# Stimulating or Inhibiting? The Impact of Physical Exercise on Chinese Residents' Willingness for Additional Childbearing

XiaoYun Wang , XiangYu Wang * , Rui Chen , Yao Pan , Yi Xue

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*Article*

# Stimulating or Inhibiting? The Impact of Physical Exercise on Chinese Residents' Willingness for Additional Childbearing

**XiaoYun Wang [1], XiangYu Wang [2,3,*], Rui Chen [2], Yao Pan [2] and Yi Xue [2]**

[1] School of Economics and Management, Chengdu Sport University; Chengdu 641000, China
[2] School of Physical Education, Sichuan Normal University; Chengdu 610141, China
[3] Key Laboratory of Sports Health Tourism Technology Research and Development, Sichuan Provincial Department of Culture and Tourism; Chengdu 610101, China
* Correspondence: wxy2021@sicnu.edu.com; Tel.: 86+18-010-543-867

**Abstract:** In recent years, the decline of birth rate in China has made the enhancement of willingness to have additional children an urgent social issue. Utilizing data from the 2021 China General Social Survey (CGSS 2021) and employing Logit regression models, Poisson regression models, and Lewbel models, this study analyzes the impact of physical exercise on Chinese residents' willingness to have more children. The results indicate that: (1) Physical exercise has a significant positive effect on the willingness to have additional children, and this finding remains robust after controlling for other variables; (2) Among samples from high-income families and individuals with shorter working hours, physical exercise positively influences the willingness to have more children, suggesting that economic and time factors affect the relationship between physical exercise and fertility intentions. This research is the first to explore the impact of physical exercise on the fertility intentions of Chinese residents, aiming to provide theoretical reference and policy implication for enhancing the willingness to have additional children, effectively unleashing fertility potential, and promoting the construction of a fertility-friendly society.

**Keywords:** physical exercise; reproductive intentions; population development; CGSS 2021

## 1. Introduction

China's demographic landscape has been characterized by a marked decline in birth rates and population growth. From 2021 to 2023, the country experienced three consecutive years of total fertility rates (TFR) below 1%, a critical threshold associated with population stability. This trend was accompanied by a shrinking net population increase, which plummeted from 480,000 in 2021 to a negative 850,000 in 2022, signaling the onset of a new era of negative population growth in China. In February 2024, the National Bureau of Statistics (NBS) released the "Statistical Communique of the People's Republic of China on the 2023 National Economic and Social Development," revealing that in 2023, the country witnessed a birth rate of 6.39‰, with 9.02 million births. This marked the second consecutive year of negative population growth and placed China's TFR at approximately 1.0, ranking it second-to-last among major global economies (NBS, 2024). The sustained decrease in birth rates reflects underlying challenges and concerns among Chinese families regarding reproductive intentions. Factors such as economic pressure, physical health, the rising cost of raising children, soaring educational expense, career-related stress, the shrinking childbearing-age population, and the diminishing "birth pile-up" effect are all potential contributors to the declining fertility rate. Given the current low fertility rate, there is an urgent need to explore new strategies to address this demographic challenge. The core of overcoming low fertility involves not only promoting "first child" births but also stimulating the reproductive intentions of families who already have children. The implementation of the "three-child" policy in July 2021 expanded the reproductive decision-

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making options for eligible families. However, this policy also led to differentiated reproductive intentions and behaviors among different groups. Currently, the focus of attention within families has shifted from the question of "how many children" to nuanced considerations regarding "whether to have children" and "whether to have more children."

The formation of a family's willingness for additional childbearing is a complex, multi-faceted dynamic process in which physical exercise, as a significant lifestyle factor, may exert a subtle influence. Current research examines the potential relationships and mechanisms between physical exercise and family fertility intentions from various perspectives, including physical and mental health, social relationship, and cultural cognition.

