment [17]. This reason also reveals that urban residents are more likely to participate in physical exercise with a certain intensity. As the schedule of urban residents is relatively inflexible [18], a reasonable and convenient physical exercise environment provided will motivate their behavior. Therefore, in the further promotion of national fitness activities, local authorities should strengthen the construction of parent-child physical exercise facilities, encourage enterprises to set up some physical exercise facilities in the workplaces, and form a diversified investment pattern jointly secured by public finances and social funds in terms of public sports services, so as to improve environmental factors affecting the degree of physical activity [19].

Parents' fitness behavior affects children's awareness on this issue. Their interaction in the process of exercise is a good way of enhancing communication. Parent-child physical exercise permeates the cultivation of values in the field of physical exercise for the next generation [20], which is also in keeping with the policy of national fitness advocated by the country. Especially against the backdrop of the "three-child policy" recently proposed by the country, in accordance with the findings of this paper, parents may reduce concerns about spending little time on their children through parent-child exercise. In accordance with the concept of Healthy China, it is necessary to pay attention to social forces and financial investment in public sports as financial funds are driving force and even foundation on this issue. Following the requirements of establishing a socialist market economic system, the state has deepened the reform of sports. At the end of the 21st century, China will initially establish a national fitness management system adapted to the socialist market economic system, establishing a socialized, scientific, industrialized, and legalized framework of national fitness system. During the whole process financial support always plays its role.

References

1. SAMUEL C. Dumith, PEDRO C. Hallal, RODRIGO S. Reis, et al. Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. Prev Med. 2011; 53: 24-28.

2. Binhosen V. Physical activity and health related quality of life among the urban thai elderly. Thai Nurs. 2003; 7: 231-242.

3. Wenfei Z, Aiping C, Yuliang S. Physical activity among older chinese adults living in urban and rural areas: a review. Journal of Sport & Health Science. 2016; 5: 281-286.

4. QI Meiling, LI Ping, MOYLE Wendy, et al. Physical Activity, Health-Related Quality of Life, and Stress among the Chinese Adult Population during the COVID-19 Pandemic. International journal of environmental research and public health. 2020; 17: 64-94.

5. World Health Organization. Global action plan on physical activity 2018- 2030: More active people for a healthier world, 2016.

6. World Health Organization. The Kazan Action Plan, 2017.

7. LU Wenyun. General Secretary Xi Jinping's Important Statement on National Fitness. Beijing Sport Journal. 2020; 43: 1-8.

8. China National Survey Data Archive.

9. ZHOU Y, Wu J, Zhang S, Yan S. Prevalence and risk factors of physical inactivity among middle-aged and older Chinese in Shenzhen: a cross-sectional study. British Medical Journal Open. 2018; 8.

10. QIAO Peiji, WANG Shengchao, XIAO Ming. Investigation and analysis of college students' health awareness and physical exercise behavior characteristics . Journal of Shanghai University of Sport. 2004; 028: 74-78.

11. REN Yanyan, KAN Xingwang, SONG Dandan. Adverse selection and moral hazard: An investigation based on the basic medical insurance market for the elderly. Journal of Shanghai University of Finance and Economics. 2014; 16: 54-63.

12. ZOU Zhichun. Relationship between physical fitness and exercise regimen for the elderly. Journal of School of Physical Education of Shanxi Normal University. 2005; 20: 118-120.

13. XU Yi, HUANG Ying. Experimental research on the relationship between physical exercise and intellectual women's self-esteem. Journal of Guangzhou Sport University. 2008; 6: 108-110.

14. YANG Wenqian, YANG Guang, MENG Binglin, et al. Research on physical exercise status of people aged 20 and above with different educational backgrounds. Contemporary Sports Science and Technology. 2016; 6: 117-118.

15. YANG Linhai. Research on the relationship between physical exercise at home and mental health of college students during the COVID-19 epidemic. Tianjin: Tianjin Normal University.

16. LIU Yang, YAO Jinghui. Cultivation of the values of physical exercise among the public. Jilin Normal University Journal (Natural Science Edition). 2010; 31: 151-153.

17. YUAN Xiao. Research on the impact of physical exercise and work stress on organizational commitment and turnover intention of corporate managers. Xi'an Physical Education University.

18. JIANG Chongmin, ZHANG Yimin, ZHANG Yanfeng. Identification of the evaluation of Chinese urban and rural residents participating in physical exercise. Sports Science. 2009; 5: 24-31.

19. WANG Zhankun. The experience of building public sports service system in developed countries and its enlightenment to my country. Sports Science. 2017; 5.

20. WANG Junwen. Guiding strategies for parents to lead children to exercise. Gansu Education. 2017; 23: 38-38.