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Hilly environment and frequency of going outof-home among older adults: Examining moderating effect of driving status

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Running head: Hilly environment and going out-of-home

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1

Abstract

2	Aim: The health benefits of "going out-of-home" frequently among older adults are well
3	known. A hilly environment would inhibit this habit. This study examined (1) longitudinal
4	associations between a hilly environment and the frequency of going out-of-home and (2) the
5	moderating effect of driving status on their association among older adults.
6	Methods: This study involved a longitudinal study design. Data on 856 older adults in Nada
7	Ward, Kobe, Japan, was obtained from a three-wave questionnaire survey (Wave 1: December
8	2017 to January 2018; Wave 2: after one year; Wave 3: after three years). In each survey, the
9	frequency of going out-of-home time was measured. The average land slope within 500m
10	network buffers of each participant's home was calculated as the index of the hilly
11	environment. Driving status was also measured.
12	<i>Results</i> : The latent growth model revealed that while a higher average land slope was not
13	significantly associated with changes in the frequency of going out-of-home over time, it was
14	significantly associated with a lower frequency of going out-of-home at the initial level. The
15	interaction term in the latent growth model showed that driving status did not moderate the
16	associations of the average land slope with the initial level of, and changes in, the frequency
17	of going out-of-home.
18	Conclusions: Although it remains unclear whether a hilly environment would accelerate a
19	decline in the frequency of going out-of-home over time, this study found that older adults
20	living in a hilly environment were less likely to leave their homes.
21	Keywords: aged; environmental design; geographic information systems; homebound persons;
22	public health
23	
24	Introduction
25	The health benefits of leaving home during the day (or "going out-of-home") more

26 frequently among older adults are well known. The concept of going out-of-home is similar to 27 the notions of homebound status and life-space mobility. Homebound status generally represents the status in which older adults rarely go out-of-home [1]. Life-space mobility 28 29 captures the frequency of going to various life spaces [2]. Along with "going out-of-home," 30 the term "going outdoors" has been commonly used. Going out-of-home is associated with 31 numerous health outcomes [3-5]. Thus, implementing effective strategies that encourage older 32 adults to go out-of-home is important for promoting their health. To establish such strategies, 33 identifying the determinants of the frequency of going out-of-home among them is essential. 34 The frequency of going out-of-home among older adults is determined by 35 environmental factors. The ecological model of health behavior [6] proposes that multi-level 36 factors are correlated with health behaviors. In particular, the ecological model underscores 37 the importance of environmental factors [6]. The frequency of going out-of-home and 38 homebound status are determined by environmental factors such as social networks [7], 39 barriers upon entry to the home [8], mixed land use in neighborhoods [9], distance to retail 40 stores [10], and perceived accessibility to parks [11]. 41 In addition, a hilly environment would also determine the frequency of going out-of-42 home among older adults. Walking in a hilly environment entails exerting more physical 43 effort—including energy expenditure [12] and muscle activities [13]—than traversing a flat 44 environment. Thus, a hilly environment might inhibit older adults from going out-of-home frequently. The undesirable influences of a hilly environment indicate that more intensive 45 46 support to promote going out-of-home should be provided to older adults living in such a 47 landscape. Physical activity studies [14-16] imply that older adults living in a hilly 48 environment are less likely to engage in physical activity. Since going out-of-home is 49 associated with physical activity [17], a hilly environment would also influence the frequency 50 of going out-of-home among older adults. However, few previous studies have examined the

associations between a hilly environment and the frequency of going out-of-home in thispopulation.

53 To better understand the influences of a hilly environment on the frequency of going 54 out-of-home among older adults, it is helpful to explore moderators (effect modifiers). Moderators signal who may be more susceptible to the influences of a hilly environment 55 56 compared to others. Driving status would be one moderator. It is reasonable to assume that 57 traveling by car in a hilly environment requires less physical effort than walking and cycling, 58 and that the undesirable effects of a hilly environment on the frequency of going out-of-home 59 might be more relevant among non-drivers than drivers. Physical activity studies denote that 60 driving status can moderate associations between the environment and physical activity 61 among older adults [18-20]. However, these studies investigated the moderating effects of 62 driving status in relation to other environmental factors.

63 The present study aimed to explore (1) longitudinal associations between a hilly environment and the frequency of going out-of-home and (2) the moderating effect of driving 64 65 status on their associations among older adults. We employed a latent growth model—a 66 statistical methodology of structural equation modeling-to analyze longitudinal data. The 67 latent growth model can specify and treat the initial status of frequency of going out-of-home 68 and the longitudinal change of it, separately. By employing this model, we posited that a hilly 69 environment would be associated with a lower frequency of going out-of-home at the initial 70 level (Hypothesis 1A) and would accelerate declines in its frequency over time (Hypothesis 71 1B). For the second purpose, the study conjectured that the associations of a hilly 72 environment with the initial level of, and changes in, the frequency of going out-of-home 73 would be more relevant among non-drivers than among drivers (initial level: Hypothesis 2A; 74 change: Hypothesis 2B).

