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Sport Consumption Policy and Population Health:Quasi-Experimental Evidence from China

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Abstract

Can sport-consumption-oriented policy improve population health beyond its economic objectives? This study examines the health effects of China's National Sports Consumption Pilot City Policy, a city-level intervention designed to stimulate sport consumption, expand sport services, and improve the local sport market environment. Drawing on Grossman's health capital theory and longitudinal data from the China Family Panel Studies from 2010 to 2022, we implement a Difference-in-Differences design to estimate the policy's effects on residents' physical and mental health. The results show that the pilot policy significantly improves both health outcomes. These findings remain robust to event-study tests, propensity-score-matched DID specifications, placebo tests, alternative health measures, controls for potentially overlapping sport-venue policies, and adjustment for COVID-19-related city-year shocks. Heterogeneity analysis indicates that the health gains are more pronounced among working-age adults and men for physical health, while mental-health effects are less heterogeneous across gender groups. Exploratory pathway analysis suggests that the policy may operate by expanding sport-related enterprises, stimulating household sport expenditure, and increasing exercise frequency and duration. The study contributes to interdisciplinary debates on sport policy, social policy, and population health by showing that sport consumption policy can function as a non-medical instrument for health capital accumulation and active health governance.

1. Introduction

Resident health is not only a pivotal metric for measuring the quality of economic and social development but also a critical conceptual lens for understanding the intricate relationship between social structures, institutional arrangements, and individual well-being. As a form of non-medical health investment embedded in daily life, sports consumption is regarded as an essential potential channel influencing physical and mental health by facilitating physical activity, improving psychological states, and expanding social interaction contexts. In recent years, China’s sports consumption market has experienced continuous expansion, with its scale reaching approximately 1.5 trillion RMB in 2022 and projected to maintain rapid growth (Tongren Jiang and Yang Jing, 2025). Within the strategic framework of "Healthy China 2030," sports consumption has gradually transcended its role as a mere stimulus for industry and demand; it is now perceived as an institutional intervention tool capable of achieving dual economic and health objectives.

However, the rapid growth of the sports consumption market has also triggered academic concern regarding its actual health effects and potential risks. Research in public health and health economics generally indicates that the marginal effect of relying solely on the expansion of the medical system to improve population health is diminishing (Duijvestijn et al., 2023). This has prompted policymakers to pivot toward more preventative and lifestyle-oriented health interventions. A United Nations report suggests that every 1 dollar invested in sports can save approximately 3.2 dollars in medical costs (Salvo et al., 2021), indicating that sports consumption represents a significant "health capital" investment rather than mere discretionary leisure spending.

Despite this, rapid growth in sports consumption does not necessarily equate to synchronized improvements in health outcomes, and its genuine health effects remain a subject of debate. On one hand, some studies argue that over-commercialized sports consumption may objectively exacerbate health inequality: high-income groups have easier access to premium sports services, while low-income groups may fall into a "health poverty trap" due to financial constraints (Richard et al., 2023). On the other hand, in the context of fast-paced lifestyles and increasing occupational stress, sports consumption has become increasingly "fragmented and hedonic." Whether such consumption can effectively translate into sustained health improvements, and under what conditions it genuinely promotes well-being, requires further verification (Westerbeek and Eime, 2021). Therefore, it is essential to conduct a systematic and quasi-experimental analysis of the health effects of sports consumption based on rigorous empirical evidence.

A growing body of research has linked sport participation and physical activity to better physical functioning, psychological well-being, and social outcomes (World Health Organization, 2020; Eather et al., 2023). Recent evidence from China also shows that sports participation can improve residents' physical and mental health through channels such as social capital accumulation (Li et al., 2026). Unlike Li et al. (2026), which focuses on individual sport participation, this study examines whether a city-level sport consumption policy shock can improve population health by reshaping the institutional and market environment in which residents make health-related choices. Three gaps therefore remain especially relevant. First, existing studies mainly examine individual participation or consumption behaviour, while less attention has been paid to the policy environments that shape the opportunities, costs, and incentives for health-enhancing sport consumption. Second, many studies rely on cross-sectional or observational designs, making it difficult to address reverse causality and unobserved confounding. Third, the literature has not sufficiently explained how a sport-consumption policy may operate through both supply-side market development and demand-side behavioural change to influence health capital accumulation.

To address these gaps, this study exploits the “National Sports Consumption Pilot City” policy, introduced by the General Administration of Sport of China in 2020, as a quasi-natural experiment. Drawing on longitudinal micro-panel data from the China Family Panel Studies (CFPS) spanning 2010-2022, we implement a Difference-in-Differences (DID) design to estimate the policy's effects on residents' physical and mental health. The inclusion of individual, city, and year fixed effects, together with pre-trend tests, propensity-score-matched specifications, placebo tests, alternative outcome measures, and controls for overlapping policy and pandemic shocks, helps mitigate endogeneity concerns and enhances the credibility of the identification strategy. Because pilot-city designation was not random, the estimates are interpreted as quasi-experimental evidence conditional on these assumptions and robustness checks.

This study makes three contributions to the interdisciplinary literature on sport policy, social policy, and population health. First, it shifts the analytical focus from individual sport participation to an urban policy intervention, showing whether sport-consumption-oriented public policy can generate health benefits beyond its economic objectives. Second, it provides quasi-experimental evidence on both physical and mental health outcomes, thereby extending Grossman's health capital framework to a policy setting in which market supply, household consumption, and everyday health behaviours interact. Third, it opens the black box of policy transmission by examining heterogeneous effects across age, income, and gender and by tracing exploratory pathways through sport-related enterprises, household sport expenditure, exercise frequency, and exercise duration. These contributions position sports consumption policy as a potential non-medical instrument for active health and sustainable social development.

2. Policy background and theoretical analysis

2.1 Policy background of National Sports Consumption Pilot City

In 2019, the General Office of the State Council issued the Opinions on Promoting National Fitness and Sports Consumption to Drive the High-Quality Development of the Sports Industry, which explicitly set the policy objective of launching national pilot programs for sports consumption and cultivating a group of national pilot cities. The General Administration of Sport of China formulated the Implementation Plan for the Pilot Program of Boosting Sports Consumption, specifying a three-year pilot cycle from 2020 to 2022.

The plan established clear application requirements covering institutional mechanisms, industrial foundation, facility provision, and supporting policies, and defined a standardized process of municipal application, provincial recommendation, expert evaluation, and final designation by the General Administration of Sport of China. Core implementation measures include strengthening cross-departmental coordination and financial support, expanding land supply for sports facilities, adopting policy tools such as government procurement, tax subsidies and sports consumption vouchers, promoting digital and intelligent supply of sports products and services, improving statistical monitoring of sports consumption, and establishing a performance evaluation and annual reporting system. Ultimately, 40 cities and districts were selected as the first batch of national pilot cities for sports consumption, aiming to form replicable experiences to expand the scale and upgrade the structure of sports consumption, so as to contribute to stabilizing employment, promoting growth, stimulating consumption and improving people's well-being.(Shuyang Liu and Jiahong Wang, 2024)

According to data released at the Summary and Exchange Meeting for National Sports Consumption Pilot Cities, the average per capita sports consumption expenditure among residents in the 40 pilot cities reached 2,576 yuan in 2022. This represents a 19.65% increase compared to 2020, a growth rate significantly outpacing that of total retail sales of consumer goods. These findings suggest that the pilot policy has yielded preliminary success in promoting sports consumption (Mingze Xu et al., 2024); however, the pathways and mechanisms through which it affects resident health require further empirical examination.

