

## Article

# Promoting Physical Activity Through Sustainable Urban Green Spaces—An Empirical Investigation of Italian Habits

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## Abstract

This paper examines the relationship between urban green spaces and sport participation among Italian adults, using microdata from the Italian National Institute of Statistics (ISTAT) for the period 2014–2022. The analysis focuses on whether living within walking distance of equipped green areas is associated with individual physical activity behavior, as urban green infrastructure may represent a cornerstone of social and environmental sustainability and act as crucial determinants of active lifestyles and urban community well-being. Two binary indicators are constructed to identify individuals who practice sport either occasionally or regularly. Probit and logit regression models are used to estimate the association between access to public green spaces and sport participation, controlling for individual socio-demographic, economic and health characteristics, as well as geographical and time effects. The results reveal a statistically significant positive relationship between proximity to green spaces and physical activity. Average marginal effects indicate that living near a park increases the probability of practicing sport by 40.2 percentage points among occasional participants and by 27.3 percentage points among regular participants. These findings provide empirical evidence that accessible public green infrastructure plays a crucial role as an environmental determinant of healthier lifestyles. From a policy perspective, the results support the role of local governments in promoting physical activity through investments in accessible and well-designed urban green infrastructure, highlighting the prominent role of dedicated parks in promoting public health sustainability and inclusive urban planning frameworks.

**Keywords:** urban sustainability; green infrastructure; physical activity; sustainable public health; sport participation; egalitarian health equalizer; Italy



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## 1. Introduction

Repeated warnings issued by the World Health Organization (WHO) about the risks associated with sedentary lifestyles have had limited impact on individual behavior. In its most recent report, the WHO [1] estimates that approximately 1.8 billion adults worldwide are currently exposed to an increased risk of noncommunicable diseases (NCDs)—such as cardiovascular illness, stroke, cancer, diabetes, and chronic respiratory conditions—due to insufficient physical activity. Evidence from a pooled global study covering more than 5.7 million individuals across 197 countries confirms a persistent upward trend in physical inactivity among adults aged over 18 years. The global prevalence of insufficient physical activity increased from 23.4% in 2000 to 31.3% in 2022 [2], corroborating earlier findings [3]. If this trend continues, the WHO target of a 15% reduction in physical inactivity by 2030 is unlikely to be met in nearly half of the monitored countries and in two-thirds of world

regions [1]. Furthermore, systematic socio-demographic disparities persist: women are less physically active than men, inactivity increases with age, and higher prevalence rates are observed in high- and middle-income countries. These unfavorable trends have long been recognized by international organizations and national governments. As early as 2004, the World Health Assembly adopted a global strategy to address sedentary behavior as a key determinant of noncommunicable diseases, alongside unhealthy diets [4]. Subsequent monitoring reports [5,6] confirmed the structural persistence of physical inactivity worldwide, with approximately 23% of adults failing to meet the minimum recommended threshold of 150 min of moderate physical activity per week in 2010 [6]. More recent assessments continue to underline the limited effectiveness of current policies, emphasizing that the world remains off track to achieving the global reduction targets set for 2025 and 2030 [7–9].

In response, the WHO introduced the Global Action Plan on Physical Activity 2018–2030 (GAPPA), establishing a comprehensive policy framework aimed at promoting more active lifestyles through coordinated action across multiple sectors, including public health, transport, education and urban planning [10]. One of the Plan's central objectives is to foster "active environments" by improving access to safe, inclusive and high-quality public spaces where individuals of all ages and abilities can engage in physical activity. Action 2.4 explicitly calls for strengthening access to green spaces, recreational areas and sport facilities in urban and rural settings, highlighting urban design as a strategic lever in tackling sedentary behavior [10].

In this framework, the Italian context offers a particularly compelling case study for exploring the nexus between environmental attributes and health behaviors driven by physical activity due to two structural features. First, Italy displays a non-negligible public health challenge regarding physical inactivity, with sedentary rates remaining high compared to northern European standards [11–13]. Second, the country is characterized by deep geographical and structural heterogeneities in urban infrastructure; the endowment, maintenance, and per capita accessibility of public green spaces vary significantly across macro-regions, exhibiting a pronounced North–South gradient and sharp differences between historical city centers and peripheral metropolitan areas [14,15]. Investigating how proximity to urban parks correlates with different frequencies of sports participation within this fragmented landscape provides critical insights for targeted public investments and localized urban welfare policies.

