

Article

Exploring the Characteristics and Influencing Factors of Leisure Walking Based on the Demand of Behavior

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Abstract: Leisure walking has been an important topic in space-time behavior and public health research. However, prior studies pay little attention to the integration and the characterization of diverse and multilevel demands of leisure walking. This study constructs a theoretical framework of leisure walking behavior demands from three different dimensions and levels of activity participation, space-time opportunity, and health benefit. On this basis, through a face-to-face survey in Nanjing, China (N = 1168, 2017–2018 data), this study quantitatively analyzes the characteristics of leisure walking demands, as well as the impact of the built environment and individual factors on it. The results show that residents have a high demand for participation and health benefits of leisure walking. The residential neighborhood provides more space opportunities for leisure walking, but there is a certain constraint on the choice of walking time. Residential neighborhood with medium or large parks is more likely to satisfy residents' demands for engaging in leisure walking and obtaining high health benefits, while neighborhood with a high density of walking paths tends to limit the satisfaction of demands for space opportunity and health benefit. For residents aged 36 and above, married, or retired, their diverse demands for leisure walking are more likely to be fulfilled, while those with high education, medium-high individual income, general and above health status, or children (<18 years) are less likely to be fulfilled. These findings that can have important implications for the healthy neighborhood by fully considering diverse and multilevel demands of leisure walking behavior.

Keywords: leisure walking; supply and demand; space-time behavior; public health; built environment; China



Citation: Jiang, Y.; Sun, H. Exploring the Characteristics and Influencing Factors of Leisure Walking Based on the Demand of Behavior.

Sustainability **2021**, *13*, 4105. <https://doi.org/10.3390/su13084105>

Academic Editor: Arnaldo Cecchini

Received: 12 March 2021

Accepted: 1 April 2021

Published: 7 April 2021

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1. Introduction

Leisure walking refers to the behavior performed for the purposes of health benefits, entertainment, emotion, and relaxation, especially outside necessary work and responsibilities [1]. The significance of leisure walking for people's quality of life and health is widely acknowledged [2–4]. In the post-urbanization era, geographers studied the spatial-temporal distribution, behavior preference, and social differentiation of leisure activities including leisure walking [5–8], and emphasized its space-time opportunities and constraints. With the pursuit of healthy life in cities, epidemiologists, public health scholars, and urban scholars stressed that leisure walking representing one of the common forms of leisure-time physical activity has significant health benefits [9,10]. They also explored the potential health effects of leisure walking based on the measures of energy expenditure and physical activity level [11].

Furthermore, the linkage between leisure walking and environmental and individual factors becomes a major focus and has been widely investigated. The theory of space-time behavior has been used to analyze the potential influence of spatial factors on behavior-related leisure activities including leisure walking [5,6]. The theory holds that spatial factors are important structural constraints affecting leisure behavior, and points out that

the generation of leisure behavior is related to the activity opportunities around residential neighborhood [12]. However, the effect of the built environment on leisure behavior is seldom analyzed. Another research on the choice behavior of leisure walking environment shown that specific environmental characteristics (e.g., traffic volume, shade, and pavement width) are the main factors influencing walking choice behavior [13].

The social ecology theory has also been widely used to explore the various channels of impact on health-related leisure walking. It stresses that leisure walking is a complex behavior that can be affected by the built environment as well as individual factors [14]. Over the last two decades, much of the published work has mainly demonstrated the possible impact of the neighborhood built environment on leisure walking. Some scholars took the provision of public spaces (e.g., parks, green spaces, leisure squares, and walking trails) into account based on the idea that it provided the space and opportunities for individuals to participate in leisure walking. The empirical results showed that the number, size, and features of public spaces had a positive association with residents' leisure walking [3,15–17], while some studies have demonstrated non-significant or contrary findings [18,19]. Additionally, land use mix [20–22], street connectivity [23], population density [21], size of land covered by vegetation [21], the walking infrastructure [24], and walkability [25] were proven to be potentially associated with leisure walking. In terms of individual socioeconomic attributes, age, gender, and education level were frequently considered important determinants of leisure walking in previous studies [2,26–29]. Besides this, work status and health status have been found to be associated with leisure walking [30]. The majority of existing studies generally apply self-reported or objectively determined frequency and duration to assess leisure walking. The measurement of these two indicators focused on health-related outcomes and emphasized the health benefits of leisure walking by providing environment-oriented and person-oriented interventions.

The researches of behavior-related leisure walking indicate that the behavior may be constrained by specific space-time conditions, which may conduct more demand for the acquisition of space-time opportunity [8]. Study on health-related leisure walking manifest that individual has the demand to promote health. In addition, the individual may also have a basic demand of participating in leisure walking [8]. However, the previous studies lack an integrated analysis for leisure walking from the demand perspective of behavior, which makes it difficult to effectively reveal these diverse demands in daily life situations. Thus, the observation of leisure walking needs to integrate its actual demands into a unified framework.

Additionally, the majority of theoretical and empirical studies have been conducted in the context of high-income countries or regions, such as North American countries, Australia, European countries, and Hong Kong. Other middle-income countries, such as Brazil and Colombia have also conducted some empirical analyses. However, the research on leisure walking and its potential determinants is understudied in rapidly growing and densely settled Chinese mainland cities. Obviously, the availability and accessibility of resources, design, and social-economic status of the countries and regions mentioned above are quite different from Chinese mainland cities. Moreover, due to the rapid urbanization speed and large population in the city, residents' opportunities of leisure walking within neighborhood area are usually limited and unbalanced, which has led to a decline in physical activity levels and increased health inequality [31,32]. Thus, it is urgent to understand the characteristics of leisure walking demands and the related influencing factors and provide empirical evidence in the Chinese context.

To summarize, there are gaps regarding leisure walking and a need for adopting a new perspective as well as empirical knowledge. Thus, this study explores the possible demands of leisure walking from the demand perspective of behavior. Based on the perspective, we mainly examine the characteristics of leisure walking demands and the effects of residential neighborhood built environment and individual factors on them. This study aims to contribute to the previous literature in two respects. First, it measures activity participation, space-time opportunity, and health benefit of leisure walking from the demand perspective

of behavior, thereby more accurately and comprehensively capturing the connotation and value of leisure walking by integrating it into a more daily life context. Second, it explore the characteristics of leisure walking demands and the influence of both the neighborhood built environment and individual factors on it in the Chinese cities context, thereby providing reference for other rapidly growing and densely settled countries and regions.