The initial cohort of 40 national sports consumption pilot cities was designated for a three-year pilot period (2020–2022). Geographically, these pilot cities exhibit a relatively balanced distribution, encompassing economically active and densely populated regions such as the Yangtze River Delta and the Chengdu-Chongqing economic circle (Fig. 1). The distribution of pilot cities and the complete list of pilot units are provided in Supplementary Figs. S1 and S2.

The development of these pilot cities holds significant practical implications, manifested in four key dimensions: cultivating new growth points for sports consumption, expanding the base of sports market entities, driving the transformation and upgrading of the sports industry, and unleashing the potential of resident demand for sports. The designation of these cities entitles them to coordinated support from the General Administration of Sport of China regarding policy and resources. Furthermore, local sports bureaus at the provincial, autonomous regional, and municipal levels are mandated to provide support through measures such as prioritizing the allocation of sports industry guidance funds and introducing major sporting events to these cities. Consequently, these cities offer an ideal quasi-natural experimental setting for investigating the impact of sports consumption on residents' physical and mental health. The list of pilot units is provided in Supplementary Fig. S2.

2.2 Literature Review and Research Hypotheses

2.2.1 Resident Sports Consumption and Physical and Mental Health

Sports consumption refers to the monetary expenditure incurred by individuals or households over a given period to satisfy diverse sport-related needs, including fitness participation, leisure and recreation, and the spectating of sporting events. As an important component of household consumption, it reflects not only the extent of engagement in sport and health-related lifestyles but also the broader market dynamism of the sports industry. From a theoretical perspective, Grossman's (1972) health capital model conceptualises health as a durable capital stock that can be accumulated through sustained investment. Individuals improve their health stock by allocating resources to health-producing activities, thereby enhancing both physical and mental health outcomes (Grossman, 1972a, 1972b).

Within this framework, the accumulation of health capital depends on continuous health investment, and sports consumption can be understood as a form of proactive health investment operating through multiple pathways. At the physiological level, sport-related expenditures promote participation in physical activity and structured exercise, which improve functional capacity, enhance physical fitness, and reduce the depreciation rate of health capital (Guo et al., 2023; Kinoshita et al., 2024). At the psychosocial level, sports participation and spectating provide opportunities for social interaction, stress reduction, and positive affective experiences. These processes are associated with higher levels of subjective well-being and lower risks of depression and anxiety (Li et al., 2021).

Taken together, both theoretical reasoning and existing empirical evidence suggest that sports consumption promotes the accumulation of health capital and encourages healthier behavioural patterns (Le et al., 2025), thereby exerting a positive effect on physical and mental health. Exploiting the National Sports Consumption Pilot City Policy as an exogenous policy shock, the following hypothesis is proposed:

H1: The *National Sports Consumption Pilot City Policy* improves residents' physical and mental health.

2.2.2 National Sports Consumption Pilot Policy and Residents' Sports Consumption

The National Sports Consumption Pilot City Policy promotes the expansion of sports consumption through several policy-driven channels, including the improvement of sport facility provision, the development of diversified consumption scenarios, and the introduction of targeted financial incentives. Existing research indicates that, building upon the construction of "15-minute fitness circles," pilot cities have established community multifunctional sports venues, intelligent fitness stations, and embedded sports parks. Data from 2023 demonstrates that per capita sports facility area in pilot cities is 28.6% higher than in non-pilot regions (Li et al., 2022).The policy-induced growth in sports consumption may further translate into higher levels of sport participation and more proactive health management behaviours. Through the accumulation of health capital, these behavioural changes are likely to generate improvements in both physical and mental health outcomes.

Accordingly, the following hypothesis is proposed:

H2: The *National Sports Consumption Pilot City Policy* improves residents' physical and mental health by increasing household sports consumption expenditure.

2.2.3 National Sports Consumption Pilot Policy and Residents' Exercise Frequency and Duration

The National Sports Consumption Pilot City Policy is expected to reduce the temporal and spatial costs of engaging in physical activity by optimising the spatial distribution of sport facilities, expanding the provision of fitness services, and fostering a supportive consumption environment for sport (Wang et al., 2024). Lower participation costs may, in turn, increase the frequency of physical activity and extend the duration of each exercise session among residents.

From the perspective of Grossman's health capital theory, sustained physical activity represents a central mechanism for the accumulation of health capital. Higher exercise frequency and longer activity duration contribute to improved physical fitness and physiological functioning (Zhigang et al., 2022), while also alleviating psychological stress, enhancing emotional regulation, and slowing the depreciation of health capital. Through these pathways, increased engagement in physical activity is likely to generate improvements in both physical and mental health.

Accordingly, the following hypothesis is proposed:

H3: The *National Sports Consumption Pilot City Policy* improves residents' physical and mental health by increasing the frequency and duration of physical activity.

2.2.4 National Sports Consumption Pilot Policy and the Number of Sports Enterprises

The *National Sports Consumption Pilot City Policy* may increase the number of sport-related enterprises through policy support and the agglomeration of local resources. As the primary providers of sport goods and services, a growing sport industry sector can expand the availability and diversity of sport and fitness services, optimise the local supply structure, and reduce barriers to accessing sport-related resources. At the same time, increased market competition among sport enterprises may improve service quality and affordability.

These supply-side changes are likely to encourage greater investment in health-enhancing activities and promote participation in physical activity, thereby contributing to the accumulation of health capital and improvements in both physical and mental health outcomes (Du and Yagihashi, 2017).

Accordingly, the following hypothesis is proposed:

H4: The *National Sports Consumption Pilot City Policy* improves residents' physical and mental health by increasing the number of sport-related enterprises.

3. Materials and methods

3.1 Data

The data used in this study are drawn from the China Family Panel Studies (CFPS), a nationally representative longitudinal survey conducted by the Institute of Social Science Survey at Peking University. The CFPS collects multidimensional information at the individual, household, and community levels and is designed to capture the dynamic changes in China's social, economic, demographic, educational, and health conditions. The baseline survey was launched in 2010 and covered 25 provinces, autonomous regions, and municipalities across mainland China. Follow-up surveys have been conducted biennially since then.

This study utilises seven waves of panel data spanning the period from 2010 to 2022. As the analysis focuses on adult health outcomes, the sample is restricted to respondents aged 16 years and above.

3.2 Variables

3.2.1 Dependent Variables

This study uses physical and mental health as the primary outcome variables.

Physical health is measured by respondents' self-rated health status, based on the question "How would you evaluate your current physical health?" Responses are recorded on a five-point scale ranging from 1 (very healthy) to 5 (unhealthy). Self-rated health in CFPS is widely used in the literature because it provides a comprehensive assessment of overall health status and has been shown to be a reliable predictor of morbidity and mortality (Li and Sun, 2022; Liao and Du, 2022).

