

科技部補助專題研究計畫報告

促進高齡者從事步行行為之主客觀環境策略：地理資訊系統之運用(第2年)

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本研究具有政策應用參考價值：否 是，建議提供機關教育部
(勾選「是」者，請列舉建議可提供施政參考之業務主管機關)
本研究具影響公共利益之重大發現：否 是

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中文摘要：有鑑於既有文獻中，較少有研究運用客觀測量工具探討高齡者所處的實質環境與其身體活動量之關係。據此，本計畫第一年之主要目的為探討「地理資訊系統測量之客觀環境因素」與「加速規測量之客觀身體活動量」的關聯性。本計畫為橫斷性設計，針對60歲以上的社區高齡者進行問卷及加速規調查，調查內容包括取得研究對象之居住村里資訊後，運用地理資訊系統計算五項宜走性客觀環境因素（人口密度、道路連結性、人行道可及性、目的地的易達性以及大眾運輸工具的易達性）、並請研究對象配帶七日的加速規（model wGT3X-BT; ActiGraph, Pensacola, FL, USA），並運用ActiLife 軟體（version 6.0, Pensacola, FL, USA）計算五項客觀身體活動量指標（整體活動量、中至高強度身體活動量、輕強度身體活動量、超過10分鐘的中高強度身體活動次數、以及每日步數）以及社會人口學變項。本計畫使用多元線性回歸進行分析。本計畫之第一年調查共有124位高齡者（平均年齡=69.9歲）提供有效的環境與身體活動資料，在控制混淆因子後，研究結果發現居住在人行道可及性較佳的社區環境與高齡者的每日步數具有正向的關聯性（ $\beta = 0.165$; 95%CI: 0.006, 0.412; $P = 0.043$ ），本研究並未發現其他客觀環境因素與身體活動指標間的關聯性。本研究提供實證證據顯示，高齡者居住在人行道可及性高的社區環境中，有助於其每日步數的累積，未來仍需縱貫性的研究來進一步確立高齡者居住之客觀環境與其客觀身體活動量的因果關係。

第二年計畫的主要目的在於探討「地理資訊系統測量之客觀環境因素」與「問卷測量之身體活動量與靜態行為」的關聯性。本年度計畫同樣為橫斷性設計，針對65歲以上的高齡者進行全國電話訪問調查（電腦輔助電話調查系統），調查內容包括取得研究對象之社會人口資料、過去七天的身體活動與靜態時間及居住村里資訊後，再運用地理資訊系統計算五種不同類型的目的地型態（休閒設施、使用性目的地、大眾運輸工具、廟宇及學校），本計畫使用二元邏輯斯回歸進行分析。共有1,040位高齡者（平均年齡：73.04 ±6.13歲）提供完整的研究變數資料並納入分析，在控制混淆因子後，研究結果發現居住在村里中有較多廟宇的高齡男性，有較高的可能性達到身體活動建議量（OR = 1:85; 95% CI: 1.16 - 2.96）；而居住在有較多使用性目的地（如銀行、郵局）的高齡女性，較容易從事過長的靜態時間（OR = 1:70; 95% CI: 1.12 - 2.56）。研究提供實證證據顯示，社區廟宇可能對於高齡男性從事身體活動扮演著支持的角色，反之，社區中有較多的使用性目的地與高齡女性從事過長的靜態行為也具有正向的關聯性。

中文關鍵詞：高齡者、每日步數、地理資訊系統、環境宜走性、身體活動

英文摘要：A limited number of studies have used both objective measures to examine the relationships of built environments and physical activity (PA) among older adults. The first study aimed to examine geographic information systems-derived neighborhood walkability attributes and accelerometer measured PA in older adults. Data were collected from 124 older Taiwanese adults aged over 60 years (mean age: 69.9). Adjusted multiple linear regression

was performed to explore the relationships between five neighborhood walkability factors (population density, street connectivity, sidewalk availability, access to destinations, and public transportation) and five metrics of accelerometer-measured physical activity (total PA, moderate-to-vigorous PA, light PA, long moderate-to-vigorous PA bouts, and daily step counts). After adjusting for potential confounders, we found that greater sidewalk availability was positively associated with daily step counts in older adults ($\beta = 0.165$; 95%CI: 0.006, 0.412; $P = 0.043$). No associations between other neighborhood environment attributes and PA metrics were observed. In conclusion, high sidewalk availability in the neighborhood may be supportive for older adults' daily step counts. Further longitudinal research is needed to establish the causality between the built environment and objectively measured PA in older adults.

The second study investigated how neighborhood destinations were associated with physical activity recommendations and excessive sedentary time among older adults. A telephone-based survey was conducted to collect cross-sectional data on the sociodemographic variables, residential neighborhoods, physical activities, and sedentary behaviors of 1,040 adults aged 65 years and above. Using data derived from Geographic Information Systems, an adjusted logistic regression was performed to examine the relationships between five neighborhood destination types (i.e., recreational facilities, utilitarian destinations, transit stops, temples, and schools) and both overall physical activity level and sedentary behavior. Results. Significant interactions related to physical activity and sedentary behavior were observed based on both gender and neighborhood destinations. After adjusting for potential confounders, older men living in neighborhoods containing higher numbers of temples were more likely to achieve physical activity recommendations (OR = 1.85; 95% CI: 1.16 - 2.96). On the other hand, older women living in neighborhoods containing higher numbers of utilitarian destinations were more likely to engage in excessive sedentary time (OR = 1.70; 95% CI: 1.12 - 2.56). Conclusions. In Asia, the presence of favorable local neighborhood temples may support physical activity levels for older men, while utilitarian destinations (which have previously been found to support activeness) may be related to excessive sedentary behaviors in older women.

英文關鍵詞：elderly, steps, geographic information system, walkability, physical activity

1st year: The associations between neighborhood walkability attributes and objectively measured physical activity in older adults

Background

Physical inactivity has led to colossal costs to global healthcare systems (approximately \$53.8 billion) [1]. There has been strong evidence supporting the many health benefits of physical activity in older adults, such as decreased rates of all-cause mortality, non-communicable diseases, and functional limitations, as well as improved bone fitness, better cognitive function, and a lower risk of falling [2]. Despite this, about 31.1% of the population in the world engages in sufficient physical activity [3], and physical activity levels have increased very little since 2012 [4]. In Taiwan, nearly 40% of Taiwanese older adults are physically inactive [5]. Strategies that encourage physical activity in elderly need to be developed to prevent non-communicable diseases and to minimize the burden on the healthcare system.