2. Analytical Framework

Based on the research of behavior-related and health-related leisure walking, this study believes that leisure walking can be integrated into the demand perspective of behavior. From the demand perspective of behavior, leisure walking can be explored under the three levels, including activity participation, space-time opportunity, and health benefit. The three levels represent diverse and multilevel demands of leisure walking and cover the content of leisure walking research. Maslow's hierarchy of needs theory holds that some demands are seen as fundamental in the sense that they should be fulfilled in order for higher-order demands [33]. Thus, in this study, at the bottom of the hierarchy is activity participation, as a basic demand and is measured by individuals' participation. Space-time opportunity represents the intermediate level of demand and is measured by the distribution pattern of leisure walking in different space-time situations. Prior studies indicated that most leisure walking behaviors occur in residential neighborhoods [3,4]. Thus, this study posits that the residential neighborhood is an important demand space for individuals, which provides the opportunity to conduct leisure walking. In terms of demands of time opportunity, individuals tend to flexible time choices when they participate in leisure walking [8]. Health benefit represents the highest level of demand and is measured by physical activity as related to the frequency and duration. Based on the above, this study further identifies the characteristics of leisure walking demands. Then, to explore the effects of environmental and individual factors on leisure walking demands, we construct an influencing factor index system on the supply level as well as the individual level. Specifically, this study examines the effects of the public space attributes on the demands of leisure walking. In addition, based on prior studies and the socioeconomic status of residents in the current stage of urban development in China, the following three groups of individual variables are taken into account: (1) demographic attributes, (2) family characteristics, and (3) health status. Finally, this study proposes the regulating strategies according to the empirical results (Figure 1).

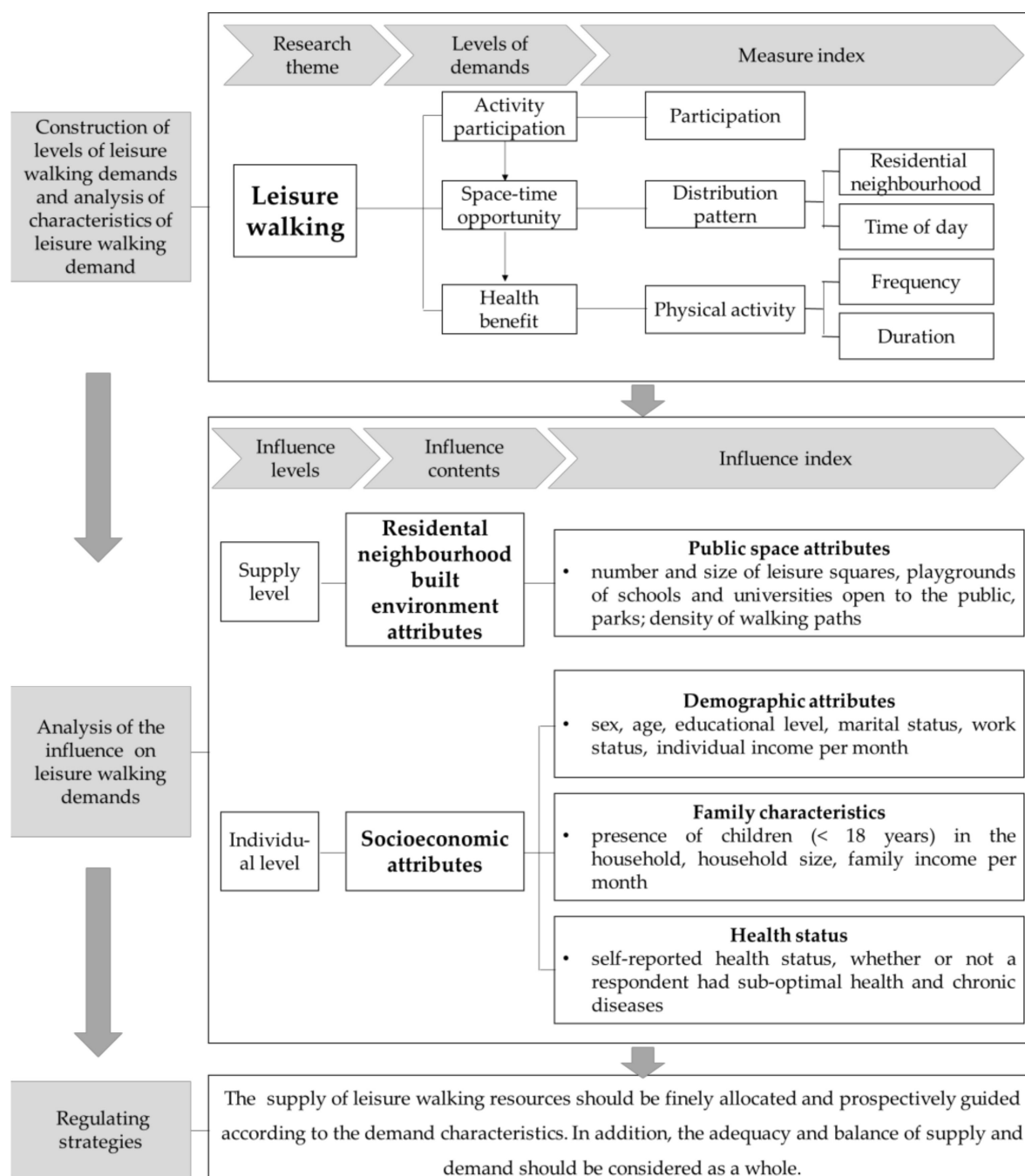


Figure 1. Theoretical framework of leisure walking from the demand perspective of behavior.

3. Methods

3.1. Study Design and Participants

This study was a cross-sectional survey conducted between December 2017 and January 2018 in Nanjing, a representative of high-density and rapid-developing cities in China. In 2019, the total population of Nanjing was about 8.50 million, and the urbanization rate was 83.2% [34] (Figure 2).