In line with WHO recommendations, urban environments have gained increasing attention as determinants of health-related behavior. While a growing body of literature documents a positive association between the built environment and physical activity, evidence remains uneven across countries and contexts. Moreover, at the aggregate level, the effectiveness of urban design policies in reducing physical inactivity remains contested. This paper seeks to contribute to this debate by providing empirical evidence from Italy, using microdata to assess whether proximity to green spaces and recreational areas influences individual sport participation. Specifically, this study examines whether living close to equipped green spaces, such as public parks and gardens, is associated with a higher probability of engaging in sport-related activities. Using individual-level data from the Italian National Institute of Statistics (ISTAT) for the period 2014–2022, the analysis estimates probit and logit models to identify the effect of access to green infrastructure on two dimensions of sport participation: regular and occasional practice. In contrast with macro-level analyses that often fail to detect significant effects of urban investment on physical activity outcomes, the micro-level evidence presented here suggests that local government provision of green spaces plays a relevant role in shaping individual behavior. The contribution of this paper is twofold. First, it provides updated empirical evidence on sport participation in Italy using nationally representative microdata over a long span.

Second, it quantifies the marginal effect of proximity to green spaces on physical activity, offering policy-relevant insights into the potential role of urban planning tools in promoting healthier lifestyles.

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on physical activity and urban design. Section 3 describes the data and variables. Section 4 presents the econometric strategy and the results. Section 5 discusses the findings, while Section 6 concludes with policy implications, limitations and future research directions.

## 2. Sedentary Lifestyles, Physical Activity and Urban Design: The Theoretical Framework

Sedentary behavior is widely recognized as one of the major threats to physical and mental well-being in contemporary societies [16,17]. Physical inactivity is estimated to account for nearly 3.9 million premature deaths annually and represents one of the leading global risk factors for mortality [18]. In economic terms, the social cost of sedentary lifestyles is substantial, with direct health-care expenditures associated with physical inactivity projected to reach approximately USD 1.4 trillion worldwide between 2020 and 2030 [8]. These figures underscore the urgency of identifying mechanisms capable of promoting physical activity at the population level. Alongside their detrimental effects, the benefits of regular physical activity are well documented. Participation in sport improves individual physical health, reduces the burden of chronic disease, and enhances mental well-being [19]. Beyond individual benefits, sport generates positive externalities in terms of social cohesion, human capital formation, subjective well-being and happiness [20–28]. As a result, physical activity can be interpreted as a quasi-public good whose promotion constitutes a relevant policy objective [29]. However, despite widespread awareness of its benefits, participation rates remain persistently low, particularly among adult populations. This raises a central policy question: which instruments are most effective in encouraging individuals to adopt more active lifestyles? From an economic perspective, individual participation in sport can be analyzed through the lens of the theory of time allocation originally developed by Becker [30]. In this framework, physical activity is conceptualized as a productive activity that enters the individual utility function, subject to both time and income constraints. Individuals allocate time between labor, leisure and household production in order to maximize utility, and sport competes with alternative uses of time, such as paid employment and domestic responsibilities [31]. Becker's later work on social interactions [32] further extends this framework by emphasizing that individual behavior depends not only on personal characteristics, but also on the social environment [33]. Accordingly, sport participation may be shaped by social norms, peer effects and the accumulation of social capital [34,35]. This theoretical perspective implies that sport participation is determined by a combination of micro-level characteristics and macro-level contextual factors. Individual attributes such as age, gender, education, income and health conditions influence personal preferences and constraints, while broader structural conditions—such as the availability of sport facilities, transport systems and public spaces—affect the opportunity set faced by individuals [36]. Moreover, informational failures concerning the long-term health benefits of physical activity and the presence of positive externalities provide an economic rationale for public intervention. Policies designed to modify preferences and expand access to enabling environments may therefore play a key role in shaping behavior. Within this framework, the urban environment has emerged as a critical determinant of physical activity. Research increasingly highlights the influence of the built environment on individual lifestyle choices, particularly in relation to walkability, land-use patterns and access to recreational facilities [37,38]. Differences

in physical activity levels across countries and regions have been partly explained by variations in urban form and infrastructure provision [39]. Compact cities, mixed-use development and pedestrian-friendly design are generally associated with higher levels of physical activity, while car-oriented environments tend to reinforce sedentary behavior. A growing empirical literature specifically focuses on green spaces and public infrastructure as enabling factors for physical activity. The International Society for Physical Activity and Health (ISPAH) identified urban design as one of eight priority areas for policy intervention, advocating investments in proximity-based services, safe walking and cycling routes, and accessible recreational spaces [40]. Subsequent assessments confirm the effectiveness of such interventions. Milton et al. [41] report consistent evidence that access to green spaces is positively associated with physical activity among both adults and adolescents. Similarly, Bao et al. [42] document a significant relationship between urban parks and children's participation in physical activity in China. The quality and configuration of green spaces also appear to matter. Cohen et al. [43] show that the number and diversity of recreational amenities within parks are positively associated with both usage intensity and time spent in moderate-to-vigorous physical activity. Their findings suggest that design features may be as important as proximity in influencing individual behavior. Cross-national evidence from the International Physical activity and Environment Network (IPEN) further confirms that park density is one of the urban attributes most strongly associated with physical activity [40]. Finally, a related strand of literature examines the role of public spending and municipal provision of recreational services. Humphreys and Ruseski [44], building on earlier work by French et al. [45], analyze the relationship between government expenditure on parks and recreational facilities and physical activity behavior in the United States. Their results indicate that public investment is positively associated with participation in outdoor leisure activities, although the magnitude of the effect varies by type of sport. At the municipal level, recent studies also emphasize the relevance of local service provision in shaping social outcomes more broadly [46–49].