According to the ecological model of health behavior [6], physical activity in older adults is influenced by their surroundings, which are determined by personal, interpersonal, and physical environmental factors. Compared with individual (psychosocial)-level intervention, making the built environment more walkable can affect a larger range of habitual physical activity in elderly in a long-term effect [7]. Neighborhoods with well-developed infrastructure and easy approach to destinations and low-cost facilities may promote the accumulation of physical activity in the everyday lives of older population [8]. However, a major limitation of most previous studies on the associations of the neighborhood built environment with physical activity in elderly is that they rely on self-report environmental and physical activity measures [9-13]. For example, two systematic reviews have indicated that a number of previous studies have focused on the

relationship between built environment and self-reported context-specific physical activity (i.e. leisure-time or transport context) in older adults [10,13], whereas another review also reported that few studies have examined this issue using both objectively-assessed environmental and physical activity measures [9].

To inform urban design practice, further research that examines this association using both objective measurement is needed. A geographic information system (GIS) is a method for integrating spatial information from different sources into a single scheme and then deriving precise measures of the built environment [14]. This technology allows us to better understand the walkability attributes of the neighborhoods of older adults. Moreover, accelerometers offer the opportunity to objectively measure physical activity intensity (light, moderate, and vigorous), patterns (long bouts), and daily step counts [15], which can address the limitation of recall bias in older adults [16]. Among limited studies, a meta-analysis study indicated that only two built environmental factors, walk friendly infrastructure and destination diversity (land use mix) were positively associated with objectively assessed total physical activity [9]. A better understanding the associations of built environmental factors and objectively measured physical activity patterns is still needed for designing effective physical activity intervention for older adults. To strengthen the evidence base and fill the research gap, this study aimed to examine the relationships between GIS-derived neighborhood walkability attributes and accelerometer-determined physical activity in older adults.

Methods

Participants and procedures

Data on older adults (aged over 60 years) from 28 different neighborhoods with the ability to walk unaided living in Taipei city of Taiwan were collected during April and September in 2018. First, each participant was asked to respond to a structured questionnaire that

consisted of items on personal attributes, health behaviors, and health status. Next, respondents participated in an on-site examination of physical performance. Finally, at the end of the on-site examination, each participant was required to wear the accelerometer for seven consecutive days. An incentive of a convenience store voucher (worth 7 United States dollars) was provided to the participant who completed the questionnaire, on-site examination, as well as accelerometer portion of the study. A total of 170 older adults finished the questionnaire and participated in the on-site examination. From these, incomplete or unavailable data on personal attributes, physical activity, and/or physical function test were excluded (n=43). For the statistical analyses of this study, 126 participants of them were included. Our study was conducted following the Declaration of Helsinki of 1975 and its subsequent revisions. Before the beginning of participating in the study, each participant has provided written informed consent. We obtained ethical approval from the Research Ethics Committee of the National Taiwan Normal University.

Objectively measured physical activity

Activity monitors (model wGT3X-BT; ActiGraph, Pensacola, FL, USA) were utilized to measure step counts and time spent engaged in light, moderate and vigorous-intensity physical activity. The validity and reliability of this triaxial accelerometer models have been confirmed [17]. The accelerometer records movement on 3 axes for 7 consecutive days. Data collected were processed using standard methods; all analyses were conducted with data using 60-second epochs. Participants were instructed to wear the monitors on their hip except for water activities such as showering and swimming. We categorized sleeping time as non-wear time, and, therefore, sleeping time was not counted as time spent sedentary. Periods of not less than 60 consecutive minutes of zero activity with allowance of up to 2 minutes of observations of limited movement were also categorized as

non-wear time. A valid day was described as having at least 10 hours (600 minutes) of monitor worn time. The results from participants with at least 3 valid days, with at least 1 weekend day was included in the present study.

Accelerometer counts that were greater than or equal to 100 counts/minute were defined as PA. The classification of PA was showed as below: (1) light-intensity PA (LPA): counts that were between 100 to 2,019 counts/minute; (2) moderate-to-vigorous intensity PA (MVPA): counts that were greater than or equal to 2,020 counts/minute [18]. We also calculated long MVPA bouts as periods of MVPA lasting at least 10 consecutive minutes with a 1-minute allowance below the MVPA threshold [17]. In this study, LPA, MVPA, long MVPA bouts, total PA (LPA + MVPA) and daily step counts were included as exposure variables. ActiLife software (version 6.0, Pensacola, FL, USA) was utilized to analyze accelerometer data.

Neighborhood walkability attributes

The neighborhood walkability attributes of this study were five neighborhood environmental attributes, based on neighborhood walkability elements reported from previous studies [19,20]. These environmental walkability attributes were measured using GIS software (ArcGIS; ESRI, Redlands, CA, USA). Five environmental measures were determined using participant's geocoded residential neighborhood: (1) "population density" was calculated by the number of people per square kilometer; (2) "street connectivity" was calculated by the total number of road nodes per square meter; (3) "sidewalk availability" was calculated by the area of sidewalks [m²]; (4) "access to public transportation" was calculated by the total number of Mass Rapid Transit (MRT) exits, train stations, high speed rail stations, and bus stops; and (5) "access to destinations" was

calculated by the total number of 30 destination types on the basis of previous studies [21,22].

Statistical Analyses

A total of 126 elderly provided complete information for the study variables were analyzed. Since a preview review indicated that not categorizing continuous environmental measures would contribute to improving the quality of future research designs [9] and the outcome variables are normally distributed, we used forced-entry multiple linear regression models for our analyses. Forced-entry multiple linear regression models adjusted for potential covariates (gender, age, marital status, educational level, employment status, living situation, body mass index, self-rated health, and accelerometer wear time) were conducted to examine the relationships of neighborhood walkability attributes (population density, street connectivity, sidewalk availability, access to destinations, access to public transportation) with total amounts and patterns of objectively measured PA (total PA time, daily LPA time, daily MVPA time, and daily step counts). IBM SPSS 23.0 software (SPSS Inc., IBM, Chicago, IL, USA) was used for all statistical analyses in this study. The level of significance was set at $p < .05$.

Results

Participant Characteristics

One hundred twenty-six older adults (men: 36, women: 90) were included in this study. The mean age of the participants was 69.9 years (standard deviation [SD]=5.0) (Table 1). Most of the study population was married (65.9%), lived with others (88.9%), had no tertiary education (78.6%), was not employed (96.8%), and had poor self-rated health (69.4%). The mean body mass index was 24.2 (SD=3.4).

Table 1. Characteristics of participants.¹

Variables	Category	Total sample (n=126)	
		n	(%)
Age (years)	Mean (SD)	69.9	(5.0)
Gender	Male	36	(28.6)
	Female	90	(71.4)
Marital status	Married	83	(65.9%)
	Unmarried	43	(34.1%)
Living status	Living with others	112	(88.9%)
	Not living with others	14	(11.1%)
Educational level	Tertiary education ²	27	(21.4%)
	No tertiary education	99	(78.6%)
Employment	Yes	4	(3.2%)
	No	122	(96.8%)
Self-rated health	Good	38	(30.6%)
	Poor	86	(69.4%)
BMI (kg/m ²)	Mean (SD)	24.2	(3.4)

¹Abbreviations: SD, standard deviation; BMI, body mass index.