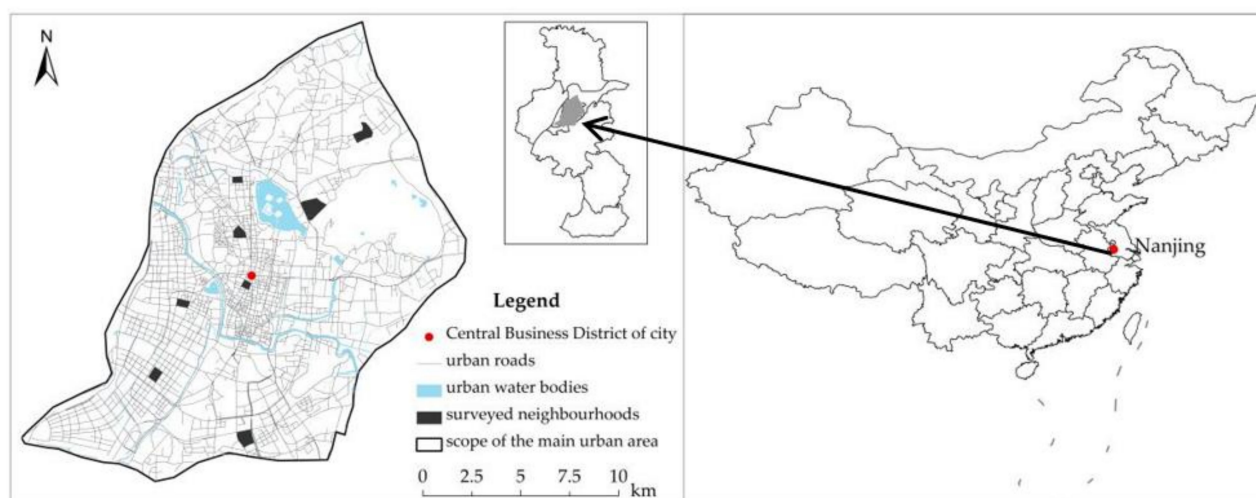


Figure 2. Study area and survey neighborhoods distribution.

Approved respondents had no major diseases, could walk easily, and had lived in the neighborhood for more than six months. A multistage sampling approach was used to randomly selected respondents from the chosen neighborhood in our study. In the first stage, eight administrative streets from six districts were randomly chosen. In the second stage, one residential neighborhood was randomly selected from each chosen administrative street, thus resulting in eight residential neighborhoods (Figure 2). We selected eight residential neighborhoods for the study according to three criteria: location, residential environment, and neighborhood socioeconomic status. In the third stage, 150 households were randomly sampled in each residential neighborhood. The final stage was to choose one respondent (aged 18 and above) in each household to complete a face-to-face survey. A total of 1168 respondents were recruited for the survey (32 respondents were excluded because of incomplete data).

3.2. Measures

3.2.1. Data Collection

The International Physical Activity Questionnaire (long-form) was used to collect respondents' physical activity. The questionnaire has been widely used to collect the type, frequency, duration, and intensity of different types of physical activity of respondents in a usual week, which has proven its validity and reliability in China [35,36]. Furthermore, this study inquired into space and time attributes of the sub-categories of physical activity through the respondents' weekly activity records. As this study focuses on leisure walking, the only sub-category chosen was leisure walking.

3.2.2. Dependent Variables

Leisure walking was set as the dependent variable in this study. The respondents were asked to report the frequency and duration (in hours and minutes) (if the cumulative time of leisure walking reported by a respondent was less than 10 min per day, the corresponding time and frequency were re-coded as '0') they spent in leisure walking in a routine week. Specifically, to determine the space and time of the respondents' leisure walking, they were asked the following two questions: "During the last week, where did you go for leisure walking on weekdays and weekends?" and "During the last week, when did you usually go for leisure walking on weekdays and weekends?" Based on the responses, we created a series of dichotomic outcomes. The reliability of the coefficient of the whole scale was 0.80. The validity of the questionnaire was determined based on the reliability of the data and the consistency between the structure of the dependent variable and the research content [37]. All these factors suggested that the following variables were acceptable:

- (1) Participation in leisure walking (or not).
- (2) Leisure walking in the residential neighborhood (weekdays and weekends) (yes/no).
- (3) In consideration of the work and leisure tendencies of residents in China, time of day of leisure walking (weekdays and weekends) was divided into three outcomes (yes/no): morning (5:00–11:00), afternoon (11:01–17:00), and evening (17:01–23:00).
- (4) Frequency of leisure walking (per week) was divided into three outcomes (yes/no): <3 times, 3–4 times, and ≥ 5 times.
- (5) The duration of leisure walking (weekly data) was divided into three outcomes (yes/no): <150 min, failing to meet physical activity recommendations, 150–299 min, largely meeting physical activity recommendations, and ≥ 300 min, exceeding the basic physical activity recommendations [3].

3.2.3. Independent Variables

Residential neighborhood built environment variables were generated using a Geographic Information System (GIS). According to the actual space context experienced by the respondents in their daily lives and the supply characteristics of environment in the city, two attributes (number and size) of public spaces were selected as environmental variables [38]. The number of leisure squares, playgrounds of schools and universities open to the public, parks, and the density of walking paths were calculated separately within a 15-min walking distance. The area of leisure squares, playgrounds of schools and universities open to the public, and parks were also measured by the same walking distance. The environmental information was derived from the urban road data, point-of-interest data, and other fundamental data in 2018.

Demographic attributes variables included sex, age, education level, marital status, work status, and individual income per month.

Family characteristics variables included the presence of children (<18 years) in the household, household size, and family income per month.

Health status variables were measured by three indicators. First, respondents were asked to rate their health status on a 5-point Likert scale (1 = very poor, 5 = very good). The rating was divided into the following four categories for this study: poor, fair, good, and very good. In addition, to determine whether the respondents had sub-optimal health and chronic diseases, they were asked to provide information about their ailments (e.g., insomnia and other sleep disorders, tiredness, aching, soreness or weakness in the waist and knees, and dizziness) with a yes/no response, and chronic diseases (e.g., hypertension, diabetes, coronary heart disease, and hyperlipidaemia) with a yes/no response.