From the physical and mental health perspective, physical exercise can effectively improve individual health, enhance fertility, and improve overall quality of life, thereby establishing favorable conditions for additional childbearing. Studies have shown that individuals of reproductive age who engage in regular physical exercise have significantly higher fertility rates compared to those who do not exercise (Mussawar [2], 2023; Belladelli [3], 2023; Malek [4], 2023). Additionally, physical exercise can improve reproductive health and reduce the risk of infertility (Sartor, 2024 [5]; Abedpoor [6], 2024). Besides, a positive emotional state induced by regular exercise can also boost fertility motivation and alleviate concerns about reproductive risks, thereby increasing the likelihood of having more children (Shepherd [7], 2018; Axinn [8], 2017). Furthermore, physical exercise promotes interaction and communication among family members, enhancing family harmony and fostering a supportive environment that can strengthen fertility motivation. Research indicates that families engaging in regular physical activity exhibit more harmonious relationship and greater mutual support (Beauchamp [9], 2014; Pentz [10], 2017).

From the social relationship perspective, physical exercise can facilitate individual participation in community activities, foster social connections, and build social capital, thereby providing a foundation for social support in the context of additional childbearing (Davis [11], 2021). Moreover, physical exercise can enhance an individual's trust in the social environment, reduce worries about future reproductive risks, and strengthen confidence in childbearing (Kurylo [12], 2021). It also encourages interpersonal communication and comparison, which can shape fertility perceptions and behaviors, subsequently influencing the willingness for additional childbearing (Rossier [13], 2009).

From the cultural cognition perspective, physical exercise contributes to the dissemination of sports culture, influencing societal values and, in turn, affecting fertility concepts and behaviors. It promotes the adoption of a healthy lifestyle, impacting individual fertility decisions and thereby affecting the intention to have more children (Topdağı [13], 2019). Additionally, physical exercise can create social role models, inspiring individuals' fertility motivation, which may further influence their willingness for additional childbearing (JI Shuyu [14], 2022).

Despite the progress in exploring the relationship between physical exercise and family fertility intentions in the existing literature, certain gaps remain. Firstly, although current research suggests that physical exercise can enhance fertility and improve individuals' quality of life, the specific mechanisms driving this influence are still not well understood. Further studies are needed to examine how physical exercise directly affects fertility intentions. Secondly, most research to date has concentrated on samples from Western cultural contexts, with relatively few studies focusing on Eastern cultural backgrounds, such as China. Therefore, more cross-cultural research is essential to validate the effects of physical exercise on fertility intentions across different cultural settings. To address this gap, this study analyzes data from the Chinese General Social Survey (CGSS 2021) to investigate the impact of physical exercise on Chinese residents' willingness for additional childbearing. The goal is to provide new insights into how physical activity affects fertility intentions among Chinese residents, thereby revealing the mechanisms at play in the context of China's persistently low fertility rate. This research aims to serve as a reference for promoting the long-term, healthy, and balanced development of China's population.

The key contributions of this study are as follows: Firstly, while existing research has primarily focused on economic and socio-cultural factors influencing residents' fertility intentions, relatively little attention has been given to non-economic factors. In contrast to previous studies, this paper

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explores the preconditions and intrinsic value of physical exercise, offering a detailed analysis of its impact on fertility intentions and the mechanisms involved. Secondly, this study employs a multi-layered, multi-dimensional measurement framework to dissect the complex structure of fertility intentions among residents. It not only considers the inclination of families with children to have additional offspring but also takes into account the fertility decisions of childless families. By constructing a composite index of "one-child" and "multi-child" fertility intentions, this research provides a comprehensive view of the diverse nature of fertility intentions. All in all, this approach enhances the understanding of how physical exercise influences Chinese families' willingness for additional childbearing, offering a more precise perspective to uncover its underlying mechanisms.

## 2. Literature Review and Research Hypotheses

### *2.1. The Positive Influence of Physical Exercise on Chinese Residents' Willingness for Additional Childbearing*

In contemporary society, the decline in China's fertility rate has drawn widespread attention of factors influencing residents' intentions to have additional children. This intention is not merely a reflection of the expectations within families that already have children but also shaped by the interplay of various determinants. Recently, physical exercise has been increasingly recognized as a potentially positive contributor to enhancing the desire for additional childbearing, given its significant role in promoting both physical and mental well-being. The biopsychosocial model posits that the individual health state is influenced not only by biological factors (e.g., genetics and physiological functions) but also by psychological (e.g., emotion and cognition) and social factors (e.g., social support and environmental context).