²Tertiary education refers to a university or college degree or higher.

Patterns of PA, step counts, and neighborhood walkability attributes

Table 2 presents the total amounts and patterns of objectively measured PA and neighborhood walkability attributes. In brief, participants accumulated a total of 316.7 (SD=84.2) minutes per day of total PA, 292.3 (SD=80.4) minutes per day of LPA, 24.4 (SD=23.2) minutes per day of cumulative MVPA, and 25 (SD=26.9) minutes per day of long-bout MVPA. They also achieved an average of 7454.6 (SD=3404.4) steps per day. Approximately half were women (53.6%), and the majority had partners (60.1%)

Table 2. Total amounts and patterns of objectively measured PA, step counts, and neighborhood walkability attributes of study participants.

	Total (n=126)	
	Mean	(SD)
Accelerometer variables		
Wear time (min/day)	920.5	(84.9)
Total PA time (min/day)	316.7	(84.2)
Daily LPA time (min/day)	292.3	(80.4)
Daily total MVPA time (min/day)	24.4	(23.2)
Daily long-bout MVPA time(min/day) ²	25.0	(26.9)
Daily step counts (steps/day)	7454.6	(3404.4)
Neighborhood walkability attributes		
Population density (person/km ²)	30594.3	(14698.4)
Street connectivity (node/m ²)	211.2	(92.7)
Sidewalk availability (m ²)	3603.1	(2704.9)
Access to destinations (amount)	14.9	(11.7)
Access to public transportation (amount)	23.0	(18.0)

¹Abbreviations: SD, standard deviation, MVPA, moderate-to-vigorous physical activity, LPA, light physical activity.

²Long bouts were defined as bouts lasting ≥ 10 min.

Neighborhood environmental attributes and objectively measured PA

After adjusting for potential confounders, we found that sidewalk availability ($\beta = 0.165$; 95%CI: 0.006, 0.412; $p = 0.043$) was positively associated with daily step counts. No significant neighborhood walkability attributes were found to be related to objectively measured PA, including time spent in total PA, LPA, MVPA, long MVPA bout.

Table 3. Associations between neighborhood environmental attributes and objectively measured PA in older adults¹

Neighborhood environmental attribute	β	95%CI	p
Total PA			
Population density	0.012	(-0.001, 0.001)	0.866
Street connectivity	0.036	(-0.096, 0.162)	0.614
Sidewalk availability	0.124	(0.000, 0.008)	0.076
Access to destinations	0.080	(-0.416, 1.559)	0.254
Access to public transportation	0.092	(-0.211, 1.075)	0.186
MVPA			
Population density	0.013	(0.000, 0.000)	0.876
Street connectivity	0.015	(-0.038, 0.046)	0.858
Sidewalk availability	0.138	(0.000, 0.003)	0.098
Access to destinations	0.115	(-0.095, 0.548)	0.165
Access to public transportation	0.119	(-0.057, 0.363)	0.151
LPA			
Population density	0.009	(-0.001, 0.001)	0.900
Street connectivity	0.034	(-0.091, 0.150)	0.633
Sidewalk availability	0.090	(-0.001, 0.007)	0.190
Access to destinations	0.050	(-0.579, 1.268)	0.461
Access to public transportation	0.063	(-0.323, 0.881)	0.360
Long MVPA bout			
Population density	0.008	(0.000, 0.000)	0.929
Street connectivity	0.016	(-0.044, 0.054)	0.848
Sidewalk availability	0.074	(-0.001, 0.002)	0.378
Access to destinations	0.079	(-0.193, 0.556)	0.339
Access to public transportation	0.051	(-0.168, 0.322)	0.537
Steps counts			
Population density	0.075	(-0.022, 0.056)	0.377
Street connectivity	0.077	(-3.3, 9.0)	0.361
Sidewalk availability	0.165	(0.006, 0.412)	0.043*
Access to destinations	0.115	(-13.3, 80.1)	0.159
Access to public transportation	0.119	(-8.0, 52.9)	0.148

¹Adjusted for gender, age, marital status, educational level, employment status, living status, self-rated health, body mass index, and accelerometer wear time.*p < .05

Discussion

This study fills a research gap by examining the associations between five GIS-derived neighborhood walkability attributes and five metrics of objectively measured PA among community dwelling older adult population. After adjusting for potential confounders, we found that greater sidewalk availability was positively associated with daily step counts in older adults. Nevertheless, because encouraging PA in older adults is a public health priority, this finding has critical implications for urban designers and local policy-makers. Increasing sidewalk availability in the neighborhood would promote PA in older adults.

Among the five neighborhood walkability attributes and five metrics of objectively measured PA, we only observed a positive association between sidewalk availability and daily steps. Although previous studies have found positive relationships between availability of sidewalks and walking for exercise [23] or transportation [24], these studies were limited by using self-reported measures of walking. Our finding extends these previous findings and confirms the positive link between sidewalk availability and accelerometer-determined daily steps in the population of older adults. It is possible that roadways with sidewalks in the neighborhood can provide the benefits of safety (i.e., keep people from the traffic and result in less crashes) and mobility (from home to destinations such as retail facilities and open public spaces) for daily PA [25]. In particular, older adults were found to be more sensitive and easily influenced by the neighborhood built environment [8]. Thus, our finding suggest that sidewalks are important urban infrastructure for older adults' accumulation of daily PA in the neighborhood. Future prospective studies are warranted to deeper understand the long-term impact of sidewalk availability on PA behavior in older adults.

This study had several strengths. Five metrics of objectively measured PA of older adults, including total PA, LPA, MVPA, long MVPA bouts, and daily step counts in free-living conditions were used, which provides important evidence for modifying PA behaviors in older adults. In addition, neighborhood walkability elements of this study were determined by GIS, which can provide actual attributes of the built environment. Nevertheless, several limitations should be noticed in this study. First, the cross-sectional design of our finding may limit the conclusions that can be drawn because the causality between environmental attributes and PA cannot be assumed. Second, a potential confounder -self-selection, was not considered in the present study. Third, the exposure variables (neighborhood walkability attributes) were calculated by using participants' self-reported living neighborhood and not exact residential address. This is because reporting personal residential address in detail is a vulnerable matter for the senior of Taiwan [26]. However, residential neighborhood has been used widely as the validated geographic unit for measuring walkability attributes in neighborhoods [27]. In addition, we did not examine the role of different destinations in older adults' physical activity in this study. Future studies further examining this issue are warranted. Finally, other factors such as weather, terrain, quality of the sidewalks and air pollution in the area, which may affect older adults' walking behavior were not included in this study.

Conclusions

Sidewalk availability in the neighborhood may play an important role in the accumulation of daily steps in older adults. Our finding could be provided to aid planners and local policy-makers in the design or re-design of neighborhoods to promote daily steps among older adults. Future studies with larger participants using a prospective design are warranted to further confirm our results.