3.2.4. Individual Walking Activity Spaces

Residential neighborhood was regarded as the main areas that fulfil the respondents' daily leisure walking needs [39]. They were defined by measuring the cost-weighted distance of 1000 m (approximately 15-min walking distance) around each respondent's home.

3.2.5. Data Analysis

All statistical and regressive analyses were conducted with Stata SE 10.0. First, to identify and exclude trivial factors, univariable analysis between leisure walking and each independent variable were run separately. In these analyses, no associations were observed between leisure walking and the factors of sex, family income per month, whether or not a respondent has sub-optimal health, and the numbers of leisure squares, playgrounds of schools and universities open to the public, parks. Thus, these variables were excluded from the models. Additionally, multilevel logistic regressions (participants and neighborhoods) were used to examine the association between leisure walking and significant influence factors. We allowed neighborhood to have a random effect, allowing for non-independence in results from participants within the same neighborhood [15,40]. The regression results with better fit were accepted using confirmatory tests and comparative tests (to raise the simulation effect of the models, the area of leisure squares, playgrounds of schools

and universities open to the public (due to the smaller effect of the coefficient than other environmental variables) were excluded from the multilevel logistic regressions). Finally, odds ratios and 95% confidence intervals were presented in a table to show the estimated effects of different variables.

4. Results

4.1. Characteristics of Leisure Walking from the Demands of Behavior

The characteristics of leisure walking demands by respondents category are reported in Table 1. Overall, more than 60% of the respondents reported that they routinely engage in leisure walking. According to the statistics of activity space, most of the respondents walk within the residential neighborhood both on weekdays (74.2%) and on weekends (72.9%). Moreover, walkers are more inclined to choose certain times (17:01–23:00) to walk, both on weekdays (55.0%) and on weekends (51.8%). A high proportion of these walkers engage in leisure walking most frequently (75.5%, ≥ 5 times/week) and sufficiently (59.5%, ≥ 300 min/week). Respondents aged 36 and over, having less education, married, retired, having not good health status or suffering from chronic diseases tend to engage in and conduct more leisure walking. Respondents aged 36 and over, having less education, married, retired or having low individual income are more likely to walk within the residential neighborhood. Additionally, they have more flexible leisure walking time.

Table 1. Descriptive information for the characteristics of study respondents and leisure walking.

Characteristics	Respondents (%)	Leisure Walking				
		Participation (%)	Residential Neighborhood (%) ^a	Time of Day (%) ^b	Frequency (%) ^c	Duration (%) ^d
All respondents	100	62.9	74.2 72.9	22.5/22.5/55.0 24.1/24.1/51.8	14.3/10.2/75.5	16.3/24.2/59.5
Sex (%)						
Female	54.02	62.8	73.0 74.0	22.4/22.9/50.3 24.1/24.9/49.3	14.8/10.0/75.2	15.6/23.6/60.8
Male	45.98	62.8	75.4 71.5	23.0/21.8/61.5 24.2/22.4/54.7	13.6/10.3/76.1	17.3/24.8/57.9
Age						
18–35 years old	31.60	42.4	67.5 73.8	8.9/13.3/50.9 13.3/17.8/47.1	27.3/13.3/59.4	35.0/33.7/31.3
36–59 years old	35.35	63.8	73.1 73.4	14.3/20.0/60.6 17.0/22.3/55.6	18.3/12.8/68.9	18.1/29.5/52.4
≥ 60 years old	33.05	81.2	78.3 71.9	36.6/28.9/53.5 35.6/28.0/50.9	4.4/6.3/89.3	5.4/14.9/79.7
Education level						
Lower than high school	23.80	71.4	80.4 76.3	34.6/22.6/56.2 33.6/22.6/55.2	9.0/5.1/85.9	6.0/15.5/78.5
High/secondary school	22.60	70.3	76.8 72.0	26.3/27.4/59.6 27.4/29.0/55.3	6.4/11.8/81.8	9.1/20.4/70.5
College/undergraduate	44.79	55.1	71.9 74.0	15.9/20.0/52.2 19.3/23.1/47.7	20.4/11.0/68.6	23.1/30.7/46.2
Postgraduate and above	8.81	59.1	55.7 59.0	4.9/18.0/55.7 6.5/14.7/49.1	26.2/18.0/55.8	39.3/32.9/27.8
Marital status						
Unmarried	15.50	41.3	62.6 72.0	8.0/10.6/50.6 12.0/18.6/52.0	30.6/12.0/57.4	32.0/30.6/37.4
Married	84.50	66.7	75.4 73.0	24.3/23.7/56.0 25.6/24.3/51.8	12.4/10.0/77.6	14.5/23.6/61.9
Work status						
Full time	48.80	50.2	67.9 69.6	8.0/13.5/60.6 12.1/18.4/53.3	25.4/16.0/58.6	30.6/34.1/35.3
Retired	35.87	82.4	78.3 73.1	35.2/27.4/56.6 34.9/26.5/54.6	3.4/5.4/91.2	4.6/13.8/81.6

Table 1. Cont.