Mental health is assessed using respondents' level of depressive symptoms. This measure is derived from the CES-D8 scale and is scored on a four-point Likert scale. The scale captures multiple dimensions of psychological well-being, including depressive affect, difficulty in performing daily activities, poor sleep quality, feelings of loneliness, life satisfaction, sadness, and psychomotor retardation. The CES-D8 has been extensively applied in population health research and demonstrates good reliability and validity (Guo et al., 2022; Wang et al., 2018).

Both health outcomes are coded so that higher values indicate better health. The original self-rated physical health item is reverse-coded as Physical Health, while the depressive symptom score is reverse-coded and shifted to a positive scale as Mental Health. This linear transformation removes negative health scores from descriptive tables and does not change the DID slope coefficients.

3.2.2 Independent Variables

The key explanatory variable in this study is a DID term constructed to capture the effect of the National Sports Consumption Pilot City Policy. The identification of the policy intervention is based on the official list of 40 pilot cities (Yu Shi et al., 2024). Cities designated as pilot cities are assigned to the treatment group, while non-pilot cities serve as the control group. Taking 2020 as the policy implementation year, a DID variable is constructed to estimate the policy effect.

3.2.3 Treatment assignment and geographic matching

Treatment assignment is based on the official list of the first batch of 40 National Sports Consumption Pilot City units. The list includes prefecture-level cities and a small number of district-level pilot units located within larger municipalities. Because the policy was assigned to administrative units rather than randomly to individuals, the treatment indicator is constructed by matching the pilot list to respondents' survey location in CFPS.

For prefecture-level pilot cities, respondents are assigned to the treatment group when their CFPS survey city matches the corresponding pilot city. For district-level pilot units, treatment is assigned only when the CFPS county/district identifier can be directly matched to the named pilot district. District-level pilots are not automatically generalized to the entire parent prefecture or municipality. This conservative matching rule reduces the risk of classifying non-treated residents as treated.

To evaluate the sensitivity of treatment assignment to geographic matching, the robustness workflow includes a specification excluding district-level pilot units. This check is designed to test whether the main estimates are driven by administrative units whose treatment boundary is narrower than the prefecture-level city used in some macro-level data sources. The corresponding coefficients should be reported as a geographic-matching sensitivity analysis when the empirical tables are re-estimated from the raw data.

3.2.4 Control Variables

Following previous CFPS-based studies on the determinants of health, this study controls for a range of covariates at the individual, household, and city levels.

At the individual level, demographic and socioeconomic characteristics that may influence health outcomes are included (Liu et al., 2022). These variables comprise age (continuous), gender (male = 1, female = 0), years of schooling (continuous; illiterate = 0, primary school = 6, junior high school = 9, senior high school = 12, college = 16, postgraduate and above = 19), hukou status (urban = 1, rural = 0).

At the household level, we control for household size to account for differences in household demographic structure. We do not include contemporaneous household income or household consumption expenditure in the preferred baseline specification because these variables may be affected by both policy exposure and subsequent changes in health status (Cao et al., 2022b; Chen et al., 2019).

At the city level, macro-contextual factors that have been shown to be associated with population health are included. These variables consist of the number of hospital beds per 10,000 people (Cao et al., 2022a) (log-transformed and winsorised at the 99th percentile), industrial sulfur dioxide (SO_2) emissions (Yuan et al., 2020) (log-transformed and winsorised at the 99th percentile), and gross domestic product (GDP)(Cao et al., 2022b) (log-transformed and winsorised at the 99th percentile).

To further account for potential confounding effects of the COVID-19 pandemic, we collected city-year-level pandemic-related information from official announcements and statistical bulletins released by municipal health commissions. Specifically, cumulative confirmed COVID-19 cases were obtained from daily or periodic epidemic reports published by each city's health commission. Lockdown days were manually coded based on official public-health emergency notices, mobility restriction announcements, and community containment policies issued by local health authorities. These variables were matched to CFPS respondents according to their survey city and survey year.

3.2.5 Pathway Variables

The pathway variables are used to examine the micro-level channels through which the policy may affect individual health outcomes. In line with the policy framework, four potential pathways are considered: expenditure on sports-related goods and services, frequency of physical activity, duration of each exercise session, and the number of sport-related enterprises.

Household expenditure on sports consumption (yuan per year) is measured using the survey question on total spending over the past 12 months on fitness activities and related products, including equipment and health supplements.

The frequency of physical activity is derived from the question “How often did you participate in sport and fitness activities in the past 12 months?” As the wording of this item changed across survey waves, the responses are standardised into the number of exercise sessions per month to ensure intertemporal comparability. The variable is coded into seven categories: 0 = no exercise; 1 = 0–10 times per month; 2 = 10–20 times; 3 = 20–30 times; 4 = 30–40 times; 5 = 40–50 times; and 6 = more than 50 times per month.

The duration of each exercise session (minutes) is based on the question on the average time spent per exercise session in the past 12 months. For the 2014, 2016, and 2018 waves, this measure is constructed by dividing the total weekly exercise time (converted into minutes) by the weekly exercise frequency. The resulting values are grouped into six categories: 0 = no exercise; 10 = 0–20 minutes; 30 = 20–40 minutes; 60 = 40–70 minutes; 80 = 70–90 minutes; 100 = 90–120 minutes; and 120 = more than 120 minutes.

The number of sport-related enterprises is measured as the annual number of newly established firms whose registered names contain the keyword “sport” in each CFPS survey city. These data are obtained from *Aiqicha*, an enterprise information platform operated by Baidu that provides comprehensive and up-to-date firm registration records. The observation period spans from 2008 to 2022. Additional diagnostics for the auxiliary machine-learning and interpretability procedures are provided in Supplementary Figs. S3-S6.

Variable definitions are reported in Table 1, and descriptive statistics are presented in Table 2.

Table 1 Defination of Variables

Variable Name	Variable Symbol	Variable Definition and Assignment Description
Mental Health	depression	Self-rated mental health status of individuals
Physical Health	physicalhealth	Self-rated physical health status of individuals
Pilot City	DID	DID = treat × post; treat takes 1 if it is the treatment group, otherwise 0; takes 1 if it is 2020 an
Sex	sex	1 = Male, 0 = Female
Years of Education	eduyears	0 = Illiterate/Semi-illiterate, 6 = Primary School, 9 = Junior High School, 12 = High School, 15 =
Family Size	familysize	The size of family
Place	urban	1 = Urban, 0 = Rural
Exercise Frequency per Month	exefreq	Grouped into six equal parts after converting the original exercise frequency to the number of
Exercise Duration per Session	exetime	Grouped into six equal parts based on the original single exercise duration (minutes), 0 = ≤1 n
Medical Service	Hospitalbeds_w_ave	99% winsorized number of beds per capita
Pollution	IndSO2emissions_w_ave	99% winsorized per capita sulfur dioxide emissions
Regional Development Status	GDP_w_ave	99% winsorized per capita GDP
Relative Health Status	relativehealth	Self-rated health status compared with one year ago (1 = Better, 3 = no change , 5 = Worse)
Others' Rated Health Status	observehealth	Investigator's evaluation of the respondent's health status (1 = Very Healthy, 7 = Very Unhealth

Table 2 Descriptive Statistics of Main Variables(N=170897)