First, the physiological effects: According to the biopsychosocial model, physical exercise can impact the intention to have more children through multiple physiological pathways. One of the key mechanisms is the enhancement of overall physical health, which can improve the reproductive system. Empirical research suggests that moderate aerobic exercise can significantly enhance ovarian function in women and improve sperm quality in men (Maleki, 2017 [15]). These health benefits create a more favorable environment for additional childbearing, potentially increasing individuals' confidence considering further reproductive decisions. Furthermore, physical exercise reduces the risk of chronic conditions such as obesity, diabetes, and cardiovascular disease, which are known to adversely affect fertility (Steven [16], 2024). By promoting overall health, physical exercise not only bolsters reproductive capacity but also mitigates potential health risks associated with child-rearing, thereby allowing families to adopt fertility decisions with greater confidence and reduced apprehension.

Secondly, the psychological effects: The biopsychosocial model also underscores the significance of psychological factors in shaping overall health. Physical exercise is widely recognized for its substantial impact on mental health. Firstly, engaging in physical activity promotes the release of neurotransmitters such as endorphins, which enhance mood and mitigate symptoms of anxiety and depression (Ligeza [17], 2019). Secondly, individuals with good mental health are generally inclined to express positive reproductive intentions. Empirical evidence suggests that physical exercise fosters a sense of vitality and physical well-being, which can translate into psychological satisfaction, thereby strengthening a positive attitude toward childbearing (Martinsen [18], 2008; Wright [19], 2009). Thirdly, physical exercise can enhance self-confidence and self-efficacy, crucial psychological factors in promoting reproductive decisions. Individuals with higher levels of self-confidence are more likely to embrace the challenges of parenthood and take on the responsibilities of raising children (Baghbani [20], 2023; Klompstra [21], 2018). This increase in self-confidence stems not only from improvements in physical health but also from the sense of achievement associated with regular exercise. Thus, physical exercise serves as a dual facilitator, improving both physical and mental health, which in turn, may increase the willingness for additional childbearing.

Lastly, social support: The biopsychosocial model further emphasizes social support in influencing health-related outcomes. Participation in group sports or social physical activities can strengthen social bonds, thereby expanding an individual's social support network (Wang [22], 2023;

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Sun [23], 2023). A robust social support system can positively affect reproductive decisions, helping families navigate the inherent challenges of child-rearing. Moreover, the social interactions provided by physical exercise create opportunities for individuals to share parenting experiences, obtain emotional support, and receive practical advice, thereby reducing parenting stress and enhancing confidence in making fertility-related decisions. Consequently, an enriched social support network not only improves psychological well-being but may also encourage a greater willingness for additional childbearing. Based on the aforementioned literature, this study proposes the following hypothesis:

**H1.** *Physical exercise exerts a positive influence on the willingness of Chinese residents to have additional children.*

### *2.2. The Negative Influence of Physical Exercise on Chinese Residents' Willingness for Additional Childbearing*

The "Child Cost-Utility Theory", initially proposed by economist Harvey Leibenstein, is grounded in the "rational economic agent" hypothesis, which asserts that individuals weigh the marginal costs against the marginal benefits of childbearing when making fertility-related decisions. According to this theory, when the perceived marginal cost of having children exceeds the perceived marginal utility, individuals are more likely to reduce or delay their fertility intentions.

First, the cost of childbearing: From the perspective of increased costs, engaging in physical exercise requires a considerable investment of time and energy, particularly for individuals already encumbered by work and family responsibilities. The time devoted to exercise may limit the amount of time available for childcare and family activities. Empirical research indicates that time constraints can intensify individuals' perception of parenting as a heavy responsibility, thus making them more cautious in their fertility decisions (Pasqua [24], 2011; Rehel [25], 2014). This aligns with the rational decision-making process articulated in the "Child Cost-Utility Theory", wherein individuals, when faced with the choice of allocating time between exercise and parenting, may regard child-rearing as a high-cost endeavor, subsequently decreasing their willingness to have more children.