Characteristics	Respondents (%)	Leisure Walking				
		Participation (%)	Residential Neighborhood (%) ^a	Time of Day (%) ^b	Frequency (%) ^c	Duration (%) ^d
Other	15.33	56.8	77.4 81.3	21.5/30.3/37.2 21.5/29.4/38.2	19.6/9.8/70.6	15.6/31.5/52.9
Individual income per month (6.6 Yuan is roughly equivalent to 1 USD)						
<¥2000	15.24	62.7	76.7 81.2	25.0/25.8/39.2 24.1/26.7/42.8	16.9/8.0/75.1	10.7/25.0/64.3
¥2000–¥6000	50.43	69.4	75.7 70.6	27.6/21.7/57.9 28.1/22.0/54.2	8.8/8.8/82.4	9.5/20.7/69.8
¥6001–¥10,000	20.80	55.4	72.5 71.8	14.0/21.4/59.2 19.2/24.4/51.8	22.9/17.0/60.1	30.3/30.3/39.4
>¥10,000	13.53	49.9	64.5 74.6	8.8/22.7/59.4 12.6/27.8/51.8	24.0/8.8/67.2	35.4/30.3/34.3
Presence of children (<18 years) in the household						
Yes	38.70	59.2	72.3 72.3	18.6/22.3/49.6 22.0/23.1/44.0	19.4/11.5/69.1	22.0/26.4/51.6
No	61.30	65.1	75.1 73.2	25.0/22.4/58.8 25.4/24.1/56.3	11.3/9.4/79.3	13.0/22.9/64.1
Household size						
<3 persons	37.42	64.8	75.7 73.5	26.7/23.9/58.4 26.7/27.1/58.4	9.5/7.0/83.5	12.3/17.2/70.5
3–5 persons	45.80	60.8	70.2 70.5	17.4/22.3/53.3 19.9/22.3/50.3	19.9/14.4/65.7	21.7/30.9/47.4
>5 persons	16.78	63.6	80.8 77.6	27.2/19.2/54.4 29.6/20.0/48.0	10.4/6.4/83.2	11.2/22.4/66.4
Family income per month						
< ¥4000	9.33	63.1	75.3 73.9	24.6/27.5/49.2 23.1/30.4/47.8	14.4/5.7/79.9	11.5/18.8/69.7
¥4000–¥12,000	44.78	68.1	73.9 70.3	27.1/21.0/55.7 27.1/20.4/53.5	11.7/10.0/78.2	12.0/19.6/68.4
¥12,001–¥20,000	25.09	59.2	72.9 74.7	18.3/22.9/54.0 21.8/25.8/49.4	17.8/12.6/69.6	22.4/33.9/43.7
>¥20,000	20.80	55.4	75.5 77.0	15.5/22.9/60.0 20.0/26.6/52.5	16.2/9.6/74.2	22.2/26.6/51.2
Self-reported health status						
Not good	6.85	70.4	73.2 71.4	46.4/42.8/35.7 46.4/44.6/33.9	7.1/5.3/87.6	5.3/23.2/71.5
General	35.62	63.3	78.4 68.9	22.3/19.6/58.7 23.8/20.4/50.7	13.6/12.5/73.9	16.6/21.2/62.2
Good	45.03	62.0	70.6 74.6	19.8/21.7/55.0 21.7/22.6/54.1	16.5/10.3/73.2	17.7/26.9/55.4
Very good	12.50	60.2	75.0 79.5	19.3/20.4/60.2 20.4/25.0/57.9	12.5/5.6/81.9	17.0/23.8/59.2
Suffering from sub-optimal health						
Yes	67.89	65.3	74.9 73.4	24.0/23.3/54.9 26.2/24.0/51.0	13.8/10.5/75.7	15.9/23.3/60.8
No	32.11	57.4	72.2 71.7	19.4/20.3/56.9 19.4/23.1/53.7	15.2/9.2/75.6	17.1/26.8/56.1
Suffering from chronic diseases						
Yes	29.02	77.3	77.9 71.1	33.4/26.2/56.2 33.4/25.8/52.4	7.6/7.6/84.8	7.9/17.2/74.9
No	70.98	56.8	72.0 73.9	16.7/20.3/55.0 19.0/22.6/51.4	18.0/11.6/70.4	20.9/28.3/50.8

^a Leisure walking in the residential neighborhood is presented both on weekdays and on weekends. The values of weekends are in bold and italics. ^b Time of day of leisure walking is presented by three categories (morning/afternoon/evening) both on weekdays and on weekends. The values of weekends are in bold and italics. ^c Frequency of leisure walking is presented by three categories (<3 times/3–4 times/≥5 times). ^d The duration of leisure walking is presented by three categories (<150 min/150–299 min/≥300 min).

4.2. Influencing Factors of Leisure Walking Participation

Table 2 shows the odds of respondents participating in leisure walking based on the environmental and individual factors. Living in a residential neighborhood with large areas of parks, being married, and being retired significantly add to the odds of the respondents participating in leisure walking. Conversely, the presence of children (<18 years) in the household is associated with a 37% reduction in the odds of engaging in leisure walking. In addition, age is positively associated with participation in leisure walking. Compared with the 18–35 age group, respondents aged 36–59 and 60 years and over have higher odds of engaging in leisure walking. A high education level significantly decreases the odds of participation in leisure walking compared with the lowest level reference group.

Table 2. Multilevel logistic estimates for the relationship between influencing factors and the participation of leisure walking.

	OR 95% CI		OR 95% CI
Area of parks (ref. small)		Marital status (ref. unmarried)	1.58 * 1.02–2.46
Medium	1.33 0.86–2.07	Work status (ref. full time)	
Large	4.93 *** 2.69–9.02	Retired	2.98 *** 1.69–5.27
Density of walking paths (ref. low)		Other	1.23 0.73–2.07
Medium	1.28 0.81–2.02	Individual income per month (ref. <¥2000)	
High	0.81 0.58–1.13	¥2000–¥6000	0.93 0.55–1.59
Age (ref. 18–35 years old)		¥6001–¥10,000	0.75 0.41–1.36
36–59 years old	1.84 ** 1.26–2.67	>¥,000	0.71 0.38–1.35
≥60 years old	2.04 * 1.07–3.88	Presence of children (< 18 years) in the household (ref. no)	0.63 * 0.43–0.93
Education level (ref. lower than high school)		Household size (ref. <3 persons)	
High/secondary school	1.18 0.78–1.79	3–5 persons	1.29 0.90–1.86
College/undergraduate	1.36 0.88–2.10	>5 persons	1.16 0.70–1.94
Postgraduate and above	0.90 * 1.02–3.52		

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The values of $p < 0.05$ are in bold and italics. As the OR values of the variables (e.g., self-reported health status and whether or not a respondent had chronic diseases) have no significant effect, the corresponding results are not listed in the table.

4.3. Influencing Factors of Space-Time Opportunity of Leisure Walking

The variables of the density of walking paths, age, marital status, work status, and presence of children (<18 years) in the household have a significant impact on leisure walking in the residential neighborhood (Table 3). Leisure walkers aged 36–59 years, married, or retired are more likely to walk in the residential neighborhood on weekdays or weekends. Conversely, living in the neighborhood with a high density of walking paths and the presence of children (<18 years) in the household significantly reduce the odds of engaging in leisure walking within the residential neighborhood.

Table 3. Multilevel logistic estimates for the relationship between influencing factors and the leisure walking in the residential neighborhood and time of day of leisure walking.