In line with this literature, the present study focuses on the role of urban green spaces as a policy-relevant determinant of sport participation. The central hypothesis is that proximity to parks and equipped green areas lowers the implicit cost of physical activity, thereby increasing participation probabilities. Unlike competitive sport, the activities examined here fall within the domain of “sport for all,” encompassing leisure-time physical practices that are socially inclusive and accessible across age groups and income levels [50]. This community-oriented dimension makes green-space provision a particularly relevant domain of public action. By examining micro-level evidence from Italy, this paper contributes to the literature in two respects. First, it extends the empirical base to a national context that remains underexplored in international studies. Second, it provides quantitative estimates of the behavioral impact of urban design, supporting a policy narrative in which spatial planning is not merely aesthetic, but also a determinant of population health.

### 3. Data and Variables

This study uses individual-level data drawn from the Aspects of Daily Life in Italy survey (*Aspetti della Vita Quotidiana*), conducted annually by the Italian National Institute of Statistics [51]. The survey is part of ISTAT's multipurpose household survey system and provides detailed information on living conditions, labor status, health, education and lifestyle behaviors for a nationally representative sample of Italian households. Approximately 25,000 households located across around 800 municipalities are interviewed each year, making the dataset particularly suitable for analyzing behavioral patterns at the population level. The analysis covers the period from 2014 to 2022 and focuses on adult individuals aged between 20 and 60 years. The initial dataset consists

of 172,842 households, corresponding to 402,972 individuals, with an annual average of approximately 44,800 respondents from 19,200 households. Following standard practice in the literature on sport participation [52,53], the empirical specification includes a set of controls capturing individual socio-demographic characteristics, economic conditions and health status, as well as geographic and time effects. To ensure full transparency and reproducibility, the dependent and primary independent variables were constructed using the exact microdata from the ISTAT 'Aspects of Daily Life' survey. Specifically, individual physical activity habits over the previous 12 months were derived from two distinct questions:

- a. "Nel tempo libero pratica con carattere di continuità uno o più sport?"—In your free time, do you practice one or more sports continuously?
- b. "Nel tempo libero pratica saltuariamente uno o più sport?"—In your free time, do you practice one or more sports occasionally?

Following this framework, two binary dependent variables were operationalized to capture alternative dimensions of sports participation and account for heterogeneity in behavioral intensity. The first indicator, *Occasional Sport*, takes the value of 1 if the individual reports practicing sports only occasionally or intermittently during specific seasons, and 0 otherwise. The second indicator, *Continuous Sport*, equals 1 when the individual reports practicing one or more sports regularly and continuously throughout the year, and 0 otherwise. This operational layout allows for a clear differentiation between structural, high-commitment health habits and sporadic or seasonal recreational activities. Moreover, the main independent variable capturing urban green accessibility was constructed based on the following survey question:

- c. "Nella zona in cui abita la famiglia ci sono parchi, giardini o altro verde pubblico raggiungibile a piedi in meno di 15 minuti?"—In the area where your family lives, are there parks, gardens, or other public green spaces that can be reached on foot in less than 15 min?

Consequently, the variable *Park* is treated as a dummy indicator taking the value of 1 if the respondent reports close access to public green infrastructure, and 0 otherwise.

A range of individual covariates commonly used in the literature are included in the analysis. Gender is measured through a dummy variable identifying female respondents, with males as the reference group. To capture potential non-linear life-cycle dynamics in physical habits, individual age is included in the econometric models as a set of categorical indicators based on the official ISTAT microdata classification. Specifically, the sample is structured into consecutive age cohorts (20–24, 25–34, 35–44, 45–54, 55–59) with the youngest bracket serving as the baseline reference category in the regressions. This categorical layout prevents the loss of granular information that would occur by treating age linearly, and accounts for structural shifts in sports participation across different stages of life. Marital status is captured through three binary indicators identifying married or cohabiting individuals, those who are divorced or legally separated, and widowed individuals, with single respondents as the reference group. Educational attainment is operationalized through four categories: primary education or no formal qualification (baseline category), lower secondary education, upper secondary education, and tertiary education. Labor market status is measured by three mutually exclusive categories: employed (reference group), unemployed job seekers, and inactive individuals not participating in the labor force. Economic conditions are captured through a self-reported indicator distinguishing respondents who evaluate their household economic resources as insufficient or very insufficient from those reporting sufficient or good conditions. Health status is controlled for

using a binary indicator identifying individuals who report having health limitations, with those declaring no limitations as the comparison group.