Second, the economic burden: Physical exercise entails various economic costs, including gym memberships, sports apparel, fitness equipment, and related training programs, which can impose a financial strain on family budget. As fitness culture gains popularity, a growing number of families are willing to invested in exercise-related activities. However, these expenditures may conflict with financial obligations of raising children (Wang [26], 2024; Jing [27], 2023). In high-cost urban areas, for example, the expenses associated with physical exercise can exert additional pressure on family fertility budget, potentially leading to more cautious considerations of having additional children. This financial tension is particularly salient among young families, who are often confronted with expensive housing and educational expenses. Consequently, they may perceive that the marginal utility of having more children does not offset these economic burdens.

Third, competitive consumption: In contemporary society, consumer culture often promotes the pursuit of a higher quality of life and personal achievement, with physical exercise occupying a prominent role in this dynamic. Therefore, individuals may allocate a disproportionate amount of time and resources to exercise and personal development, rather than to family expansion (Zhang [28], 2022). This pursuit extends beyond physical health to include continuous lifestyle enhancement. When individuals prioritize personal enjoyment and competitive consumption, they may inadvertently neglect familial responsibilities, resulting in a decreased willingness to pursue additional childbearing. Furthermore, the influence of competitive consumption may lead to more cautious fertility decisions. With the increasing prevalence of social media, individuals' spending on fitness and lifestyle is often shaped by external social influences. In this context, the pursuit of a high-cost, fitness-oriented lifestyle may render additional childbearing less desirable, as it is perceived to potentially undermine the quality of life. This social pressure can further exacerbate concerns about having more children, ultimately leading to a decline in fertility intentions. Based on the foregoing analysis, this study proposes the following hypothesis:

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**H2.** *Physical exercise exerts a negative influence on Chinese residents' willingness for additional childbearing.*

## 3. Research Methodology

### *3.1. Data*

This study employs data from the 2021 Chinese General Social Survey (CGSS), which is the earliest nationwide, comprehensive, and continuous academic survey project in China. Launched in 2003, the CGSS aims to systematically collect and analyze data to provide an in-depth overview of the social, economic, political, and cultural transformations occurring within Chinese society. It captures various dimensions of social change, including institutions, structures, behaviors, and attitudes, offering insights into development trajectories and trends at different levels. The survey also details shifts in the relative status, roles, and perceptions of social members and groups, thereby providing a nuanced depiction of China's social stratification and the actual conditions of various societal segments.

The CGSS 2021 employed a multi-stage stratified sampling method and conducted in-person interviews, resulting in a nationwide collection of 8,148 valid samples. Building upon the methodology adopted by Zhang Haifeng et al. [29] (2024), this study focuses on individuals of reproductive age, specifically males aged 22–60 and females aged 20–49. During the data processing phase, this study excludes cases with missing values in the dependent variable, key independent variables, and control variables. Additionally, responses categorized as extreme outliers, or those marked as "97" ("Indifferent"), "98" ("Don't know"), and "99" ("Refuse to answer"), were removed to ensure data integrity. After applying these criteria, the final sample comprised 1,203 valid observations.

### *3.2. Variable Selection*

(1) Dependent Variable

The dependent variable in this study is the willingness for additional childbearing, which reflects whether individuals desire to have more children beyond their current number. Drawing on the methodology of previous research (Zhang Xiaoqian et al. [30], 2024), the difference between the ideal and actual number of children is used as indicator for this willingness. Specifically, this study calculated this variable using responses from the CGSS 2021 survey to the questions: "If there were no policy restrictions, how many children would you like to have?" and "How many children do you currently have (including stepchildren, adopted children, and deceased children)?" The difference between these responses serves as a measure of the willingness for additional childbearing. A positive difference (greater than zero) indicates a desire for more children and is coded as 1, while a zero or negative difference signifies no desire for additional childbearing and is coded as 0.