	Leisure Walking in the Residential Neighborhood		Time of Day of Leisure Walking					
	Weekdays	Weekends	Weekdays			Weekends		
			Morning	Afternoon	Evening	Morning	Afternoon	Evening
	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI	OR 95% CI
<i>Area of parks</i> (ref. low)								
Medium	1.66 0.59–4.62	1.70 0.80–3.58	1.14 0.60–2.16	1.29 0.56–2.99	1.25 0.82–1.91	1.36 0.71–2.62	1.45 0.65–3.21	1.02 0.66–1.58
Large	1.31 0.44–3.90	0.95 0.43–2.09	1.46 0.81–2.64	1.07 0.45–2.58	0.40 *** 0.24–0.67	1.71 0.91–3.22	1.10 0.47–2.53	0.37 *** 0.22–0.62
<i>Density of walking paths</i> (ref. low)								
Medium	1.20 0.41–3.55	1.32 0.60–2.89	0.88 0.45–1.71	1.27 0.54–2.98	0.78 0.49–1.22	1.13 0.58–2.23	1.58 0.71–3.53	0.67 0.42–1.06
High	0.53 0.24–1.19	0.52 ** 0.29–0.93	0.84 0.53–1.33	0.77 0.40–1.48	0.84 0.61–1.17	0.81 0.49–1.33	0.77 0.41–1.44	0.79 0.57–1.09
<i>Age</i> (ref. 18–35 years old)								
36–59 years old	1.51 ** 1.03–2.20	1.44 0.99–2.09	1.29 0.60–2.76	1.94 ** 1.05–3.59	1.63 ** 1.09–2.43	1.14 0.59–2.21	1.85 ** 1.04–3.27	1.68 ** 1.11–2.55
≥60 years old	1.46 0.81–2.65	1.14 0.64–2.05	2.14 0.86–5.32	3.00 ** 1.32–6.82	1.13 0.61–2.09	1.54 0.67–3.55	2.54 ** 1.14–5.63	1.10 0.59–2.07
<i>Marital status</i> (ref. unmarried)	1.82 *** 1.15–2.89	1.56 0.99–2.44	2.07 0.81–5.28	1.52 0.68–3.37	1.62 * 1.01–2.62	1.69 0.76–3.80	0.99 0.50–1.96	1.36 0.84–2.22
<i>Work status</i> (ref. full time)								
Retired	2.40 *** 1.44–4.01	2.58 *** 1.55–4.28	3.74 *** 1.81–7.73	2.87 ** 1.41–5.82	1.76 ** 1.05–2.96	3.29 ** 1.67–6.51	1.91 0.97–3.76	2.19 ** 1.29–3.70
Other	1.42 0.85–2.36	1.33 0.81–2.20	2.54 ** 1.17–5.52	3.27 *** 1.64–6.54	0.67 0.39–1.16	1.99 0.96–4.13	2.01 ** 1.03–3.94	0.68 0.39–1.19
<i>Self-reported health status</i> (ref. not good)								
General	1.35 0.79–2.31	1.02 0.61–1.73	0.51 ** 0.28–0.92	0.37 *** 0.20–0.68	2.64 ** 1.48–4.70	0.49 ** 0.27–0.89	0.36 ** 0.20–0.65	2.39 ** 1.33–4.32
Good	1.22 0.71–2.09	1.28 0.75–2.18	0.54 * 0.29–0.99	0.46 ** 0.25–0.85	2.72 ** 1.51–4.90	0.53 ** 0.29–0.97	0.43 ** 0.24–0.79	3.02 *** 1.66–5.51
Very good	1.42 0.76–2.65	1.49 0.81–2.76	0.56 0.26–1.21	0.44 ** 0.20–0.94	3.02 ** 1.55–5.89	0.52 0.24–1.11	0.51 0.25–1.05	3.24 ** 1.65–6.39
<i>Presence of children (< 18 years) in the household</i> (ref. no)	0.59 * 0.41–0.85	0.65 ** 0.45–0.94	0.52 ** 0.29–0.93	1.08 0.64–1.82	0.56 ** 0.38–0.82	0.66 0.38–1.13	1.20 0.72–1.99	0.53 ** 0.36–0.78

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The values of $p < 0.05$ are in bold and italics. As the OR values of the variables such as education level, individual income per month, whether or not a respondent had chronic diseases, and household size have no significant effect, the corresponding results are not listed in the table.

The time of day of leisure walking is affected by the following variables: the area of parks, age, marital status, work status, presence of children (<18 years) in the household, and self-reported health status (Table 3). Respondents living in the residential neighborhood with large areas of parks are less likely to engage in leisure walking at night both on weekdays and on weekends. Respondents aged 36–59 years are more inclined to choose afternoons and evenings to walk for leisure. For this age group, no obvious difference in the odds of participating in leisure walking is found between weekdays and weekends. In contrast, respondents aged 60 and over are willing to walk in the afternoons, especially on weekdays. Compared with full-time workers, retirees as well as those without full-time employment have more choices to walk at different times. Those who report general, good, or very good health are less likely to walk in the mornings or afternoons on weekdays and weekends, and higher odds are found for their walking in the evening. In addition, respondents living with children (<18 years) in the household significantly reduce the chances of participating in leisure walking, especially in the mornings on weekdays, and at night on weekdays and weekends.

4.4. Influencing Factors of Health Benefit of Leisure Walking

Regarding the influencing factors of frequency of leisure walking, these variables of the area of parks, the density of walking paths, age, education level, marital status, work status, and the presence of children (<18 years) in the household are considered (Table 4). Respondents who reside in a neighborhood with large areas of parks are more likely to have 3 times and above frequencies of leisure walking in a week. Furthermore, the results show that respondents who live in a neighborhood with a high density of walking paths and live with children (<18 years) in the household have fewer chances to walk five times or more in a week. Respondents aged 36–59 years show an increased likelihood of leisure walking frequency than these aged 18–35 years by 49%, that is, five times or more in a week. There is a marked increase in the likelihood of walking 3–4 times or more in a week with respect to respondents who have a high/secondary school education level or are married compared with the lowest level reference group. The retired have more possibility to walk 5 times and above in a week.