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2nd year: Which neighborhood destinations matter in the Asian context? The role of destinations in older adults' physical activity and sedentary behaviors

Background

The older adult population is now increasing on a global scale. A United Nations report indicates that Taiwan is expected to be among the top 10 most-aged countries by 2050 (with more than 40% of the population aged 60 or over) [1]. A key aspect of promoting healthy and active aging in these societies is to ensure that older adults maintain the functional abilities necessary to facilitate health and well-being [2]. Research has shown that physical inactivity and sedentary behavior are the two modifiable behavioral risk factors related to daily physical function in older adults [3, 4]. In addition to the adverse impacts on physical independence, physical inactivity and prolonged sedentary time are related to higher risks of mortality and non-communicable diseases in older adults [5, 6]. In order to make long-term changes in larger populations, it is critical to develop effective strategies for older adults through urban design and environmental initiatives.

Ecological models provide theoretical bases for understanding the role of environmental walkable attributes on physical activity [7] and sedentary behavior [8]. These models can thus inform initiatives designed to promote healthy and active ageing. In particular, neighborhoods with good access to destinations within walkable distances may supportive daily resident activity [9]. Previous studies have emphasized that physical activity among older adults can positively be influenced by the presence of neighborhood destinations, including utilitarian facilities (i.e., local stores and services), recreational areas (i.e., parks and sports facilities), and transit stops [9-11]. However, few studies have examined how a variety of neighborhood destination options relates to sedentary behaviors

in older adults. In addition to utilitarian, recreational, and public transit destinations, neighborhood schools can also serve as public open spaces to provide opportunities for older adults to engage in daily physical activity. Based on local cultural and environmental contexts, temples can be considered distinct neighborhood destinations in a number of Asian countries, as well. Most of the Taiwanese population (around 70%) practices Buddhism, Dao, or a folk religion (i.e., superstitious beliefs) [12]. There is also a considerable density of temples in Taiwan (i.e., more than 12,000 total; one for every 2,000 people in 2018) [13, 14]. Neighborhood temples thus play a central role in everyday religious and social activity for Taiwanese seniors. We therefore hypothesized that neighborhoods containing a variety of destinations (e.g., recreational facilities, utilitarian destinations, transit stops, temples, and schools) were positively associated with physical activity levels in older adults (i.e., more physical activity resulting from trips between the home and destination), but negatively related to sedentary behavior (i.e., less sedentary time spent in the home). This study strengthened the evidence base and examined age-friendly environments in Asian contexts to investigate how a broad range of neighborhood destinations were related to physical activity levels and sedentary behaviors in older adults.

Methods

Participants and Procedures

A cross-sectional telephone survey using a computer-assisted telephone interviewing (CATI) technique was conducted among older Taiwanese adults in 2017. We acquired a representative sample that closely matched the characteristics of the older adult population in Taiwan using a two-phase sampling procedure. The first phase involved dividing Taiwan into four geographic areas (i.e., northern, southern, western, and eastern). The

second phase involved randomly selecting respondents of the desired sex and age attributes. Well-trained interviewers (at least 8 hours of training for research ethics, questionnaire, and interviewing skills) then conducted a standardized questionnaire during each telephone survey. A total of 3,282 older adults were reached. Of these, 1,068 completed the survey (a response rate of 32.5%). No incentives were provided. Verbal informed consent was obtained at the beginning of each phone survey. All procedures used in this study were reviewed and confirmed by the Research Ethics Committee of National Taiwan Normal University (REC number: 201706HM020).

Self-Reported Physical Activity and Sedentary Behavior

Physical activity.

The total amount of physical activity among older adults was assessed using the International Physical Activity Questionnaire – short version (IPAQ-SV). The test-retest reliability and criterion validity of the Taiwanese IPAQ-SV was both high ($r = 0.78$) and acceptable ($r=0.31-0.41$) [15]. The Taiwanese IPAQ-SV is available for use via telephone survey, and is thus widely utilized in phone surveys among older adult populations in Taiwan [16, 17]. Three physical activity types were determined, as follows: (1) Vigorous-intensity physical activity, (2) moderate-intensity physical activity (excluding walking), and (3) walking. The time spent in each of these three physical activities was calculated by multiplying frequency (i.e., how many times per week) by duration (i.e., how many hours and minutes per day). The sum indicated total physical activity. According to the recommended levels of physical activity for older adults [5], we categorized physical activity into two levels (i.e., “not achieving the physical activity recommendation (less than 150 min/week)” and “achieving the physical activity recommendation (equal to or greater than 150 min/week)”.

Sedentary behavior.

The total time spent in sedentary behavior was measured using the validated Sedentary Behavior Questionnaire for the Elderly in Taiwan [18]. Total sedentary time was calculated for a seven-day period prior to taking the survey by adding the time spent on the following activities: Screen-based sedentary time, reading, chatting with others, eating, sitting for hobbies, sitting while working or volunteering, and other sedentary activities. We categorized overall sedentary time into “less than eight hours/day” and “more than eight hours/day” using the cut-off point for heightened risk for all-cause mortality in older adults [19].

Objective Neighborhood Destinations

This study examined five types of neighborhood destinations (i.e., recreational facilities, utilitarian destinations, temples, schools, and public transportation). The data used for these destinations were obtained from the National Land Surveying and Mapping Center and Ministry of the Interior in Taiwan [20, 21]. Neighborhood destinations were assessed using geographic information systems (GIS) software (ArcGIS Pro; ESRI, Redlands, CA). The sum of each destination was computed for each participant’s geocoded residential neighborhood. Each destination was categorized into “high” and “low” categories according to median value. The following five neighborhood destination types were revealed:

- (a) Recreational facilities: The total number of parks and sports facilities. The sum of recreational facilities was categorized into “high ($N \geq 1$)” and “low ($N = 0$)”.
- (b) Utilitarian destinations: The total number of shops, convenience stores, supermarkets, post offices, libraries, book stores, restaurants, banks, and pharmacies. The sum of utilitarian destinations was categorized into “high ($N \geq 4$)” and “low ($N < 4$)”.

- (c) Temples: The total numbers of temples related to Buddhist, Daoist, and folk religions (churches and chapels were not included). The sum of temples was categorized into “high ($N \geq 2$)” and “low ($N < 2$)”.
- (d) Schools: The total numbers of elementary schools, junior high schools, high schools, colleges, and universities. The sum of schools was categorized into “high ($N \geq 2$)” and “low ($N < 2$)”.
- (e) Public transportation: The total number of stations and bus stops. The sum of public transportation was categorized into “high ($N \geq 12$)” and “low ($N < 12$)”.

Sociodemographic Variables

Participants were asked to report their age, gender, current marital status, living status, educational level, employment status, health behaviors (i.e., smoking status, alcohol consumption, and diet), height, weight (i.e., body mass index (BMI)), and self-rated health.