(2) Independent Variable

The independent variable of interest is physical exercise. This variable is assessed based on the CGSS survey item, "A30.9: In the past year, how often have you engaged in physical exercise during your leisure time?" Responses are rated on a five-point scale: "daily," "several times a week," "several times a month," "several times a year or less," and "never," which capture the frequency of respondents' engagement in physical exercise. To facilitate analysis and ensure consistency, we adopt the approach used in prior studies (Sui Xiaodong [31], 2023; Xu Wenxin [32], 2024) to recode these responses. The first four options—"daily," "several times a week," "several times a month," and "several times a year or less"—are grouped into a single category indicating participation in physical exercise and are coded as 1. Conversely, the "never" option is categorized as non-participation in physical exercise and is coded as 0.

(3) Control Variables

To control for the potential confounding effects and enhance the robustness of the model, a set of demographics, family condition, and social capital-related variables are included as control variables (refer to Table 1). Demographic characteristics variables include gender, age, household registration (hukou), ethnicity, retirement status, education level, religious belief, marital status, and

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current childbearing status. Family condition variables include family size, number of properties owned, and economic status. Social capital variables include region, social security participation, and health insurance coverage.

**Table 1.** Definitions and Descriptive Statistics of Control Variables.

| Category | Variable | Definition |
|---|---|---|
| **Demographic Characteristics** | Gender | Male = 1; Female = 0 |
| | Age | Actual age of the respondent at the time of the survey |
| | Household Registration | Non-agricultural = 1; Agricultural = 0 |
| | Ethnicity | Han = 1; Other ethnicities = 0 |
| | Retirement Status | Self-support for elderly care = 1; Otherwise = 0 |
| | Education Level | No formal education = 0; Primary = 1; Junior High = 2; High School/Vocational = 3; College/University = 4; Postgraduate and above = 5 |
| | Religious Belief | Has religious belief = 1; No religious belief = 0 |
| | Marital Status | Married (first marriage, remarried, separated) = 1; Unmarried (divorced, widowed, cohabiting, single) = 0 |
| | Current Childbearing Status | Has biological children = 1; No biological children = 0 |
| **Family Conditions** | Family Size | Number of family members excluding the respondent |
| | Number of Properties | Total number of properties owned |
| | Economic Status | Household income above the local average = 1; Otherwise = 0 |
| **Social Capital** | Social Security | Participates in at least one social security program = 1; Otherwise = 0 |
| | Health Insurance | Enrolled in at least one health insurance program = 1; Otherwise = 0 |

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*3.3. Model Construction*

In this study, the dependent variable—willingness for additional childbearing—is a binary variable. To test the hypotheses, a Generalized Linear Model (Logit regression) was employed using Stata 17.0. The model is specified as follows:

$$ZFI_i = Beta_0 + Beta_1 physical\ exercise_i + Beta_2 C_i + ?_i \quad (1)$$

In this model, $ZFI_i$ denotes the additional childbearing intention of individual $i$. The term $Beta_0$ is the intercept, while $Beta_1$ represents the coefficient associated with the frequency of physical exercise. The variable $physical\ exercise_i$ reflects the exercise frequency for individual $i$.Additionally, $Beta_2$ corresponds to the coefficients of the control variables, with $C_i$ encompassing the set of control variables included in the model. The error term $?_i$ accounts for the random variation not explained by the model.

## 4. Results

*4.1. Descriptive Statistical Analysis*

Table 2 provides the descriptive statistics for the key variables in this study, including the dependent variable (willingness for additional childbearing), the independent variable (physical exercise), and the control variables. The control variables encompass a range of demographic characteristics, such as gender, age, household registration (hukou), ethnicity, retirement status, education level, religious belief, marital status, current childbearing status, family size, number of properties owned, economic status, region, social security participation, and health insurance coverage.