The duration of leisure walking is influenced by the following variables: the area of parks, the density of walking paths, age, education level, work status, individual income per month, presence of children (<18 years) in the household, and household size (Table 4). Respondents who live close to large areas of parks are more likely to walk for 300 min and above in a week. In addition, compared with the lowest level reference group, we find lower odds to obtain more leisure walking time for these respondents who live in the neighborhood with a high density of walking paths, having medium-high individual income per month, and living with children (<18 years) in the household. However, respondents aged 36–59 years, 60 years and over, or retired are more likely to dedicate 300 min and above per week to leisure walking. Moreover, respondents with a medium-high education level or medium household size are more likely to walk between 150 min and 299 min in a week.

Table 4. Multilevel logistic estimates for the relationship between influencing factors and the frequency and duration of leisure walking.

	Frequency of Leisure Walking			The Duration of Leisure Walking		
	<3 Times OR 95% CI	3–4 Times OR 95% CI	≥5 Times OR 95% CI	<150 min OR 95% CI	150–299 min OR 95% CI	≥300 min OR 95% CI
<i>Area of parks</i> (ref. <i>small</i>)						
Medium	0.72 0.34–1.54	0.77 0.34–1.76	1.66 ** 1.06–2.60	0.92 0.46–1.81	0.94 0.54–1.63	1.55 0.96–2.50
Large	2.59 1.28–5.26	3.12 ** 1.36–7.12	1.55 0.96–2.51	2.07 1.07–4.01	1.50 0.84–2.69	1.94 ** 1.17–3.21
<i>Density of walking paths</i> (ref. <i>low</i>)						
Medium	1.69 0.82–3.48	0.92 0.33–2.58	1.10 0.69–1.74	1.25 0.64–2.44	1.26 0.71–2.24	1.07 0.65–1.75
High	1.43 0.79–2.59	1.83 0.89–3.79	0.62 ** 0.44–0.87	1.02 0.59–1.76	1.27 0.81–1.99	0.68 ** 0.47–0.98
<i>Age</i> (ref. 18–35 years old)						
36–59 years old	1.33 0.76–2.31	1.46 0.73–2.91	1.49 ** 1.01–2.21	0.88 0.53–1.48	1.35 0.83–2.17	2.19 ** 1.37–3.48
≥60 years old	1.30 0.42–3.98	3.02 0.88–10.38	1.39 0.74–2.58	1.14 0.37–3.51	1.68 0.76–3.72	1.96 ** 1.02–3.78
<i>Education level</i> (ref. <i>lower than high school</i>)						
High/secondary school	0.63 0.29–1.40	2.64 ** 1.17–5.96	1.01 0.68–1.49	1.33 0.60–2.92	1.42 0.83–2.41	0.93 0.63–1.37
College/undergraduate	0.99 0.48–2.05	1.66 0.68–4.01	1.21 0.79–1.84	1.51 0.70–3.26	1.78 ** 1.03–3.07	0.91 0.59–1.40
Postgraduate and above	1.05 0.41–2.67	2.69 0.86–8.43	1.39 0.75–2.59	2.23 0.89–5.60	2.03 0.94–4.39	0.89 0.43–1.82
<i>Marital status</i> (ref. <i>unmarried</i>)	0.55 0.28–1.08	1.27 0.52–3.11	2.03 ** 1.26–3.26	0.82 0.44–1.55	1.47 0.81–2.68	1.49 0.86–2.59
<i>Work status</i> (ref. <i>full time</i>)						
Retired	0.25 ** 0.09–0.70	0.28 ** 0.09–0.86	5.01 *** 2.93–8.56	0.35 0.12–1.00	0.54 0.27–1.09	4.67 *** 2.74–7.96
Other	0.73 0.31–1.71	0.67 0.24–1.89	1.56 0.94–2.64	0.85 0.36–1.98	1.14 0.59–2.18	1.43 0.81–2.52
<i>Individual income per month</i> (ref. < ¥2000)						
¥2000–¥6000	0.64 0.27–1.51	1.08 0.38–3.04	1.05 0.63–1.74	1.22 0.48–3.10	1.12 0.58–2.15	0.81 0.48–1.37
¥6001–¥10,000	0.84 0.33–2.18	1.25 0.40–3.97	0.67 0.37–1.22	2.02 0.75–5.46	0.98 0.46–2.08	0.46 ** 0.25–0.87
> ¥10,000	0.71 0.26–1.95	0.57 0.15–2.19	0.90 0.48–1.71	1.94 0.69–5.43	0.79 0.35–1.79	0.53 0.26–1.08
<i>Presence of children (<18 years) in the household</i> (ref. <i>no</i>)	1.75 0.99–3.11	0.95 0.50–1.81	0.51 *** 0.35–0.75	1.57 0.89–2.74	0.71 0.45–1.12	0.60 ** 0.40–0.91
<i>Household size</i> (ref. < 3 persons)						
3–5 persons	1.12 0.62–2.01	1.75 0.90–3.41	1.07 0.75–1.54	1.02 0.58–1.78	1.76 ** 1.13–2.76	0.90 0.61–1.31
>5 persons	0.69 0.30–1.64	0.87 0.32–2.38	1.43 0.86–2.37	0.62 0.28–1.40	1.65 0.88–3.11	1.10 0.64–1.90

Note: ** $p < 0.01$, *** $p < 0.001$. The values of $p < 0.05$ are in bold and italics. As the OR values of the variables (e.g., self-reported health status and whether or not a respondent had chronic diseases) have no significant effect, the corresponding results are not listed in the table.

5. Discussion

5.1. Findings and Comparisons

In this cross-sectional study, we have shown that residents may have diverse and multilevel demands for leisure walking. This implies that the analysis of leisure walking can be considered from the demand of behavior. In addition, due to the fact that our data are collected in daily life situations, this result indicates that the actual observation of leisure walking should be seen from an integrative perspective. The majority of studies in related areas of research looked at leisure walking from single perspective, leading to inadequate and incomplete interpretation for leisure walking: behavior-related studies highlighted the space-time opportunity and constraint of leisure walking, whereas health-related research stressed the health benefit of leisure walking.