Regarding spatial and geographical controls, it is worth noting a structural feature of the dataset. To strictly comply with data protection laws and guarantee statistical confidentiality, the public-use microdata from the ISTAT ‘Aspects of Daily Life’ survey restrict geographical identifiers exclusively to the macro-regional level (North-West, North-East, Centre, South, and Islands). Finer administrative indicators, such as municipality size, degree of urbanization, or neighborhood-level variables, are omitted in the public release to prevent any potential re-identification of respondents.

For this reason, limited geographical controls are introduced to account for spatial heterogeneity across Italian macro-regions. Four broad areas are considered: North-West, North-East, Centre and South, with the Islands serving as the baseline category. Year fixed effects are also included to control for time-specific shocks and structural changes affecting sport participation over the observation period. The reference year is 2022. The key variable of interest captures exposure to green infrastructure. A binary variable (*Park*) is constructed to indicate whether the respondent reports living within approximately 15 min walking distance of a park, public garden or other publicly accessible green area. This indicator serves as a proxy for access to urban green spaces and captures a spatial feature influenced by municipal planning decisions and local public investment.

This operationalization is consistent with international guidelines issued by the World Health Organization, which identify proximity to recreational spaces as a key factor in enabling physical activity [54], and with previous empirical studies that use distance-based measures to operationalize environmental exposure [38,41].

Summary statistics for all variables included in the analysis are reported in Table 1. These provide an overview of the distribution of sport participation across socio-demographic groups and illustrate the prevalence of access to green spaces across the population.

**Table 1.** Summary Statistics of variables.

Variables	Mean	Std. Dev.	Min	Max	Obs
<i>Occasional Sport</i>	0.346	0.476	0	1	392,881
<i>Continuous Sport</i>	0.250	0.433	0	1	393,726
<b>Gender</b>					
<i>female</i>	0.518	0.500	0	1	208,638
<i>male</i>	0.482	0.500	0	1	194,334
<b>Civil status</b>					
<i>single</i>	0.374	0.484	0	1	142,858
<i>married/cohabitant</i>	0.462	0.499	0	1	176,720
<i>separate/divorced</i>	0.076	0.264	0	1	28,901
<i>widow</i>	0.089	0.284	0	1	33,838
<b>Age</b>					
<i>age cluster (range)</i>					205,369
8: (20–24)					19,272
9: (25–34)					38,948
10: (35–44)					52,237
11: (45–54)					64,567
12: (55–59)					30,345
<b>Education</b>					
<i>Elementary license or no degree</i>	0.238	0.426	0	1	90,671
<i>Middle School diploma</i>	0.287	0.452	0	1	109,273

Table 1. Cont.

Variables	Mean	Std. Dev.	Min	Max	Obs
<b>Education</b>					
High School diploma	0.339	0.473	0	1	129,181
College Degree or higher	0.135	0.342	0	1	51,499
<b>Economic Resources</b>					
Economic Resources: Adequate	0.628	0.483	0	1	252,005
Economic Resources: Inadequate	0.372	0.483	0	1	149,495
<b>Job Position</b>					
Employed	0.414	0.493	0	1	145,886
Job Seekers	0.101	0.302	0	1	35,750
Inactive	0.485	0.500	0	1	170,789
<b>Geographic</b>					
northwest	0.217	0.412	0	1	87,268
northeast	0.210	0.407	0	1	84,367
central	0.184	0.387	0	1	73,889
south	0.286	0.452	0	1	115,292
islands	0.103	0.305	0	1	41,626
<b>Time</b>					
year_2014	0.112	0.315	0	1	44,974
year_2015	0.112	0.316	0	1	45,204
year_2016	0.108	0.310	0	1	43,360
year_2017	0.121	0.326	0	1	48,855
year_2018	0.111	0.314	0	1	44,672
year_2019	0.113	0.316	0	1	45,483
year_2020	0.106	0.308	0	1	42,805
year_2021	0.113	0.317	0	1	45,597
year_2022	0.104	0.306	0	1	42,022
<b>Policy Control Variables</b>					
Parks	0.742	0.438	0	1	402,028

Source: [51].