**Table 2.** Descriptive Statistics.

| Variable Category | Variable | Mean/Percentage | SD |
|---|---|---|---|
| **Dependent Variable** | Willingness for Additional Childbearing | 40.76% | - |
| **Independent Variable** | Physical Exercise | 2.34 | 1.23 |
| **Demographic Characteristics** | Gender | 51.60% | - |
| | Age | 36.12 | 7.31 |
| | Household Registration | 59.29% | - |
| | Ethnicity | 92.66% | - |
| | Retirement Status | 40.11% | - |
| | Education Level | 2.34 | 1.47 |
| | Religious Belief | 20.81% | - |
| | Marital Status | 77.94% | - |
| | Current Childbearing Status | 74.84% | - |
| **Family Conditions** | Family Size | 2.19 | 1.69 |
| | Number of Properties | 1.13 | 0.53 |

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| | | | |
|---|---|---|---|
| **Social Capital** | Economic Status | 37.25% | - |
| | Social Security | 96.10% | - |
| | Health Insurance | 90.60% | - |

* Note: Percentages are provided for binary variables to indicate the proportion of participants selecting a given category.3.3. Formatting of Mathematical Components.

*4.2. Regression Analysis*

The Logit regression results, which explore the influence of physical exercise on Chinese residents' willingness for additional childbearing, are presented in Table 3. In Model $M_1$, several control variables—including gender, ethnicity, marital status, education level, current childbearing status, economic status, and social security participation—exert a statistically significant effect on the willingness for additional childbearing, achieving significance at the 10% level or higher.

**Table 3.** Regression Analysis Results of the Impact of Physical Exercise on Willingness for Additional Childbearing.

| **Variable** | ***ZFI*** | | $ZFI_{one}$ | $ZFI_{two}$ |
|---|---|---|---|---|
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ |
| **Physical Exercise** | | 0.069** | 0.148** | 0.070** |
| | | （0.051） | （0.012） | （0.029） |
| **Gender** | 0.068* | 0.066* | 0.109* | 0.102* |
| | （0.020） | （0.020） | （0.021） | （0.021） |
| **Age** | -0.004 | -0.004 | 0.009 | 0.008 |
| | （0.001） | （0.001） | （0.035） | （0.040） |
| **Household Registration** | 0.056 | 0.071 | 0.455 | 0.261 |
| | （0.089） | （0.037） | （0.052） | （0.092） |
| **Ethnicity** | 0.134* | 0.026** | 0.031 | -0.061*** |
| | （0.038） | （0.023） | （0.035） | （0.023） |
| **Retirement Status** | 0.032 | 0.070 | 0.069 | 0.104 |
| | （0.041） | （0.051） | （0.051） | （0.079） |
| **Education Level** | 0.066** | 0.080** | -0.010 | -0.093* |
| | （0.027） | （0.030） | （0.032） | （0.055） |
| **Religious Belief** | 0.280 | 0.036 | 0.035 | 0.018 |
| | （0.173） | （0.024） | （0.024） | （0.023） |
| **Marital Status** | -0.480*** | -0.464*** | 0.597** | 0.330** |
| | （0.033） | （0.056） | （0.058） | （0.014） |
| **Current Childbearing Status** | -0.937** | -0.940*** | 0.332** | 0.142* |
| | （0.005） | （0.008） | （0.140） | （0.006） |
| **Family Size** | -0.178* | -0.111* | -0.117 | 0.206** |
| | （0.095） | （0.040） | （0.143） | （0.066） |
| **Number of Properties** | -0.008 | -0.006 | -0.008 | -0.004 |
| | （0.001） | （0.001） | （0.001） | （0.001） |
| **Economic Status** | 0.124* | 0.121** | -0.137* | -0.093* |
| | （0.011） | （0.011） | （0.017） | （0.055） |

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| | | | | |
|---|---|---|---|---|
| **Social Security** | 0.142* | 0.141* | 0.065 | 0.062 |
| | （0.056） | （0.010） | （0.049） | （0.010） |
| **Health Insurance** | 0.203 | 0.070 | 0.069 | 0.043 |
| | （0.071） | （0.051） | （0.051） | （0.066） |
| **Constant** | -0.085 | -0.264 | 0.465 | 0.166 |
| | （0.040） | （0.072） | （0.056） | （0.018） |
| ***N*** | 1203 | 1203 | 1203 | 1203 |
| **Pseudo $R^2$** | 0.210 | 0.218 | 0.223 | 0.096 |

* Note: p < 0.10 indicates statistical significance at the 10% level, p < 0.05 at the 5% level, and p < 0.01 at the 1% level.