The key point therefore appears to understand the diverse and multilevel demands and their characteristics and influencing factors. Different from the previous research, we constructed the level and content of demands by integrating the studies of behavior-related and health-related leisure walking from the demand perspective of behavior. Additionally, we also demonstrated the effects of environmental and individual factors on the demand of leisure walking.

As regards the demands of leisure walking, three levels including activity participation, space-time opportunity, and health benefit were explored. Residents showed different demand characteristics for leisure walking. More than 60% of the residents reported that they routinely engage in leisure walking, indicating that most residents have a demand for participating in leisure walking. The results of this study showed that over 70% of leisure walking behavior occurs in the residential neighborhood. Similar findings have been observed in urban areas of developed countries [37,41,42], although the environment of their residential neighborhood is different than that of developing countries. This reveals that the residential neighborhood is an important demand space for leisure walking. In addition, leisure walkers were more inclined to walk at night, indicating a certain time constraint on behavior demand. Most walkers can obtain sufficient physical activity by the participation of leisure walking, indicating that residents have high health demand for leisure walking.

In terms of the impact of the built environment, the area of parks and the density of walking paths within the residential neighborhood had varying effects on the levels of leisure walking demands. First, this study found that residents living in the residential neighborhood with large parks nearby rarely walk at night. This may be due to a low sense of security in large parks at night. Residents living in the residential neighborhood with large areas dedicated to parks were more likely to satisfy their demand for engaging in and accomplishing a high frequency and duration of leisure walking. Despite studying different urban settings, a similar conclusion has been drawn by other studies [15,38,43,44]. This may be because medium or large parks in the residential neighborhood can provide more opportunities to participate in activities and create a healthy environment. This has effectively increased the level of participation and health of leisure walking. Second, the higher the density of walking paths in the residential neighborhood, the lower the probability of walk in the residential neighborhood and the high frequency and duration of leisure walking. The high density of walking paths appears to limit the fulfillment of demands for space opportunity and health benefit, which may have been caused by low safety, poor sanitation, crowded population, and insufficient public spaces in areas with a high number of walking paths. In addition, in the areas of high walking paths, the travel process is often short, which also leads to insufficient accumulation of leisure walking [45]. Furthermore, no significant association between the number and size of public spaces (e.g., parks, leisure squares, and playgrounds of schools or universities open to the public) and leisure walking were found in the present study, which is inconsistent with the conclusions from developed or low population density countries [18,43]. This may be related to the insufficient and unbalanced supply of public spaces.

In terms of the impact of individual factors, residents aged 36–59 years or retired have more flexibility in choosing leisure time; they were also more likely to participate in leisure walking and obtain space opportunities and health benefits. Residents with a high education level had a lower likelihood of participating in leisure walking, which is inconsistent with previous research [46–48]; meanwhile, this study noted that this group is less committed to a higher level of leisure walking. Compared with the unmarried group, married residents were more willing to frequently engage in leisure walking in the residential neighborhood at night, and this decision may be influenced by family members, such as through accompanying behavior. No significant association was observed between self-reported health status and the frequency of walking for leisure. This result, which is different from the previous research [48], may be due to the health benefit of leisure walking being weakened or offset by other factors. However, this study observed that the better the residents' self-reported health, the more likely they were to participate in leisure walking in the evening. Due to the influence of increased living and working pressures, residents earning a medium-high level of individual income per month had fewer opportunities to obtain more health benefits from leisure walking. Residents living with children (<18 years) in the household were less likely to participate in leisure walking and obtain more space-time opportunities and health benefits.

5.2. Regulating Strategies

The optimization of leisure walking behavior from the demand perspective of behavior can provide multiple paths and directions for meeting different levels of demands. First, the results of the empirical analysis suggest that rapid urbanization brings together a large number of people, which is the root cause of the complex and diverse demand for leisure walking and the insufficient supply of leisure resources. Therefore, it is necessary to establish a primary approach based on the orderly diversion of high-density population and the distributed layout of leisure resources. Second, it is necessary to optimize the space-time supply of leisure resources and environment according to the space-time demand characteristics of leisure walking. Considering the complementarity of space supply and time supply of resources and environment, a leisure walking resource and environment system with balanced distribution, sufficient quantity, good quality, and flexible time should be established. Third, regulating strategies should respect the multilevel and differentiated demands of the whole society for leisure walking and encourage more residents to increase their activity participation and take advantage of the space-time opportunity and health benefit of leisure walking. This approach will eventually create an inclusive and harmonious social atmosphere to promote leisure walking.

5.3. Strengths and Limitations

In this study, based on the research of behavior-related and health-related leisure walking, we innovatively integrated its activity participation, space-time opportunity, and health benefit from the demand perspective of behavior. Our findings emphasize the diversity and multilevel of leisure walking demands and identify the important influence of residential neighborhood built environment and individual attributes on the demand characteristics. In urban planning and public health terms, it emphasizes the importance of public policies and urban designs for the satisfaction of leisure walking demands. In addition, this is the first study to explore the characteristics of leisure walking demands and their influencing factors in rapidly growing and densely settled Chinese cities. Some limitations should be also mentioned. First, the measurement of leisure walking-related data depends on the self-report of the residents, which may lead to recall errors. Second, due to limited data, the construction of built environment factors is not yet comprehensive. Third, we did not assess possible statistical interactions between the built environment and individual factors, in favor of more parsimonious models. Finally, empirical analysis cases are not enough, which may limit the application of the findings to other cities.

6. Conclusions

The demands of daily leisure walking in large cities with high population density during the urban transition period is complex and diverse, especially in developing countries. This study constructs a theoretical framework of the leisure walking behavior demands, which is from three different dimensions and levels of activity participation, time-space opportunity, and health benefit. Based on the empirical analysis, we identify the characteristics of leisure walking demands in Nanjing, China, and reveal the impact of residential neighborhood built environment and individual factors on it. This research can provide a useful reference for planning and governance of urban leisure walking environment with similar backgrounds.

Author Contributions: Y.J. contributed to the conception and design of the study, and wrote the original draft. H.S. provided comments on the improvement of manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This study was funded by the National Social Science Fund of China, grant number 20AZD040.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ongoing research in this field.

Acknowledgments: The authors thank the anonymous reviewers whose comments will have greatly improved this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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