#### 4. Estimation Strategy, Models and Results

The estimation strategy employs Probit and Logit models for binary dependent variables, represented by the following equation:

$$Pr(Y_i = 1 | X_j, Z_k) = 1 - F(-X_j'\beta - Z_k'\gamma), i = 1, 2; j = 1, 2, \dots, n \quad (1)$$

where  $Y_i$  denotes the dependent variable,  $X_j$  and  $Z_k$  represent vectors of  $n$  control variables and the  $k$ -th policy variable, respectively, and  $F(\cdot)$  is the standard normal cumulative distribution function for the Probit model and the logistic function for the Logit model. Given that the dependent variables take values of 0 or 1, the expected value of  $Y_i$  corresponds to the probability that  $Y_i = 1$ , allowing a conventional interpretation of the binary specification in terms of the conditional mean. Accordingly, Equation (1) can be expressed in regression form as:

$$Y_i = 1 - F(-X_j'\beta - Z_k'\gamma) + \varepsilon_i + \delta_t \quad (2)$$

where  $\varepsilon_i$  represents the deviation of the binary outcome from its conditional mean. To account for potential structural breaks and time-varying macroeconomic or social shocks—most notably the disruptions caused by the COVID-19 pandemic during 2020—we include a full set of year fixed effects  $\delta_t$  in all model specifications. This ensures that our estimates are net of annual nationwide shifts in physical activity habits. All models incorporate ISTAT

sampling weights to ensure representativeness. Robust standard errors are calculated via the Huber-White estimator; due to statistical confidentiality restrictions in the public micro-data, finer clustering identifiers (e.g., municipality or household IDs) were unavailable.

Two Probit (PBT) and two Logit (LGT) models are estimated (all estimates were calculated using STATA 18 software) and coded as 1 and 2. In Model 1, the dependent variable identifies respondents who engage in sport “at least occasionally,” while in Model 2, it identifies respondents who practice sport “continuously.” Models are further distinguished as A and B: Models A are estimated without the policy variable (Park), whereas Models B include it. All models incorporate fixed effects for geographic and temporal factors; for brevity, results for secondary variables are omitted. Table 2 reports the estimation results, with coefficients shown for the Probit models and odds ratios for the Logit models.

Specifically, the Logit models show that living near public green spaces significantly increases the odds of sport participation. For individuals living near parks, the odds of practicing sport continuously are 24.9% higher (OR = 1.249,  $p < 0.001$ ) compared to those without close access, while the odds of engaging in sport at least occasionally increase by 34.2% (OR = 1.342,  $p < 0.001$ ), *ceteris paribus*.