The regression coefficient for physical exercise in Model $M_2$ (β=0.069, p<0.05) indicates that physical exercise has a significant positive effect on Chinese residents' willingness for additional childbearing, thereby supporting Hypothesis H1. To further examine the reliability and robustness of this effect, this study adopts the methodology of previous research [29] and uses the survey item, "If there were no policy restrictions, how many children would you like to have?" to construct additional models. Specifically, in Model $M_3$ this study introduces the variable for "one-child" fertility intention (coded as 1 if the respondent desires at least one child, otherwise 0), and in Model $M_4$, the variable for "two-child" fertility intention (coded as 1 if the respondent desires at least two children, otherwise 0). The regression results indicate that physical exercise has a significant positive impact on both "one-child" and "two-child" fertility intentions (β=0.148, p<0.05; β=0.070, p<0.05, respectively).

Additionally, engaging in physical exercise requires a certain level of economic resources and time commitment. Frequent participation in physical activities may reduce a household's disposable income and the time available for raising children, potentially increasing the perceived costs of child-rearing. Thus, economic status and time availability could influence the relationship between physical exercise and the willingness for additional childbearing.

To explore this further, we classified households with per capita income above the local average as high-income families (coded as 1) and those below the local average as low-income families (coded as 0). Similarly, based on the survey item "How many days did you work in the past month?", respondents who reported more than 22 workdays were categorized as high work-time individuals (coded as 1), while those with 22 days or fewer were categorized as low work-time individuals (coded as 0).

First, the regression coefficients for physical exercise in Models $M_5$ and $M_6$ (refer to Table 4) indicate that, within the high-income sample, physical exercise significantly enhances the willingness for additional childbearing (β=0.136, p<0.05). This finding suggests that economic resources may affect the extent to which physical exercise influences fertility intentions.

Second, the results from Models $M_7$ and $M_8$ show that, in the low work-time sample, physical exercise has a significant positive effect on the willingness for additional childbearing (β=0.167, p<0.05). This suggests that the availability of free time may shape the relationship between physical exercise and fertility intentions, leading to the rejection of Hypothesis H2.

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**Table 4.** Impact of Economic and Time Factors on the Relationship Between Physical Exercise and Willingness for Additional Childbearing.

| Variable | *ZFI* | | | |
|---|---|---|---|---|
| | $M_5$ (Low-Income) | $M_6$ (High-Income) | $M_7$ (Low Work-Time) | $M_8$ (High Work-Time) |
| **Physical Exercise** | 0.049 | 0.136** | 0.167** | -0.053 |
| | （0.045） | （0.081） | （0.184） | (0.390) |
| **Control Variables** | yes | yes | yes | yes |
| **Constant** | -0.005 | -0.340 | -1.603 | 0.271 |
| | （0.514） | （0.569） | （1.634） | （0.041） |
| **Pseudo $R^2$** | 0.216 | 0.224 | 0.213 | 0.217 |

* Note: $p < 0.10$ indicates statistical significance at the 10% level, $p < 0.05$ at the 5% level, and $p < 0.01$ at the 1% level.

*4.3. Robustness Tests*

To ensure the robustness and reliability of the model, this study employs three robustness tests (refer to Table 5). First, this study modifies the core independent variable by replacing the binary indicator of physical exercise participation with a frequency-based measure. Specifically, responses to the survey question—ranging from "daily," "several times a week," "several times a month," "several times a year or less," to "never"—were assigned scores from 1 to 5. The regression results indicate that the direction of the coefficient for physical exercise frequency on Chinese residents' willingness for additional childbearing remained consistent, suggesting that the findings are robust.

Second, a Poisson regression model was utilized as a supplementary test to address the nature of the dependent variable. The results of the Poisson regression were consistent with those of the Logit model in both direction and statistical significance, further reinforcing the robustness of the results.