Statistical Analyses

Data were analyzed from 1,040 respondents who had no missing data. Binary logistic regression models were used to analyze the relationships between the five types of destinations and both physical activity levels and sedentary behaviors for the total sample (adjusted for potential confounders). Likelihood ratio tests were then conducted to examine the interaction terms for the outcome variables (i.e., physical activity and sedentary behavior) between objective neighborhood destinations and gender. The sample was divided according to gender when significant interactions were found. Finally, subgroup analyses were conducted based on gender. Odds ratios and 95% confidence intervals (CIs) were computed for each variable using IBM SPSS 25.0 (significance was set at $P < 0.05$).

Results

Participant Characteristics

Table 1 shows the basic characteristics for the total sample and according to gender. Mean respondent age (SD) was 73.04 (\pm 6.13) years (50.5% were men, 64.3% were aged 65–74 years, 30.6% had tertiary degrees, 10.3% had full-time jobs, 75.9% were married, 85.7% were living with others, 7.0% were current smokers, 9.7% consumed alcohol, 82.3% had healthy diets, 12.3% reported poor health status, and 52.8% were of normal-weight). A total of 79.3% respondents completed at least 150 minutes of weekly physical activity, while 30.9% engaged in daily sedentary behavior for more than eight hours. Chi-square tests revealed that older men were more likely to be married, have full-time jobs, tertiary educations, smoke, and consume alcohol.

Table 1 Characteristics of the study participants (N=1,040)

	Total sample (N=1040)		Older Men (N=525)		Older Women (N=515)		P-value a
	N	%	N	%	N	%	
Age group (years)							0.26
65-74	669	64.3%	329	62.7%	340	66.0%	
75+	371	35.7%	196	37.3%	175	34.0%	
Marital status							< 0.001*
Married	789	75.9%	428	81.5%	361	70.1%	
Unmarried	251	24.1%	97	18.5%	154	29.9%	
Employment status							0.001*
Full-time job	107	10.3%	71	13.5%	36	7.0%	
No full-time job	933	89.7%	454	86.5%	479	93.0%	
Educational level (years)							< 0.001*
<13	722	69.4%	336	64.0%	386	75.0%	
≥13	318	30.6%	189	36.0%	129	25.0%	
Living status							0.83
Alone	149	14.3%	74	14.1%	75	14.6%	
With others	891	85.7%	451	85.9%	440	85.4%	
Current smoking status							< 0.001*
Yes	73	7.0%	66	12.6%	7	1.4%	
No	967	93.0%	459	87.4%	508	98.6%	
Alcohol consumption							< 0.001*
Yes	101	9.7%	89	17.0%	12	2.3%	
No	939	90.3%	436	83.0%	503	97.7%	
Healthy diet							0.04*
Yes	856	82.3%	420	80.0%	436	84.7%	
No	184	17.7%	105	20.0%	79	15.3%	
BMI (kg/m ²)							0.52
Normal weight	549	52.8%	272	51.8%	277	53.8%	
Not normal weight	491	47.2%	253	48.2%	238	46.2%	
Self-rated health							0.07
Good	493	47.4%	266	50.7%	227	44.1%	
Fair	419	40.3%	194	37.0%	225	43.7%	
Poor	128	12.3%	65	12.4%	63	12.2%	
Physical activity							0.49
150+ min/week	825	79.3%	412	78.5%	413	80.2%	
< 150 min/week	215	20.7%	113	21.5%	102	19.8%	
Sedentary behavior							0.35
8+ hours/day	321	30.9%	169	32.2%	152	29.5%	
< 8 hours/day	719	69.1%	356	67.8%	363	70.5%	

a Chi-square tests * p < .05

Objective Neighborhood Destinations Associated with Physical Activity and Sedentary Behavior (Total Sample)

For the total sample, older adults living in neighborhoods with higher numbers of temples were more likely to engage in physical activity adding up to at least 150 minutes/week (OR = 1.71; 95% CI: 1.21–2.41). Older adults living in neighborhoods with greater numbers of utilitarian destinations were more likely to engage in sedentary time lasting more than eight hours/day (OR = 1.48; 95% CI: 1.12–1.95) (Table 2).

Table 2 Associations of objectively-measured neighborhood destinations with physical activity and sedentary behavior in the total sample

	Odds of meeting physical activity recommendation			Odds of excessive sedentary time		
	OR	95%CI	p	OR	95%CI	p
Recreational facilities						
Low	1.00 (ref.)			1.00 (ref.)		
High	1.06	0.77-1.47	0.72	1.32	0.98-1.77	0.07
Utilitarian destinations						
Low	1.00 (ref.)			1.00 (ref.)		
High	1.01	0.74-1.39	0.92	1.48	1.12-1.95	0.006*
Temple						
Low	1.00 (ref.)			1.00 (ref.)		
High	1.71	1.21-2.41	0.002*	1.10	0.76-1.34	0.96
Schools						
Low	1.00 (ref.)			1.00 (ref.)		
High	1.23	0.90-1.68	0.19	1.17	0.89-1.53	0.27
Public transportation						
Low	1.00 (ref.)			1.00 (ref.)		
High	0.91	0.66-1.24	0.54	1.21	0.92-1.59	0.18

Adjusted for gender, age, current marital status, living status, educational level, employment status, smoking status, alcohol consumption, healthy diet, BMI, and self-rated health.

*Statistically significant (p < .05).

Interactions Between Gender and Objective Neighborhood Environment

Significant interactions relating to physical activity were observed between gender and temples ($p=0.03$). Significant interactions relating to sedentary behavior were found between gender and utilitarian destinations ($p=0.04$) (Table 3).

Table 3. Statistical significance of the interactions between gender and variables related to destinations using binary logistic regression models

Objective destinations	neighborhood	P value for interaction term with gender	
		Physical activity p-value	Sedentary behavior p-value
Recreational facilities		0.82	0.15
Utilitarian destinations		0.81	0.04*
Temple		0.03*	0.92
Schools		0.35	0.38
Public transportation		0.72	0.20

Adjusted for age, current marital status, living status, educational level, employment status, smoking status, alcohol consumption, healthy diet, BMI, and self-rated health.

*Statistically significant ($p < .05$).

Objective Neighborhood Destinations Associated with Physical Activity and Sedentary Behavior in Older Men and Women

A gender stratification revealed that neighborhoods with higher numbers of temples were positively associated with the achievement of physical activity recommendations in older men (OR = 1.85; 95% CI: 1.16–2.96). On the other hand, neighborhoods with higher numbers of utilitarian destinations were related to excessive sedentary time in older women (OR = 1.70; 95% CI: 1.12–2.56) (Tables 4 & 5).

Table 4 Associations of the objectively-measured neighborhood destinations with physical activity by gender

	Odds of meeting physical activity recommendation						
	Older men			Older women			
	OR	95%CI	p	OR	95%CI	p	
Temple							
Low	1.00	(ref.)		1.00	(ref.)		
High	1.85	1.16-2.96	0.01*	1.52	0.91-2.54	0.11	

Adjusted for age, current marital status, living status, educational level, employment status, smoking status, alcohol consumption, healthy diet, BMI, and self-rated health.