	Mean	SD	Min	Max
Mental health	-14.92105	3.680327	-32	-11
Physical health	-3.71337	.8246495	-5	-1
relativehealth	3.353827	1.258853	1	5
observehealth	5.293844	1.169689	1	7
DID	.0227037	.1489577	0	1
age	47.08611	16.66425	16	110
familysize	4.281567	1.966882	1	26
eduyears	6.911268	4.943439	0	22
urban	.4641032	.4987112	0	1
exefreq	.982785	1.388284	0	6
exetime	19.96635	36.15171	0	120
population	654.2892	625.9033	31.33	3213.34
Hospitalbeds_w_ave	44.37607	13.66919	4.696434	137.8223
IndSO2emissions_w_ave	86.24779	99.43006	.5896835	643.432
GDP_w_ave	4.726941	3.151352	.5835771	19.69162
enterprises	120.0387	229.0825	1	2595

3.3 Models

Given the implementation of the first batch of National Sports Consumption Pilot City Policy across regions, a Difference-in-Differences (DID) model with high-dimensional fixed effects is employed to estimate its policy effect on residents' physical and mental health (Athey and Imbens, 2017). The baseline specification is as follows:

$$Y_{ct} = \alpha + \beta DID_{ct} + X_{ct}'\gamma + \mu_i + \delta_c + \lambda_t + \varepsilon_{ct} \quad (1)$$

In Eq. (1), Y_{ct} denotes the health outcome for individual i in city c and survey year t. The outcomes are Physical Health and Mental Health, both coded so that higher values indicate better health. Treatc equals 1 if city or district c is matched to a national sports consumption pilot unit, and 0 otherwise. Postt equals 1 for the post-policy survey waves 2020 and 2022, and 0 for pre-policy waves. DID_{ct} = Treatc × Postt is the treatment indicator, and β is the parameter of interest. X_{ct} is a vector of individual-, household-, and city-level controls. The terms μ_i, δ_c, and λ_t denote individual, city, and year fixed effects, respectively. Standard errors are clustered at the county level to account for within-area correlation. Because all first-batch pilot units were launched in 2020, the design is a single-adoption DID rather than a staggered DID; there is no variation in treatment timing across treated units.

Several features of the empirical design are intended to address the non-random selection of pilot cities. First, the model controls for individual, city, and year fixed effects, thereby absorbing time-invariant individual and local characteristics as well as common macro shocks. Second, standard errors are clustered at the county level to account for within-area correlation. Third, the validity of the DID design is assessed through an event-study specification, PSM-DID estimates, time placebo tests, alternative health outcomes, and additional controls for overlapping sport-venue policies and COVID-19 shocks. These analyses cannot make pilot designation equivalent to random assignment, but they reduce the likelihood that the main results are driven by observable selection, pre-existing trends, or contemporaneous shocks.

4. Results

4.1 Benchmark Regression Results

Table 3 reports the baseline estimates of the effects of the National Sports Consumption Pilot City Policy on residents' physical and mental health. To minimise potential bias arising from correlations among covariates, a stepwise specification is adopted, following previous studies (Nawaz et al., 2021), in which control variables are introduced sequentially.

Columns (1) and (3) present the results without additional covariates. The estimated coefficients on the policy variable are positive and statistically significant, indicating that the *National Sports Consumption Pilot City Policy* is associated with improvements in both physical and mental health outcomes.

Given that individual, household, and regional characteristics may also influence health, Columns (2) and (4) further include the full set of control variables at these levels. The estimated coefficients on the policy variable remain positive and statistically significant, and their magnitudes change only slightly, providing additional evidence for the robustness of the baseline findings.

Table 3 Baseline DID estimates

	(1)	(2)	(3)	(4)
VARIABLES	Physical health	Physical health	Mental health	Mental health
did	0.2668***	0.2642***	0.4424***	0.5153***
	(0.0284)	(0.0291)	(0.1076)	(0.1209)
age		0.0003		-0.0509
		(0.0096)		(0.0408)
urban		-0.0345		0.0548
		(0.0224)		(0.1376)
eduyears		0.0020		0.0248
		(0.0038)		(0.0160)
FamilySize		0.0013		0.0170
		(0.0031)		(0.0175)
Hospitalbeds_w_ave		0.0011		0.0073*
		(0.0008)		(0.0041)
IndSO2emissions_w_ave		-0.0000		0.0006
		(0.0001)		(0.0004)
GDP_w_ave		0.0085*		0.0167
		(0.0049)		(0.0290)
Constant	-3.7439***	-3.9167***	-15.0508***	-13.4008***
	(0.0008)	(0.5095)	(0.0030)	(2.0755)
Observations	89,313	85,585	93,470	87,569
R-squared	0.582	0.579	0.503	0.503
Individual Fixed Effects	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

4.2 Parallel trend test

The validity of the Difference-in-Differences approach relies on the assumption that the treatment and control groups follow parallel trends prior to the policy intervention. To examine this assumption, an event-study specification is estimated using the following model:

$$Y_{ct} = \alpha + \sum_{k \neq -1} \theta_k (Treat_c \times 1[t - 2020 = k]) + X_{ct}'\gamma + \mu_i + \delta_c + \lambda_t + \varepsilon_{ct} \quad (2)$$

In Eq. (2), k indexes survey waves relative to the policy year 2020. The interaction term Treatc × 1[t − 2020 = k] captures the difference between pilot and non-pilot areas in each relative period. The 2018 wave (k = −1) is omitted as the reference period. The coefficients θ_k for pre-policy periods are used to assess the parallel-trends assumption: if the treated and control groups followed similar pre-policy trends, these pre-policy coefficients should not be statistically different from zero. The model includes the same covariates, individual fixed effects, city fixed effects, year fixed effects, and clustered standard errors as the baseline specification.

As shown in Fig. 2, the estimated coefficients for the pre-policy periods are either negative or fluctuate around zero and are statistically insignificant, indicating that there is no systematic difference in pre-treatment trends between the treatment and control groups. This provides supporting evidence for the parallel trends assumption.

4.3 Propensity Score Matching DID

Table 4 reports the PSM-DID estimates based on three alternative matching procedures. The results show that the estimated policy effects remain positive and statistically significant across all specifications. Specifically, the coefficient for physical health ranges from 0.239 to 0.245, while the coefficient for mental health ranges from 0.490 to 0.503, all significant at the 1% level. These estimates are highly consistent across 1:4 nearest-neighbor matching, kernel

matching, and caliper matching, indicating that the baseline findings are not driven by observable differences between pilot and non-pilot cities. After improving covariate balance through propensity score matching and further controlling for individual, city, and year fixed effects, the National Sports Consumption Pilot City Policy continues to show a significant positive association with residents' physical and mental health. This provides additional evidence for the robustness of the DID estimates.

Table 4 PSM-DID robustness checks

Matching method	**Panel A**	**Panel B**	**Panel C**
	1:4 Nearest Neighbor Matching	**Kernel Matching**	**Caliper Matching**
Physical Health	0.239***	0.239***	0.245***
	(0.0295)	(0.0298)	(0.0305)
Mental Health	0.491***	0.490***	0.503***
	(0.1268)	(0.1271)	(0.1312)
Observations	76,219	71,542	69,871
Controls	Yes	Yes	Yes
Individual Fixed Effects	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

4.4 Placebo Test

To rule out the possibility that the estimated effects are driven by unobserved confounding factors, a series of placebo tests are conducted by assigning false policy implementation years based on the baseline specification. The results of the time placebo tests are reported in Table 5

The estimates are statistically insignificant across all placebo specifications, indicating that the observed improvement in physical health is not driven by time-varying unobserved confounders or spurious temporal trends. This finding further strengthens the quasi-experimental interpretation of the baseline DID estimates and provides additional evidence for the robustness of the main results.