Third, a heteroskedasticity-based Instrumental Variable (IV) approach was implemented to further assess robustness. This method effectively mitigated potential endogeneity concerns by constructing instrumental variables based on heteroskedasticity. When comparing these results with those of the baseline regression model, the direction and significance of the coefficients remained stable. In Lewbel Model 1 and Model 2, the P-value for the under-identification test was less than 0.01, thereby rejecting the null hypothesis of under-identification. Additionally, the F-value for the weak instrument tests exceeded 10, indicating the absence of weak instrument issues. The over-identification test, using Hansen's J statistic, produced P-value greater than 0.1, suggesting that the null hypothesis—that the instruments are uncorrelated with the error term—could not be rejected, thus confirming the validity of the selected instrumental variables.

In summary, all three robustness tests confirm that the results of this study are both reliable and robust.

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**Table 5.** Results of Robustness Tests.

| Variable | *ZFI* | | | |
|---|---|---|---|---|
| | *Linear Regression* | *Poisson Regression* | $Lewbel_1$ | $Lewbel_2$ |
| **Physical Exercise (frequency of participation)** | 0.142*** (0.056) | | | |
| **Physical Exercise** | | 0.134*** (0.038) | 0.117*** (0.047) | 0.111*** (0.040) |
| **Control Variables** | yes | yes | yes | yes |
| **Constant** | 0.059*** (0.053) | -1.956*** (0.540) | 0.024*** (0.181) | 0.096*** (0.160) |
| **Under-identification test (P-value)** | | | 0.000 | 0.000 |
| **Weak Instrument F-Value** | | | 94.48 | 93.33 |
| **Hansen J Test (P-value)** | | | 0.207 | 0.399 |

* Note: $p < 0.10$ indicates statistical significance at the 10% level, $p < 0.05$ at the 5% level, and $p < 0.01$ at the 1% level.

## 5. Conclusions

The decline in birth rates presents a significant challenge to demographic development of China, with far-reaching implications for the labor market, social security system, and the sustainable growth of the economy and society. Enhancing the willingness for additional childbearing and increasing birth rates have therefore become critical policy issues. This study, utilizing data from the CGSS 2021, investigates the impact of physical exercise on Chinese residents' willingness for additional childbearing and offers several key conclusions.

First, the findings reveal that physical exercise exerts a positive influence on residents' willingness for additional childbearing. Previous literature has indicated the beneficial effects of physical exercise on both fertility and fertility intentions (Topdağı [33], 2019; Lin [34], 2022; Butt [35], 2023). This study further substantiates these claims, demonstrating that physical exercise can promote a fertility-friendly environment, potentially unlocking fertility potential and facilitating long-term, balanced population development.

Second, within the high-income family sample, physical exercise is shown to have a positive effect on the willingness for additional childbearing. This suggests higher-income households where economic pressure seems not to be a barrier, allow more resources to be devoted to activities enhancing life quality, such as physical exercise. Moreover, engagement in physical exercise may improve overall well-being, health, and life satisfaction, thereby fostering a stronger intention for additional childbearing.

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Third, in the low work-time sample, physical exercise similarly exhibits a positive impact on the willingness for additional childbearing. This finding indicates that when time constraints are minimized, the positive effects of physical exercise become more pronounced. It suggests that individuals with reduced working hours and increased leisure time are more inclined to engage in physical exercise, which in turn enhances their confidence and intention to expand their families.

Fourth, although Hypothesis H2 was rejected, this does not wholly invalidate the "Child Cost-Utility Theory". Even under conditions where physical exercise and the intention for additional childbearing are positively correlated, the "Child Cost-Utility Theory" retains explanatory power in the context of low fertility intentions because the theory accounts for a broad spectrum of factors, including but not limited to economic and time costs. For example, in both high-income and low work-time samples, other costs—such as career development and personal freedom—may continue to exert an influence. The "Child Cost-Utility Theory", being a multi-dimensional explanatory framework, acknowledges that the impact of these various costs can differ across contexts. In certain situations, specific costs may be mitigated or counterbalanced by other factors (e.g., the positive effects of physical exercise), yet this does not render the cost-utility theory universally inapplicable.

In conclusion, this study underscores the crucial role of physical exercise in shaping the willingness for additional childbearing, particularly among groups differentiated by income levels and time availability. Furthermore, it acknowledges the intricate interplay of economic, social, and personal factors influencing fertility intentions, thereby offering valuable insights into policy formulation aimed at promoting balanced population growth.

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