*Statistically significant ($p < .05$).

Table 5 Associations of the objectively-measured neighborhood destinations with sedentary behavior by gender

	Odds of excessive sedentary behavior						
	Older men			Older women			
	OR	95%CI	p	OR	95%CI	p	
Utilitarian destinations							
Low	1.00	(ref.)		1.00	(ref.)		
High	1.33	0.91-1.97	0.14	1.70	1.12-2.56	0.01*	

Adjusted for age, current marital status, living status, educational level, employment status, smoking status, alcohol consumption, healthy diet, BMI, and self-rated health.

*Statistically significant ($p < .05$).

Discussion

This is the first study to examine a range of objective neighborhood destinations and their relationships with both physical activity levels and sedentary behaviors among older populations in an Asian context. Results revealed that different neighborhood destinations had specific behavioral effects according to gender. This is consistent with previous findings [22]. Our results showed that a higher number of neighborhood temples aided older men in meeting their daily physical activity recommendations, while a greater number of utilitarian destinations was associated with excessive sedentary time in older women. These findings may provide two critical implications for urban policy and planning initiatives designed to promote “Active Aging” in Asian countries. First, neighborhood temples should be considered prominent local destinations for promoting daily physical activity levels for older men. Second, although previous studies have found that utilitarian destinations were related to increased walking time [9, 23] (in the Asian context, see: [24, 25], walking-supportive environmental attributes may increase sedentary behavior for older adults in Asian countries.

This study uniquely found that higher numbers of neighborhood temples were positively associated with older men meeting the recommended 150 minutes of total weekly physical activity. It is traditionally assumed that men and women have distinct gender roles in a number of Asian cultures (e.g., Japanese, Korean, and Chinese). Here, women are more likely to be responsible for housework [26, 27]. On the other hand, older men may have more free time. Here, temples may provide a “Third Place (social surroundings separate from the usual social environments)” [28] in which older men can engage in social events and religious activities in the Taiwanese cultural context. Easy access to neighborhood temples can thus motivate older men to engage in increased physical activity while traveling to these locations from home. Previous studies have found that environmental settings (e.g., shopping malls [29] and parks [30]) can be used for community-level physical activity programs or interventions. Our results also suggest that neighborhood temples can serve as important environmental settings for effective community-based physical activity interventions among older men. In this regard, urban planners in Taiwan may consider how religious spaces can be used to support aging populations.

Contrary to our hypothesis, we also found that neighborhoods with more utilitarian

destinations were associated with excessive sedentary time among older women. This is consistent with previous findings in the Asian context asserting that walkable neighborhood attributes were positively associated with sedentary behaviors [24, 25]. Here, it is possible that neighborhoods with higher numbers of utilitarian destinations reduce the time it takes older women to complete daily errands. Such individuals would thus have increased time to engage in sedentary behaviors. First, these results suggest that the possible negative impacts of favorable neighborhood destinations on sedentary behavior should be considered when planning intervention programs. Second, an increasing number of studies are finding different environmental/behavioral associations between Western and Asian countries. Our results thus suggest the importance of further examining these relationships in the Asian context.

This study had several limitations. First, it employed a cross-sectional design that may have limited the causal inferences between neighborhood destinations and active/sedentary behaviors among older adults. Second, respondents self-reported their physical activities and sedentary behaviors. Responses were thus subject to recall bias. Further studies should thus attempt to objectively measure these factors among older adults. Finally, older adults in Taiwan may be reluctant to report their exact residential addresses [24]. The neighborhood destinations used in this study were thus obtained according to participant residential neighborhood rather than exact residential addresses. Nevertheless, residential neighborhood units have widely been used as validated geographic areas when measuring walkability attributes [31].

Conclusions

Gender is a potential moderator between neighborhood destinations and physical activity/sedentary behavior among older adults. In Asia, conveniently located neighborhood temples may support older men in reaching their daily physical activity requirements, while utilitarian destinations (which have previously been found as activity-supportive attributes) may be related to excessive sedentary behavior among older women.

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科技部補助研究計畫加值國際合作成果報告

日期：109年10月24日

計畫編號	MOST 107-2410-H-003-117-MY2		
計畫名稱	中文：活躍老化:設計動態的支持性環境-韓國與臺灣的跨國研究 英文： Designing activity-supportive environment for Active Living among older adults: an international study across Korea and Taiwan		
計畫主持人姓名	廖甯	服務機構及職稱	Department of Health Promotion and Health Education, National Taiwan Normal University
外國合作對象姓名	Jong-Hwan Park	服務機構及職稱	Institute of Convergence Bio-Health, Dong-A University
合作研究期間	2019年1月1日至 2020年7月31日	合作國家	韓國
合作研究性質	<input checked="" type="checkbox"/> 分工收集研究資料 <input type="checkbox"/> 共同執行理論建立模式並驗證 <input type="checkbox"/> 元件或產品分工研發 <input type="checkbox"/> 其他 (請填寫) _____		
	<input type="checkbox"/> 交換分析實驗或調查結果 <input checked="" type="checkbox"/> 共同執行歸納與比較分析		

一、 執行國際合作研究過程

感謝科技部補助研究計畫加值國際合作，本計畫於2019年1月1日開始執行國際合作，期間研究主持人於1月份及5月份兩次造訪韓國釜山，結合本學系碩士班及師大運動與休閒學院的樂活EMBA海外課程，同時進行國際合作的討論，包含初步確立雙方的調查題項、調查方法及預計取得的資料。於計畫執行期間內，台灣方面共取得126位社區高齡者的客觀環境(運用地理資訊系統、walk score)及客觀身體活動量(運用三軸加速規測量)的資料、以及1,068筆全國高齡者的客觀環境(運用地理資訊系統、walk score)及主觀身體活動量資料(國際身體活動量表-台灣版)；而韓國部分共蒐集到3,000筆具全國代表性的高齡者的客觀環境(運用地理資訊系統、walk score)及主觀身體活動量資料(國際身體活動量表-韓國版)。而韓國的研究合作

對象 Jong-Hwan Park 博士，也於 2019 年 6 月來台針對資料的分析、文章主題方向和寫作分工進行討論。而原訂 2020 年 Park 教授訪台的規劃，由於新冠肺炎疫情的影響，無法來台，最後改由多次線上會議討論的方式進行。

二、 主要研究成果

本次科技部補助研究計畫加值國際合作的主要成果為，雙方已共同合作完成了六篇 SCI/SSCI 的研究文章，其中四篇文章已經順利刊登、一篇文章正在審查中，另外由於韓國方面的地理資訊資料處理時間耗時較久，目前有兩篇文章正在準備中，預計於 2021 年進行投稿。茲將各篇文章之重要發現陳述如下：