Table 5 Time-placebo tests

Panel A Physical Health					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	**Physical Health**				
DID	0.2531***				
	(0.0273)				
DID_placebo_2012		0.0511			
		(0.0701)			
DID_placebo_2014			-0.0048		
			(0.0409)		
DID_placebo_2016				-0.0533	
				(0.0337)	
DID_placebo_2018					-0.0197
					(0.0482)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	78,464	59,310	59,310	59,310	59,310
R-squared	0.586	0.606	0.606	0.606	0.606
Individual Fixed Effects	Yes	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Panel B Mental Health					
	(1)	(2)	(3)	(4)	(5)
VARIABLES	**Mental Health**				
DID	0.4302***				
	(0.1260)				
DID_placebo_2012		0.0545			
		(0.2777)			
DID_placebo_2014			-0.0871		
			(0.2267)		
DID_placebo_2016				-0.0052	
				(0.1950)	
DID_placebo_2018					0.1707
					(0.2091)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	80,082	59,441	59,441	59,441	59,441
R-squared	0.512	0.533	0.533	0.533	0.533
Individual Fixed Effects	Yes	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

4.5 Alternative Measures of Dependent Variables

As an additional robustness check, alternative outcome measures are employed. Two substitute health indicators are considered. The first is self-assessed relative health, based on the question “Compared with one year ago, how would you rate your current physical health?” (1 = better; 3 = no change; 5 = worse).

For ease of interpretation, the responses are reverse-coded so that higher values indicate better health. The second is interviewer-rated health, derived from the interviewer's assessment of the respondent's overall health status.

Relative health and interviewer-rated health were reverse-coded before estimation; therefore, higher values in the regression analysis indicate better health.

The estimation results are reported in Table 6. The coefficients on the DID interaction term remain statistically significant across both alternative specifications, providing further evidence of the positive effect of the National Sports Consumption Pilot City Policy on residents' health and supporting the baseline findings.

It is worth noting that the statistical significance is somewhat weaker when interviewer-rated health is used as the dependent variable. A plausible explanation is the change in survey mode during the COVID-19 pandemic in 2020 and 2022, when a substantial share of the interviews was conducted by telephone rather than through face-to-face interviews. Telephone interviews may not fully capture respondents' observable health conditions, which could introduce measurement error (Zheng et al., 2023). The potential impact of the COVID-19 pandemic will be further examined in subsequent robustness checks.

Table 6 Alternative outcome measures

	(1)	(2)
VARIABLES	Relativehealth	Observehealth
DID	0.1092***	0.2243**
	(0.0266)	(0.1078)
Controls	Yes	Yes
Observations	136,196	136,196
R-squared	0.414	0.440
Individual Fixed Effects	Yes	Yes
Regional Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

Note: Values in parentheses are robust standard errors. *p < 0.1, p < 0.05, ***p < 0.01.

4.6 Policy Trend Adjustment

4.6.1 Free or low-cost access to large public sports venues

In 2018, the General Administration of Sport of China, in conjunction with the Ministry of Finance, introduced a series of policy documents to promote free or low-cost public access to large sports venues. These policies were supported by central government subsidies and aimed to improve the operational efficiency of sports venues and the provision of public sport services (Gao et al., 2022).

To account for potential confounding effects from concurrent policies and to alleviate identification concerns, an additional Difference-in-Differences variable capturing the post-2018 "free or low-cost venue access" policy (DID_B) is incorporated into the baseline specification. Columns (1) and (2) of Table 7 report the results using physical health and mental health as the outcome variables, respectively. After controlling for DID_B, the coefficient on the core policy variable (DID_A) remains consistent in sign, magnitude, and statistical significance with the baseline estimates, indicating that the positive effect of the National Sports Consumption Pilot City Policy on residents' health is statistically robust.

Table 7 Adjusting for overlapping venue-access policy

	(1)	(2)
VARIABLES	Physical Health	Mental Health
DID_A	0.2512***	0.5093***
	(0.0287)	(0.1222)
DID_B	0.0156	0.1037
	(0.0274)	(0.1359)
Controls	Yes	Yes
Observations	78,464	80,082
R-squared	0.586	0.512
Individual Fixed Effects	Yes	Yes
Regional Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

4.6.2 COVID-19 Pandemic

To address potential confounding effects of the COVID-19 pandemic, which coincided with the implementation of the National Sports Consumption Pilot City policy, we augment our baseline specification with four city-year level pandemic-related variables: cumulative confirmed cases per 10,000 people, annual cumulative and lockdown days. These variables respectively capture the direct health damage of the pandemic, restrictions on physical activity and consumption imposed by containment measures, indirect economic shocks to household income.

Table 8 Adjustment for COVID-19 shocks

	(1)	(2)
VARIABLES	**Physical Health**	**Mental Health**
DID	0.2389***	0.4872***
	(0.0291)	(0.1253)
covid_case	-0.0324**	-0.0876**
	(0.0142)	(0.0415)
lockdown_days	-0.0087***	-0.0215***
	(0.0021)	(0.0068)
Constant	-3.5872***	-13.7629***
	(0.5526)	(1.9214)
Observations	76,892	78,541
R-squared	0.591	0.518
Original Controls	Yes	Yes
Individual Fixed Effects	Yes	Yes
Regional Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

The table 8 show that the core findings remain stable. After controlling for COVID-19 related shocks, the estimated effect of the pilot policy on physical health decreases slightly from 0.2642*** to 0.2389***, and the effect on mental health decreases from 0.5135*** to 0.4872***. The estimates decline moderately but remain statistically significant at the 1% level. This provides additional evidence that the estimated policy effects are not fully explained by pandemic-related shocks.

Consistent with theoretical expectations, the coefficients on the COVID-19 variables all have the predicted signs. Higher cumulative confirmed cases, longer lockdown periods are associated with significantly worse physical and mental health outcomes. The coefficients on the original control variables remain stable in sign and statistical significance, further supporting the reliability of our model specification.

5. Heterogeneity Analysis

5.1 Age

Given the substantial differences between older adults (aged ≥65 years) and the working-age population (aged 15–64 years) in terms of capacity for sport participation, baseline health conditions, exposure to pandemic-related health risks, and responsiveness to policy interventions, the sample is stratified by age group.

The table 9 are reported in Columns (1)–(4) of Table 8. The policy effect is statistically significant for the working-age population but not for older adults. This pattern may reflect higher participation barriers and lower policy adaptability among older individuals, as well as their greater vulnerability to COVID-19-related hospitalisation. In contrast, working-age individuals generally have stronger physical capacity for sport participation and higher consumption willingness, which may allow the health benefits of the policy to be more fully realised.