**Table 2.** Probit and Logit models.

Dependent Variable: Sport Practice Adult People (20–60). 2014–2022								
Model	PROBIT				LOGIT			
	Occasional Sport		Continuous Sport		Occasional Sport		Continuous Sport	
Groups and Variables	PBT_1_A Coeff.	PBT_1_B Coeff.	PBT_2_A Coeff.	PBT_2_B Coeff.	LGT_1_A Odds Ratio	LGT_1_B Odds Ratio	LGT_2_A Odds Ratio	LGT_2_B Odds Ratio
<b>Gender</b> (omitted group: <i>Males</i> )								
<i>Female</i>	−0.339 *** (0.008)	−0.341 *** (0.008)	−0.297 *** (0.008)	−0.298 *** (0.008)	0.570 *** (0.000)	0.568 *** (0.000)	0.603 *** (0.008)	0.602 *** (0.008)
<b>Age</b> (omitted group: 20–24)								
<i>Age 25–34</i>	−0.212 *** (0.015)	−0.209 *** (0.015)	−0.178 *** (0.015)	−0.176 *** (0.015)	0.708 *** (0.000)	0.711 *** (0.000)	0.746 *** (0.018)	0.750 *** (0.018)
<i>Age 35–44</i>	−0.333 *** (0.015)	−0.332 *** (0.015)	−0.300 *** (0.157)	−0.299 *** (0.016)	0.580 *** (0.000)	0.581 *** (0.000)	0.608 *** (0.016)	0.609 *** (0.016)
<i>Age 45–54</i>	−0.356 *** (0.016)	−0.356 *** (0.016)	−0.322 *** (0.016)	−0.322 *** (0.016)	0.558 *** (0.000)	0.558 *** (0.000)	0.583 *** (0.016)	0.583 *** (0.016)
<i>Age 55–59</i>	−0.446 *** (0.018)	−0.446 *** (0.018)	−0.399 *** (0.018)	−0.398 *** (0.018)	0.478 *** (0.000)	0.479 *** (0.000)	0.509 *** (0.016)	0.510 *** (0.016)
<b>Civil Status</b> [omitted group: single ( <i>never married</i> )]								
<i>Married or Cohabiting</i>	−0.238 *** (0.009)	−0.240 *** (0.009)	−0.235 *** (0.009)	−0.237 *** (0.010)	0.674 *** (0.000)	0.672 *** (0.000)	0.669 *** (0.011)	0.667 *** (0.011)
<i>Separated legally or Divorced</i>	−0.082 *** (0.014)	−0.082 *** (0.014)	−0.061 (0.014)	−0.060 *** (0.014)	0.875 *** (0.000)	0.876 *** (0.000)	0.906 *** (0.022)	0.907 *** (0.022)
<i>Widowed</i>	−0.186 *** (0.035)	−0.185 *** (0.035)	−0.253 *** (0.039)	−0.253 *** (0.039)	0.735 *** (0.000)	0.735 *** (0.000)	0.645 *** (0.046)	0.645 *** (0.046)
<b>Education</b> (omitted group: <i>elementary school license or no degree</i> )								
<i>Middle School</i>	0.469 *** (0.028)	0.463 *** (0.028)	0.433 *** (0.031)	0.428 *** (0.031)	2.413 *** (0.000)	2.384 *** (0.000)	2.424 *** (0.158)	2.398 *** (0.156)
<i>Secondary</i>	0.934 *** (0.027)	0.923 *** (0.027)	0.843 *** (0.031)	0.834 *** (0.031)	5.243 *** (0.000)	5.136 *** (0.000)	4.958 *** (0.319)	4.869 *** (0.313)
<i>Degree or more</i>	1.269 *** (0.028)	1.253 *** (0.028)	1.111 *** (0.032)	1.098 *** (0.032)	9.020 *** (0.000)	8.770 *** (0.000)	7.710 *** (0.503)	7.530 *** (0.491)
<b>Professional Condition</b> (omitted group: <i>employed</i> )								
<i>Job seekers</i>	−0.086 *** (0.011)	−0.084 *** (0.011)	−0.079 *** (0.012)	−0.077 *** (0.012)	0.864 *** (0.000)	0.867 *** (0.000)	0.870 *** (0.018)	0.873 *** (0.018)
<i>Inactive</i>	−0.057 *** (0.011)	−0.054 *** (0.011)	−0.031 ** (0.011)	−0.029 ** (0.011)	0.907 *** (0.000)	0.912 *** (0.000)	0.944 *** (0.018)	0.947 *** (0.018)

Table 2. Cont.

Dependent Variable: Sport Practice Adult People (20–60). 2014–2022								
<b>Economic Resources</b> (omitted group: <i>good or at least adequate economic resources</i> )								
<i>Inadequate or totally insufficient economic resources</i>	0.208 *** (0.008)	0.205 *** (0.008)	0.198 *** (0.008)	0.195 *** (0.008)	1.409 *** (0.000)	1.402 *** (0.000)	1.397 *** (0.020)	1.392 *** (0.020)
<b>Health Conditions</b> (omitted group: <i>no health limitation</i> )								
<i>Serious or non-serious health limitation</i>	−0.070 *** (0.010)	−0.072 *** (0.010)	−0.094 *** (0.012)	−0.095 *** (0.011)	0.888 *** (0.000)	0.886 *** (0.000)	0.848 *** (0.017)	0.847 *** (0.017)
<b>Geographical origin</b> (omitted group: <i>Islands</i> )								
<i>North-West</i>	0.313 *** (0.013)	0.248 *** (0.014)	0.224 *** (0.014)	0.177 *** (0.014)	1.674 *** (0.000)	1.504 *** (0.000)	1.459 *** (0.035)	1.346 *** (0.033)
<i>North-East</i>	0.365 *** (0.013)	0.304 *** (0.014)	0.249 *** (0.014)	0.205 *** (0.014)	1.820 *** (0.000)	1.647 *** (0.000)	1.517 *** (0.037)	1.406 *** (0.035)
<i>Centre</i>	0.186 *** (0.014)	0.137 *** (0.014)	0.165 *** (0.014)	0.129 *** (0.014)	1.358 *** (0.000)	1.254 *** (0.000)	1.322 *** (0.033)	1.245 *** (0.031)
<i>South</i>	−0.098 *** (0.013)	−0.110 *** (0.013)	−0.096 ** (0.041)	−0.104 *** (0.014)	0.850 *** (0.000)	0.833 *** (0.000)	0.849 *** (0.020)	0.837 *** (0.020)
<b>Time controls</b> ( <i>year 2022 baseline</i> )	yes	yes	yes	yes	yes	yes	yes	yes
<b>Policy Control Variables</b>								
<i>Parks, Gardens, Public Greenery (within a 15 min walk)</i>		0.179 *** (0.009)		0.132 *** (0.009)		1.342 *** (0.020)		1.249 *** (0.021)
Constant	−0.862 *** (0.032)	−0.950 *** (0.035)	−1.106 *** (0.037)	−1.172 *** (0.038)	0.216 *** (0.000)	0.188 *** (0.000)	0.133 *** (0.010)	0.120 *** (0.009)
<i>Pseudo R<sup>2</sup></i>	0.107	0.109	0.085	0.087	0.107	0.109	0.085	0.085
Wald $\chi^2$	17,274.9	17,492.3	12,165.1	12,265.0	15,823.3	16,031.7	11,458.0	11,570.4
Prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Obs	187,464	187,185	187,822	187,534	187,464	187,185	187,822	187,534