1. 運用社區高齡者調查資料所發表之文章：

- (1) Chen BI, Hsueh MC, Rutherford R, **JH Park***, **Liao Y***. The associations between neighborhood walkability attributes and objectively measured physical activity in older adults. PLoS One 2019. 14(9): e0222268 (SCI) [2019 Impact factor: 2.74] 已刊登

本研究運用地理資訊系統所測量之五項環境指標以及三軸加速規測量之五項身體活動指標進行探討，研究結果發現居住在人行道可及性較佳的社區環境與高齡者的每日步數具有正向的關聯性 ($\beta = 0.165$)。此研究提供實證證據顯示，高齡者居住在人行道可及性高的社區環境中，有助於其每日步數的累積。

- (2) Chang SH, Rutherford R, Hsueh MC*, **Park JH***, Wang S, **Liao Y**. Neighborhood walkable attributes and objectively-measured sedentary behavior in older adults: A cross-sectional study. Frontiers in Public Health (SSCI) [2019 Impact factor: 2.48] 第一輪審查意見回覆中

本研究運用地理資訊系統所測量之五項環境指標以及三軸加速規測量之靜態行為型態進行探討，研究結果發現人行道的可及性與較少的 ≥ 30 分鐘的久坐次數 ($\beta = -0.185$)、 ≥ 30 分鐘久坐的總時間 ($\beta = -0.180$) 具有負向的關聯性。此研究結果顯示，高齡者居住在人行道可及性較佳的社區，除上述研究所提及的較高的每日步數外，且有助於減少其長時間久坐的次數與時間。

2. 運用全國高齡者調查資料所發表之文章：

- (1) **Liao Y**, Lin CY, Lai TF, Chen YJ, Kim BY, **Park JH***. Walk Score® and Its Associations with Older Adults' Health Behaviors and Outcomes. International Journal of Environmental Research and Public Health. 2019; 16(4). pii: E622. (SSCI) [2019 Impact factor: 2.84] 已刊登

本研究探討客觀環境宜走性指標-Walk Score® 與台灣高齡者健康行為與結果之關聯性，研究發現居住在高宜走性的地區的高齡者，有較長時間的靜態及電視觀賞行為，此發現與西方國家相異，為未來高齡健康促進以及設計行為改變方案需特別注意的議題。

- (2) Lin CY#, **Park JH#**, Hsueh MC, Lai TF, **Liao Y***. Are Area-Level Crimes Associated with Older Adults' Physical Activity and Sedentary Behavior? Sustainability. 2019, 11, 2454. (SSCI) [2019 Impact factor: 2.57] 已刊登

本研究探討客觀測量的區域犯罪事件（運用內政部犯罪統計資料）與高齡者的主觀身體活動量與靜態時間的關聯性，研究結果發現高齡者居住在有較高毒品犯罪、竊盜犯罪事件的區域較不容易達到身體活動建議量，且較容易會有過長的靜態時間。此發現指出，區域犯罪事件的防範也可為促進高齡者的身體活動量與減少靜態時間的策略之一。

- (3) **Park JH**, Song SH, Park JH, Lai TF, **Liao Y***. Which neighbourhood destinations matters in the Asia context? The role of destinations in older adults' physical activity and sedentary behaviours. BioMed Research International 2020 :8432934 (SCI) [2019 Impact factor: 2.27] 已刊登

本研究主要運用地理資訊系統計算五種不同類型的目的地型態（休閒設施、使用性目的地、大眾運輸工具、廟宇及學校），探討其與問卷測量之身體活動量、靜態時間之關聯性。研究結果發現，研究結果發現居住在村里中有較多廟宇的高齡男性，有較高的可能性達到身體活動建議量 (OR = 1:85)；而居住在有較多使用性目的地（如銀行、郵局）的高齡女性，較容易從事過長的靜態時間 (OR = 1:70)。研究提供實證證據顯示，社區廟宇可能對於高齡男性從事身體活動扮演著支持的角色，反之，社區中有較多的使用性目的地也許對於高齡女性過多的靜態行為具有正向的關聯性。

三、 雙邊研究人員交流成果

(一) 外國學者來台研究：

學者姓名	Jong-Hwan Park	服務機構 及職稱	Institute of Convergence Bio-Health, Dong-A University
國籍	韓國	來臺時間	108 年 5 月 31 日至 108 年 6 月 2 日
來訪目的 (可複選)	<input type="checkbox"/> 技術指導 <input type="checkbox"/> 實驗設備設立 <input checked="" type="checkbox"/> 計畫諮詢/顧問 <input type="checkbox"/> 學術演講 <input type="checkbox"/> 國際會議主講員 <input checked="" type="checkbox"/> 其他 <u>資料蒐集、分析及投稿文章討論</u>		
成果說明	討論台灣和韓國資料的運用及撰寫方向，以實證研究，找出動態的支持性環境，以利未來政策與環境規劃。		

四、 本項加值國際合作對原專題計畫產生之影響及貢獻

原專題計畫主要目的為探討「高齡者環境因素與步行行為」的關聯性，在此基礎上更進一步延伸成臺灣及韓國的跨國研究調查，除探討高齡者的步行行為外，更廣泛調查高齡者的身體活動 (physical activity)與靜態行為 (sedentary behavior)，以期研究成果能提供公部門設計動態支持性環境的參考，且達到「活躍老化」之目標。本計畫產生之影響與貢獻在於 (1) 取得高齡者環境因素與動、靜態行為之跨國研究資料：臺韓計畫主持人能有技術及工具上之互補及交流 (如：臺灣計畫之協同主持人能提供地理資訊系統的專業技能指導；韓國計畫主持人能提供 ActiGraph GT3X 之工具協助)，且有利於臺韓跨國研究合作文章的進行，為本次加值計畫提供加乘效果。

五、 國際合作具體成效(如共同發表論文、技術創新、社會經濟效益及人才培育等)

關於本次科技部補助研究計畫加值國際合作的國際影響力綜述如下，就學術合

作部分，加值計畫所提供之資源增加了許多雙方的合作機會，包括共同發表 4 篇論文（1 篇審查中、2 篇準備中）、創新科技交流（如 VR 運用於失智預防、體感式健康促進器材）、以及促進雙方學校與系所的連結（國立臺灣師範大學與韓國東亞大學、國立釜山大學間的交流）；而就人才培育部分，本計畫也提供了培養年輕學者（如發表文章中共同作者中的台灣和韓國碩博士生共 11 人次參與投稿文章）進行跨國研究的機會。