Table 9 Age heterogeneity

	Panel A Physical health		**Panel B Mental health**	
	(1)	(2)	(3)	(4)
VARIABLES	Old	Adult	Old	Adult
DID	0.1343	0.2849***	0.1095	0.5789***
	(0.0878)	(0.0318)	(0.2884)	(0.1259)
Controls	Yes	Yes	Yes	Yes
Observations	16,088	59,704	12,654	64,737
R-squared	0.594	0.594	0.553	0.516
Individual Fixed Effects	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Note: Values in parentheses are robust standard errors. *p < 0.1, p < 0.05, ***p < 0.01.

5.2 Income

To examine income-related heterogeneity in the health effects of the National Sports Consumption Pilot City Policy, the sample is divided into high- and low-income groups based on the logarithm of household income. Individuals with log income above the sample mean (10.38446) are classified as the high-income group, while those below the mean constitute the low-income group. To avoid inferring group differences from within-group statistical significance, Table 9 reports the DID coefficient for the reference group and the formal between-group difference test.

Panel A of Table 9 shows that the between-group differences are not statistically significant for either Physical Health or Mental Health. Therefore, the evidence does not support a robust income gradient in the policy effect. Income-related patterns should be interpreted as suggestive and should be further verified through separate group regressions when the raw data are re-estimated.

5.3 Gender

To examine gender heterogeneity in the health effects of the policy, a triple-difference (DDD) model is estimated by introducing interaction terms with the gender indicator. As shown in Panel B of Table 9, Column (3), which uses physical health as the outcome variable, indicates that the policy has a statistically significant positive effect on women's physical health. The DDD interaction term further shows that the improvement in physical health is significantly larger for men than for women. This difference may be related to men's higher responsiveness to sport-related consumption environments and their greater capacity to translate policy-induced opportunities into actual participation in physical activity.

Column (4) focuses on mental health and shows that the policy significantly improves women's psychological well-being. However, the DDD interaction term does not reach statistical significance at the 10% level, indicating that the policy effect on mental health does not differ significantly between men and women.

Table10 Income and gender heterogeneity with between-group difference tests

	Panel A Income		Panel B Gender	
	(1)	(2)	(3)	(4)
VARIABLES	Physical Health	Mental Health	Physical Health	Mental Health
DID (reference group)	0.2617***	0.4765***	0.2800***	0.5941***
	(0.0299)	(0.1398)	(0.0420)	(0.1750)
Between-group difference	-0.0590	0.2058	0.1211**	0.0097
	(0.0592)	(0.2940)	(0.0561)	(0.2551)
Controls	Yes	Yes	Yes	Yes
Observations	78,464	80,082	78,464	80,082
R-squared	0.586	0.512	0.587	0.512
Individual Fixed Effects	Yes	Yes	Yes	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

6. Exploratory Pathway Analysis

The sports industry can be broadly defined as the set of economic activities that provide sport-related goods and services. According to the *Statistical Classification of the Sports Industry (2019)* issued by the National Bureau of Statistics of China (Order No. 26), the sector comprises 11 major categories. For analytical purposes, sport-related enterprises are classified into two groups: service-oriented firms that provide sport and fitness services, and firms engaged in the production and sale of sport consumption goods.

The policy explicitly emphasises the implementation of preferential measures to promote sport consumption and develop the sports industry, particularly in terms of land supply for sport use, access to financing, and support for small and medium-sized sport enterprises. Through these measures, the growth of sport service providers may increase residents' frequency and duration of physical activity, while the expansion of firms producing and selling sport-related goods may stimulate sport consumption expenditure. Both channels are expected to contribute to improvements in physical and mental health.

To examine the pathways through which the pilot policy may affect health outcomes, an exploratory pathway analysis is constructed based on Grossman's health investment theory and the hypothesised role of sport enterprises. Four pathway variables are included: the number of sport-related enterprises, sport consumption expenditure, exercise duration, and monthly exercise frequency. Because these variables are measured after policy exposure and may be jointly shaped by individual preferences and local conditions, the pathway analysis is interpreted as suggestive evidence rather than definitive causal pathway evidence.

To strengthen the temporal ordering of the exploratory pathway analysis, the number of sport-related enterprises is measured as a one-period lagged variable. Specifically, denotes the number of newly established sport-related enterprises in city prior to the survey year . This specification ensures that the supply-side sports environment precedes residents' contemporaneous sport consumption, exercise behaviour, and health outcomes, thereby reducing concerns about simultaneity in the exploratory pathway analysis.

Table 11 reports the exploratory pathway results for the effect of the policy on physical health through the sequence "number of sport enterprises → sport consumption expenditure / exercise frequency / exercise duration." The three-stage potential pathway is tested sequentially.

In the first stage, Column (2) shows that the coefficient on the DID term is positive and statistically significant at the 1% level, indicating that the policy significantly increases the number of sport-related enterprises. In the second stage, Columns (3), (5), and (7) demonstrate that the number of sport enterprises is positively associated with sport consumption expenditure, exercise frequency, and exercise duration, respectively, all at the 1% significance level. These results provide suggestive evidence of a link between the upstream supply-side environment and downstream health-related behaviours.

In the third stage, both the number of sport enterprises and the corresponding behavioural pathway variables are included simultaneously in the regression. Columns (4), (6), and (8) show that the three transmission paths remain statistically significant, pointing to partial pathway associations. This suggests that the pilot policy affects physical health through both direct effects and indirect behavioural and market-environment pathways.

To formally test the significance of the exploratory pathway effects and to address the limitation of the traditional stepwise approach, a bootstrap procedure with 5,000 replications is implemented to construct 95% confidence intervals. The results indicate that the estimated pathway proportion is 18.44% (95% CI = [0.012, 0.083]) for the pathway "policy → sport enterprises → sport consumption expenditure → physical health," 23.49% (95% CI = [0.021, 0.099]) for the pathway through exercise frequency, and 21.43% (95% CI = [0.018, 0.092]) for the pathway through exercise duration. None of the confidence intervals include zero, suggesting that all three exploratory pathway effects are statistically significant.

Table 11 Exploratory pathway analysis for Physical Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Physical Health	Lagged enterprises	SportExp	Physical Health	exefreq	Physical Health	exetime	Physical H
DID	0.2571***	3.3044***	134.2993***	0.2097***	0.5393***	0.1967***	3.8025*	0.2020***
	(0.0284)	(1.0353)	(38.5751)	(0.0300)	(0.1177)	(0.0293)	(2.2201)	(0.0293)
Lagged enterprises			13.8369***	0.0158***	0.0507***	0.0144***	0.7696***	0.0146***
			(3.5710)	(0.0044)	(0.0145)	(0.0041)	(0.1790)	(0.0042)
SportExp				0.0052***				
				0.0001				
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78,464	136,196	135,539	77,974	136,196	78,464	136,196	78,464
R-squared	0.586	0.535	0.426	0.589	0.453	0.588	0.454	0.588
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

From the perspective of the potential pathways for mental health, the results in Column (2) of Table 11 suggest that the first-stage association linking the policy to corporate investment in sport is stable and statistically significant. Columns (3), (5), and (7) show that when corporate sport investment is treated as the key explanatory variable, it is positively associated with sport consumption expenditure, exercise frequency, and exercise duration, all at the 1% significance level. These findings provide suggestive support for the sequential linkage between corporate sport investment and the three behavioural pathway variables, thereby offering an empirical basis for the exploratory pathway analysis.