Robust standard errors in parentheses. Sampling weights applied. \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

To provide a straightforward interpretation for policy purposes and isolate the practical difference between the two scenarios, the average predicted probabilities are evaluated by holding the park proximity indicator at its counterfactual values ( $Park = 0$  versus  $Park = 1$ ). The results from the Marginal Effects estimation reveal a substantial public health premium: living within a 15 min walk from a public green space ( $Park = 1$ ) increases the absolute predicted probability of practicing occasional physical activity by 40.2 percentage points compared to the baseline scenario of absence or inaccessibility ( $Park = 0$ ). For continuous sports participation, the shift from  $Park = 0$  to  $Park = 1$  yields a robust increase of 27.3 percentage points in the predicted probability. These figures underscore the powerful role of urban green networks as active facilitators of community health behaviors.

Regarding other covariates, the results align with existing empirical evidence. Females engage in sport less frequently than males, and sport participation declines with age: compared to the reference group (ages 20–24), participation roughly halves for the 55–59 age group, particularly for occasional sport. Marital status also plays a role, with singles exhibiting a higher likelihood of engaging in sport than other groups, particularly widows. Education positively influences an active lifestyle: individuals with secondary or lower education levels are more than twice as likely to practice sport, rising to nearly five times for those with a diploma and approximately nine times for those with a university degree, and employment status is positively associated with sport participation. Intriguingly, the econometric estimates reveal a positive and statistically significant link between individuals reporting scarce economic resources and the probability of practicing

sports. While counterintuitive at first glance, this finding can be robustly explained through the economic theory of time allocation and the substitution effect of public goods. First, individuals facing tighter budget constraints face higher barriers to accessing costly private indoor fitness facilities; thus, they structurally substitute private sports with free public alternatives, such as running or walking in urban green spaces. This highlights the crucial role of public parks as socio-economic equalizers for community health. Second, lower economic resources (often tied to underemployment, part-time regimes, or student status) lower the opportunity cost of time, leaving individuals with more unallocated hours to dedicate to physical well-being. Finally, this pattern is heavily influenced by a demographic cohort effect, as a substantial share of low-income respondents in the ISTAT sample is composed of young adults and students, who naturally display a high baseline propensity for physical activity despite their temporary budget constraints.

Health limitations negatively affect sport engagement. Geographically, residents in northern and central Italy are more active than those in the reference area (Islands), whereas the South exhibits lower participation rates. Furthermore, given that our temporal horizon (2014–2022) encompasses the COVID-19 pandemic, a potential methodological concern is whether this unprecedented structural shock distorted the observed relationship between park proximity and physical activity. In our empirical setup, the inclusion of individual Year Fixed Effects structurally accounts for and isolates year-specific, country-wide macro-shocks, such as the 2020/2021 containment measures, mobility restrictions, and indoor sports facility closures. The fact that the park proximity coefficient remains highly stable, positive, and statistically significant across the entire multi-year span indicates that the supportive role of urban green infrastructure represents a resilient, long-term determinant of public health rather than a temporary anomaly driven by the pandemic crisis. While spatial proximity represents a fundamental structural prerequisite for reducing barriers to physical activity, the literature on landscape architecture and urban planning emphasizes that proximity alone may not suffice if not paired with high environmental quality. Features such as the inner functional design, aesthetic maintenance, perceived safety (e.g., adequate public lighting), and the diversity of recreational layouts significantly modulate behavioral patterns. For instance, the presence of dedicated jogging paths, open-air fitness equipment, and well-segregated pedestrian zones actively promotes continuous and structured sports participation, whereas poorly maintained or unsafe green spaces might discourage long-term engagement. Although the present study relies on a binary nationwide proxy for green accessibility, integrating these qualitative dimensions is essential. Landscape design principles should therefore be viewed as active health policy instruments, where the architectural layout and functional composition of urban parks serve as structural catalysts to maximize the public health returns of green infrastructure.