六、建議

無。

107年度專題研究計畫成果彙整表

計畫主持人：廖邕		計畫編號：107-2410-H-003-117-MY2			
計畫名稱：促進高齡者從事步行行為之主客觀環境策略：地理資訊系統之運用					
成果項目		量化	單位	質化 (說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等)	
國內	學術性論文	期刊論文	1	篇	賴鼎富、黃翊軒*、林倩宇、廖邕 (2019)。Walk Score®作為宜走性環境測量工具之效度檢驗。台灣衛誌，第38卷4期：445-452。
		研討會論文	0		
		專書	0	本	
		專書論文	0	章	
		技術報告	0	篇	
		其他	0	篇	
國外	學術性論文	期刊論文	5	篇	<p>1. Park JH, Song SH, Park JH, Lai TF, Liao Y*. Which neighbourhood destinations matters in the Asia context? The role of destinations in older adults' physical activity and sedentary behaviours. <i>BioMed Research International</i> 2020 :8432934 (SCI) [2019 Impact factor: 2.27, 92/156 in <i>Biotechnology & Applied Microbiology</i>]</p> <p>2. Liao Y, Lin CY*, Park JH*. Is motorcycle use associated with unhealthy lifestyles? Findings from Taiwan. <i>Journal of Transport and Health</i>. 2019, 15, 100659. (SSCI) [2019 Impact factor: 2.41, 45/170 in <i>Public, Environmental & Occupational Health</i>]</p> <p>3. Chen BI, Hsueh MC, Rutherford R, JH Park*, Liao Y*. The associations between neighborhood walkability attributes and objectively measured physical activity in older adults. <i>PLoS One</i> 2019. 14(9): e0222268 (SCI) [2019 Impact factor: 2.74, 27/71 in <i>Multidisciplinary Sciences</i>]</p> <p>4. Lin CY#, Park JH#, Hsueh MC, Lai TF, Liao Y*. Are Area-Level Crimes Associated with Older Adults' Physical Activity and Sedentary Behavior? <i>Sustainability</i>. 2019, 11,</p>

					2454. (SSCI) [2019 Impact factor: 2.57, Rank 53/123 in Environmental studies] 5. Liao Y, Lin CY, Lai TF, Chen YJ, Kim BY, Park JH*. Walk Score® and Its Associations with Older Adults' Health Behaviors and Outcomes. International Journal of Environmental Research and Public Health. 2019; 16(4). pii: E622. (SSCI) [2019 Impact factor: 2.84, 32/170 in Public, Environmental & Occupational Health]
		研討會論文	1		Liao Y, Park JH. Are area-level crimes associated with older adults' physical activity and sedentary behavior? 24st Annual Congress of the European College of Sport Science. July 2019, Prague. Czech Republic
		專書	0	本	
		專書論文	0	章	
		技術報告	0	篇	
		其他	0	篇	
參與計畫人力	本國籍	大專生	0	人次	
		碩士生	4		協助資料蒐集、統計分析，成果撰寫等相關事宜。
		博士生	0		
		博士級研究人員	0		
		專任人員	0		
	非本國籍	大專生	0		
		碩士生	0		
		博士生	0		
		博士級研究人員	0		
		專任人員	0		
其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)					

科技部補助自由型國際合作加值(MAGIC)成果彙整表

計畫主持人：廖邕	計畫編號：107-2410-H-003-117-MY2
計畫名稱：促進高齡者從事步行行為之主客觀環境策略：地理資訊系統之運用	計畫執行機構：國立臺灣師範大學健康促進與衛生教育學系（所）

一、對臺灣國際學術能見度之提昇

項目	人/次	重要國際學術成就	補充資料
參與國際學會		擔任國際學會指導委員會委員	
		擔任國際學會重要委員	
參與國際學術期刊重要職務		擔任國際學術期刊審查委員	
		擔任國際學術期刊編輯委員	
參與國際學術會議籌備		擔任國際學術會議召集人	
		擔任國際學術會議籌備委員	
		擔任國際會議專題演講人 (invited speaker)	
參與大型國際計畫		成功參與歐盟計畫	
		成功參與 NSF 計畫	
		成功參與其他大型國際計畫	
參與國際研究中心		擔任國際研究中心審查委員	
邀請國際重要學者來訪		諾貝爾獎級得主	
		國家院士	
		世界百大大學校長	

註1. 補充資訊請述明參與學會、期刊、會議、計畫、中心之名稱；或邀請學者之資訊。

二、執行國際合作加值之雙邊交流

項目	人/次	雙邊交流互訪	補充資料
計畫主持人互訪	1	國外學者訪台	Jong-Hwan Park 討論台灣和韓國資料的運用及撰寫方向，以實證研究，找出動態的支持性環境，以利未來政策與環境規劃。
		臺灣學者出訪	
年輕學者交流		國外博士後來台研修	
		臺灣博士後出國研修	
		國外博士生來台研修	
		臺灣博士生出國研修	

註2. 補充資訊請述明來訪學者之國家、單位，以及出訪國家、單位等資訊。

三、學術研究及技術發展表現

項目	人/次	成果類型	補充資料
共同發表	4	學術期刊論文	(1)Chen BI, Hsueh MC, Rutherford R, JH Park*, Liao Y*. The associations between neighborhood walkability attributes and objectively measured physical activity in older adults. PLoS One 2019. 14(9): e0222268 (SCI) [2019 Impact factor: 2.74] 已刊登 (2) Liao Y, Lin CY, Lai TF, Chen YJ, Kim BY, Park JH*. Walk Score® and Its Associations with Older Adults' Health Behaviors and Outcomes. International Journal of Environmental Research and Public Health. 2019; 16(4). pii: E622. (SSCI) [2019 Impact factor: 2.84] 已刊登 (3) Lin CY#, Park JH#, Hsueh MC, Lai TF, Liao Y*. Are Area-Level Crimes Associated with Older Adults' Physical Activity and Sedentary Behavior? Sustainability. 2019, 11, 2454. (SSCI) [2019 Impact factor: 2.57] 已刊登 (4)Park JH, Song SH, Park JH, Lai TF, Liao Y*. Which neighbourhood destinations matters in the Asia context? The role of destinations in older adults' physical activity and sedentary behaviours. BioMed Research International 2020 :8432934 (SCI) [2019 Impact factor: 2.27] 已刊登
		學術研討會論文	
		專書論文	
		專書	
技術開發		共同申請專利	
		技術移轉	

註3. 補充資訊請述明學術期刊、研討會及專書名稱；或專利申請國家、申請案號；或技術移轉廠商等資訊。

四、合作研究成果之國際影響力綜述

關於本次科技部補助研究計畫加值國際合作的國際影響力綜述如下，就學術合作部分，加值計畫所提供之資源增加了許多雙方的合作機會，包括共同發表4篇論文（1篇審查中、2篇準備中）、創新科技交流（如VR運用於失智預防、體感式健康促進器材）、以及促進雙方學校與系所的連結（國立臺灣師範大學與韓國東亞大學、國立釜山大學間的交流）；而就人才培育部分，本計畫也提供了培養年輕學者（如發表文章中共同作者中的台灣和韓國碩博士生共11人次參與投稿文章）進行跨國研究的機會。

註4. 本表將做為日後複審或再申請計畫核定時之參考。