In the third stage, corporate sport investment and the corresponding pathway variables are simultaneously included in the regression to assess their joint effects on residents' mental health. The estimates reported in Columns (4), (6), and (8) indicate that the three-stage potential pathway remains statistically significant, suggesting partial pathway associations. Taken together, these results indicate that the pilot policy influences mental health through both direct effects and indirect pathways operating via corporate sport investment and subsequent behavioural responses.

To formally test the statistical significance of the exploratory pathway effects for mental health, a bootstrap procedure with 5,000 replications is employed to construct 95% confidence intervals. The estimated pathway proportion of the total effect is 26.81% (95% CI = [0.042, 0.235]) for the pathway "policy → corporate sport investment → sport consumption expenditure → mental health." The pathway through exercise frequency accounts for the largest share of the total effect, at 30.76% (95% CI = [0.056, 0.260]), followed by the pathway through exercise duration, which accounts for 29.02% (95% CI = [0.051, 0.248]). None of the confidence intervals include zero, suggesting that all three exploratory pathway effects are statistically significant.

Table 12 Exploratory pathway analysis for Mental Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Mental Health	Lagged enterprises	SportExp	Mental Health	exefreq	Mental Health	exetime	Mental Health
DID	0.5137***	3.3044***	134.2993***	0.3760***	0.5393***	0.3557***	3.8025*	0.3646***
	(0.1243)	(1.0353)	(38.5751)	(0.1259)	(0.1177)	(0.1276)	(2.2201)	(0.1281)
Lagged enterprises			13.8369***	0.0156	0.0507***	0.0121	0.7696***	0.0128
			(3.5710)	(0.0113)	(0.0145)	(0.0105)	(0.1790)	(0.0105)
SportExp				0.0027***				
				(0.0000)				
exefreq						0.0267*		
						(0.0141)		
exetime								0.0011*
								(0.0006)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80,082	136,196	135,539	79,627	136,196	80,082	136,196	80,082
R-squared	0.512	0.535	0.426	0.512	0.453	0.512	0.454	0.512
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

7. Discussion

Drawing on Grossman's health capital framework, this study examined whether a sport-consumption-oriented urban policy can improve residents' physical and mental health. Using the National Sports Consumption Pilot City Policy as a quasi-natural experiment and CFPS data from 2010 to 2022, the results show that the pilot policy significantly improved both physical and mental health. These estimates remain stable after event-study tests, PSM-DID specifications, alternative health measures, controls for the free or low-cost access policy for large public sports venues, and additional adjustment for COVID-19-related city-year shocks. The findings therefore suggest that sports consumption policy should not be understood only as an industrial or demand-stimulus policy. It may also operate as a non-medical health promotion instrument that expands residents' opportunities to invest in health-producing activities.

This conclusion is consistent with the broader literature on sport, physical activity, and health. International evidence shows that adequate physical activity is associated with substantial physical and psychological health benefits (World Health Organization, 2020), while systematic review evidence suggests that sport participation can improve mental health and social outcomes among adults (Eather et al., 2023). In the Chinese context, Li et al. (2026) used CFPS data to show that sports participation improves residents' physical and mental health partly through social capital. Our study complements this evidence but differs in its object of explanation. Rather than asking whether individuals who participate in sport are healthier, we ask whether a government-led sport consumption policy can change the institutional and market environment in ways that generate population-level health gains. This distinction is important for interdisciplinary social science because it links individual well-being to social policy, market organisation, and everyday opportunities for active living.

The findings also extend Grossman's health capital theory. Sport consumption is not merely discretionary leisure spending; it can be interpreted as a form of health investment that combines time, goods, services, and behavioural effort. By improving facility provision, supporting sport-related enterprises, introducing consumption incentives, and diversifying sport services, the pilot policy may reduce the effective cost of health investment and increase the expected return to physical activity. This interpretation is consistent with evidence that physical inactivity imposes substantial health and economic burdens (Ding et al., 2017) and with the argument that physical activity promotion requires coordinated action beyond the health-care sector (Sallis et al., 2016; Salvo et al., 2021).

The exploratory pathway analysis helps clarify how the policy effect may be transmitted. The pilot policy increased the number of sport-related enterprises, and this supply-side expansion was associated with higher household sport expenditure, greater exercise frequency, and longer exercise duration. These pathways remained significant for both physical and mental health. The result indicates that the health effect of sports consumption policy does not depend only on individual motivation. It also depends on the local service environment in which residents make health-related choices. A richer sport-enterprise ecology can provide more diverse, accessible, and affordable opportunities for fitness, recreation, and organised activity, thereby lowering temporal, spatial, and informational barriers to participation. This evidence complements studies emphasising the role of public sport facilities and urban physical-activity environments in shaping participation behaviour (Gao et al., 2022; Westerbeek and Eime, 2021).

The heterogeneity results reveal the social boundaries of the policy effect. Health gains are more evident among working-age adults than among older adults. This differs from some individual-level evidence suggesting that older adults may benefit strongly from sport participation because of greater health needs and more discretionary time (Li et al., 2026). A plausible explanation is that potential benefit and policy responsiveness are not the same. Older adults may face higher barriers related to mobility, safety, chronic conditions, digital access, and adaptation to market-oriented sport services. Income heterogeneity points in a similar direction: the stronger physical-health gains among higher-income groups suggest that commercialised sport consumption may reproduce health inequalities when access to high-quality services depends on household resources (Richard et al., 2023). Gender differences are more nuanced. The policy improved women's physical and mental health, while the physical-health effect was larger among men and the mental-health effect did not differ significantly by gender. This suggests that men may translate sport-consumption opportunities more readily into physical activity intensity or duration, whereas the psychological benefits of a supportive sport environment may be more broadly shared.

These findings have several policy implications. First, urban sport consumption policy can be incorporated into a broader framework of preventive health governance rather than being evaluated solely by industry growth or consumption expansion. Second, supporting sport-related enterprises can be a legitimate component of public health strategy if market development is aligned with accessibility, affordability, and service quality. Third, the uneven effects across age and income groups call for a more inclusive policy design. Pilot cities should combine commercial sport consumption with public sport services, age-friendly fitness spaces, community-based guidance, and targeted subsidies for low-income residents. Finally, the mental-health effects suggest that sport consumption policy should be linked with social participation and community well-being agendas, not framed narrowly as consumer spending.

Two limitations should be acknowledged. First, the health outcomes are based mainly on self-reported CFPS measures, which may involve reporting bias, recall bias, and changes in survey mode during the pandemic. Although alternative health measures and COVID-19 controls support the robustness of the results, future research could combine survey data with objective indicators such as medical records, wearable-device data, or clinical assessments. Second, because the study focuses on China during 2010-2022, the external validity of the findings should be tested in other institutional contexts and over longer post-policy periods. Despite these limitations, the study shows that health is produced not only in clinics or through individual lifestyle choices, but also through the institutional and market environments that organise everyday opportunities for movement, consumption, and social participation.

Declarations

Data availability

In accordance with the official CFPS data use agreement, we, as data users, do not have the right to directly share the original data or the complete processed dataset with third parties. All researchers can register for free and apply to download public data that meet their research needs through the official CFPS website. The official data download link is: https://www.isss.pku.edu.cn/cfps/

Code availability

The analysis code is available.