## 5. Policy and Urban Planning Implications

The empirical findings of this study provide crucial insights for urban planners and local policymakers aiming to promote active lifestyles and public health. Our econometric results demonstrate that proximity to urban green spaces (accessible within a 15 min walk) is a powerful structural determinant of physical activity, significantly increasing both occasional and continuous sports participation. Therefore, urban planning should move beyond the mere quantitative provision of green surfaces per capita, shifting the focus toward spatial accessibility, connectivity, and micro-design. To translate these results into actionable urban policies, we suggest three priority axes:

- a. *The 15-Minute City framework.* Urban regeneration strategies should adopt the 15 min city model, ensuring that public green spaces are homogeneously distributed across the urban fabric. Priority should be given to peripheral or disadvantaged neigh-

borhoods characterized by green deserts, where the lack of accessible parks acts as a structural barrier to physical activity. Prominent empirical examples of this strategy are increasingly emerging across the Italian urban landscape, reflecting a shared policy effort across different macro-regions. Recent literature underscores how multi-level urban regeneration projects—ranging from tactical urbanism and pedestrianization protocols in Milan [55] to strategic green infrastructure renewals in Rome [56] and multifunctional sport park rehabilitations in Reggio Calabria [57] and Turin [58]—are also designed to eliminate spatial barriers, improving sport participation. These nationwide interventions demonstrate how localized spatial micro-designs and the recovery of public areas can effectively enhance walking-distance accessibility, serving as structural catalysts to foster active community lifestyles and support public health.

- b. *Pedestrian Connectivity and Green Corridors.* Proximity is ineffective if walking paths are unsafe or fragmented. Planners must design continuous pedestrian networks, traffic-calming zones, and green corridors that connect residential areas directly to public parks. Transforming simple sidewalks into shaded, attractive “active travel veins” can significantly lower the cognitive and physical friction of reaching green areas.
- c. *Multifunctional Green Infrastructure.* To maximize the return on public investments, urban parks must be designed as multi-generational and multifunctional spaces. This includes incorporating low-impact sports facilities (e.g., outdoor fitness equipment, jogging loops, cycling paths) alongside natural areas. Such integration allows green spaces to simultaneously serve ecological functions (biodiversity, urban cooling) and public health goals, directly stimulating the transition from sedentary to active habits.

## 6. Conclusions, Limitations and Future Research

As detailed in the previous section, these findings translate into precise spatial design guidelines, moving the political debate from the mere quantitative provision of green space to strategic, accessibility-driven urban interventions. From an academic perspective, this study is formally positioned within the field of interdisciplinary applied economics, operating at the convergence of *Urban Economics*, *Spatial Planning*, and *Public Health*. By bridging these domains, this study empirically investigates the relationship between the availability of outdoor public green spaces and sports participation in Italy. Using micro-level data from the annual ISTAT survey (2014–2022), the Probit and Logit models reveal a positive, robust, and statistically significant association between park proximity and active lifestyles. Specifically, our empirical estimates show that park proximity is a powerful predictor of active behaviors: living within a 15 min walk from a public green space increases the odds of sports participation by 34.2% (occasional) and 24.9% (continuous), which translates into an absolute increase in the probability of practicing sports of 40.2 percentage points for occasional practitioners and 27.3 percentage points for continuous practitioners. To the best of our knowledge, this study provides novel empirical evidence on the structural role of public green infrastructure in mitigating sedentary behaviors across the Italian population over nearly a decade, controlling for individual socio-demographic characteristics and time-specific structural breaks. These findings underscore that public investments in urban green spaces are not merely environmental or aesthetic choices, but are fundamental tools for public health and sustainability.

Despite its robust econometric setup, this study is not without limitations. First, the cross-sectional nature of the ISTAT data prevents us from establishing a pure, dynamic causal relationship, capturing instead strong and stable statistical associations. This framework also leaves open the potential for residential self-selection: individuals with an innate

preference for active lifestyles and sports may deliberately choose to reside in neighborhoods with better access to public green infrastructure, potentially biasing the statistical estimates. Second, the primary independent variable relies on the perceived distance to green spaces (accessible within 15 min on foot) rather than objective metric distances. Third, due to strict statistical confidentiality regulations governing public-use microdata, finer geographical controls—such as municipality type, urban/rural divide, or neighborhood-level socio-economic indicators—were unavailable for analysis. Finally, although the COVID-19 pandemic introduced an unprecedented shock to physical habits, the inclusion of individual year fixed effects properly isolates these fluctuating macro-trends, confirming that the positive link between park proximity and sports participation remained a stable, resilient, and structural determinant of public health across the entire timeframe. Future research could productively merge these nationwide survey data with Geographic Information Systems (GIS) mapping and institutional localized datasets to assess how the objective quality, size, and specific amenities of urban parks interact with individual sporting habits across specific municipal contexts.

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