Ethics approval and consent to participate

This study used anonymized secondary data. The original CFPS survey obtained ethical approval and informed consent from participants. No new human participants were recruited for this study.

Competing interests

The authors declare no competing interests.

Author Contribution

Author contributionsX.C.: Conceptualization, Data curation, Formal analysis, Methodology, Writing - original draft. Y.Q.: Conceptualization, Supervision, Writing - review and editing. L.S.: Literature review, Policy background analysis, Writing - review and editing. J.X.: Literature review, Data organization, Writing - review and editing. Z.C.: Methodology, Statistical analysis, Data validation, Writing - review and editing. All authors read and approved the final manuscript.

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Figures

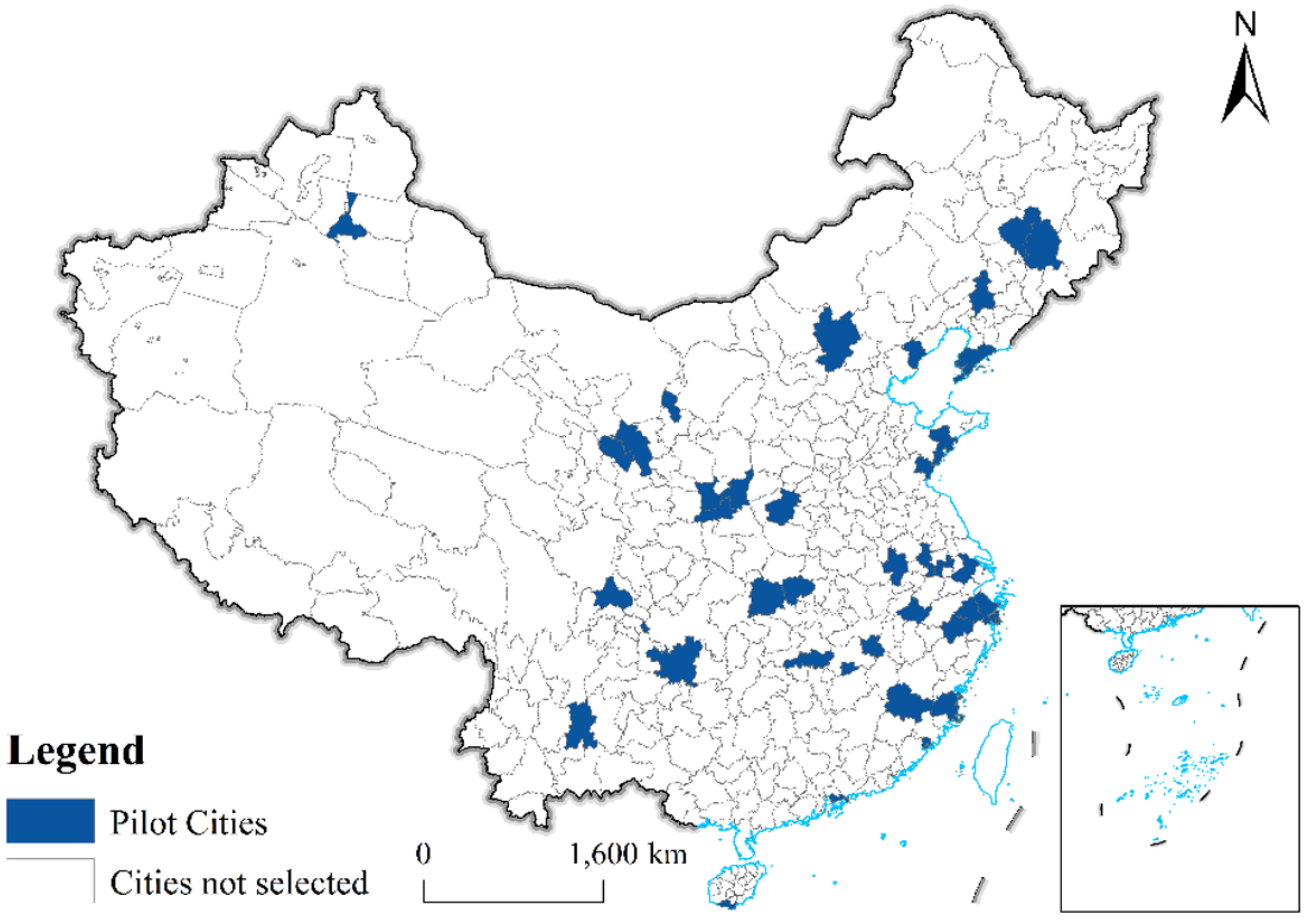


Figure 1

Distribution of National Pilot Cities for Sports Consumption

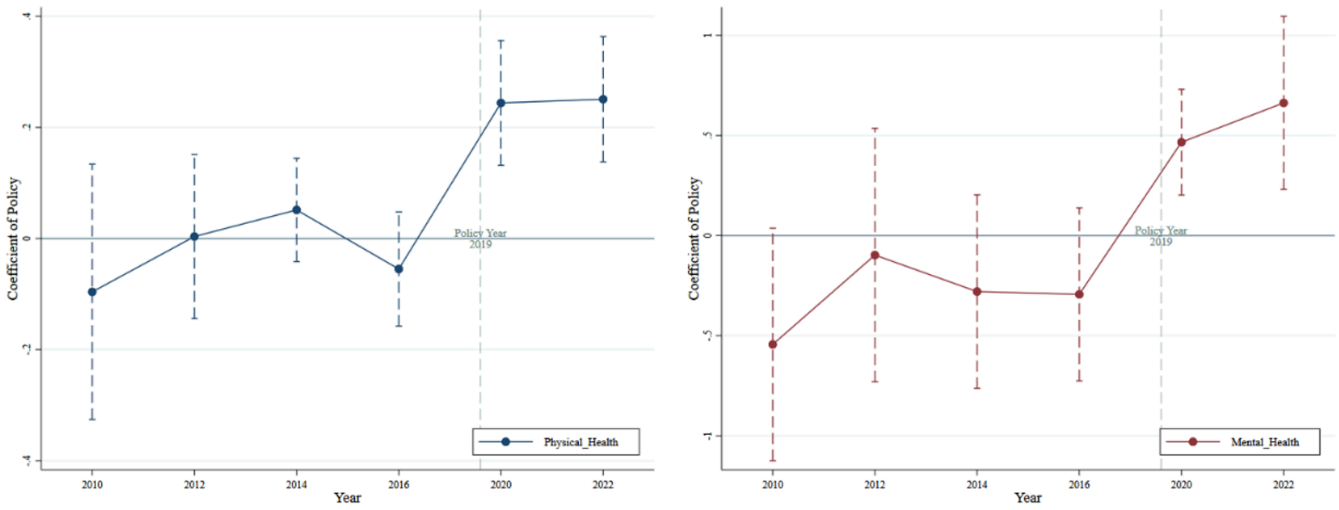


Figure 2

Parallel Trend Test of Physical Health(left) and Mental Health(right)

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryFigureS1PilotCityDistribution.png
- SupplementaryFigureS2PilotCityList.png
- SupplementaryFigureS3MLModelPerformance.png
- SupplementaryFigureS4KDEPredictionPerformance.png
- SupplementaryFigureS5SHAPFormula.jpeg
- SupplementaryFigureS6SHAPSummary.png