Methods

75

76 **Participants and procedures (Figure 1)**

77 The present study analyzed data obtained from a three-wave questionnaire survey by postal mail. The survey targeted older adults living in Nada Ward in the city of Kobe, Hyogo 78 79 Prefecture. Nada Ward is a typical urban area in Japan. Since Nada Ward is at the base of Mt. 80 Rokko and adjacent to the sea, it has both hilly and flat areas. From the official register of 81 residents of Nada Ward, the survey identified all men who were 64, 69, and 74 years old on 82 the first day of April 2017 (n=2,204), as well as their wives, whose age was within 10 years of 83 the men's age (n=1,516). At the baseline (December 2017 to January 2018: Wave 1), the 84 survey asked these 3,720 individuals to answer the questionnaire, and 1,784 individuals 85 responded. Among them, 1,079 agreed to have further contact with our research group. After 86 one year from the baseline (Wave 2), the survey asked 1,079 individuals to answer a one-year 87 follow-up survey, and 919 individuals responded. After three years from the baseline (Wave 88 3), the survey asked 1,079 individuals to answer a three-year follow-up survey, and 854 89 individuals responded.

In this study, among the 1,784 respondents of Wave 1, 928 were excluded from the
analyses due to the reasons shown in Figure 2. Thus, the present study scrutinized the data of
856 individuals.

We implemented the survey as part of a larger research project. We have already
published one paper [21] and submitted several other papers using the data from the survey.
None of the other papers analyzed a hilly environment.

Written informed consent was obtained from all participants. The survey received
approval from the Ethics Committee of the Graduate School of Human Development and
Environment at Kobe University (No. 549-2). All procedures were conducted in accordance
with the principles of the Declaration of Helsinki.

100 Measures

101 Frequency of going out-of-home

102	Each wave of the survey asked respondents to indicate the frequency of going out of
103	the house on usual non-working days (except for checking the mailbox and taking out the
104	garbage) from five choices: almost every day; once every 2-3 days; once every 4-5 days; once
105	every 6–7 days; and hardly ever. Similar to a previous study [5], to convert weekly
106	frequencies and treat frequency as a continuous variable, the present study coded the choice of
107	almost every day as 7, once every 2-3 days as 2.8, once every 4-5 days as 1.55, once every 6-
108	7 days as 1.08, and <i>hardly ever</i> as 0, respectively.
109	Average land slope
110	Similarly to previous physical activity studies [14-16], the present investigation
111	measured the average land slope as the index of a hilly environment. Using geographic
112	information systems (ArcGIS for Desktop 10.5 Network Analyst and Spatial Analyst; ESRI
113	Japan Corporation), the current study calculated the average land slope within 500m network
114	buffers of each respondent's home. Physical activity studies have commonly employed 400-
115	500 m or 800–1000 m buffer sizes [22]. We selected 500 m buffer because the hilliness
116	around the home would be much more relevant to older adults' decision to go out than the
117	hilliness at a 800–1000 m distance. Digital Elevation Model 5 m Grid, provided by the
118	Geospatial Information Authority of Japan, and ArcGIS Geo Suite Road Network data (2019),
119	provided by ESRI Japan Corporation, were utilized to calculate it.
120	Driving status
121	Similarly to a prior study [20], the survey at Wave 1 asked the respondents whether
122	they usually drove a car and/or motorbike by themselves (yes or no).
123	Demographic factors

124The present study explored the data of age, gender (*male/female*), education level125(*junior to high school/more than high school*), living alone (*yes/no*), employment status

126 (yes/no), perceived household economic status (a five-point Likert scale from 1 = very poor to 127 5 = very good, and frailty (ves/no) as demographic factors at Wave 1. The survey measured 128 education level by four options: junior school or junior high school; high school; 2-year 129 college or vocational school; and 4-year college. For convenience of analysis, we 130 dichotomized the educational level to treat the ratio of each sample size as equal. The Kihon 131 Checklist [23, 24] was utilized to evaluate frailty. This checklist has 25 items, and the 132 sensitivity and specificity to screen for frailty by cut-off point as 7/8 are 89.5% and 80.7%, 133 respectively [24].

134 Analyses

135 For the main analyses, the present study conducted latent growth modeling (Figure 136 2). Latent growth modeling estimated the intercept (the initial level) and slope (longitudinal 137 change over time) of the frequency of going out-of-home. The factor loading for the slope 138 was set as 0, 1, and 3 for Wave 1, Wave 2, and Wave 3, respectively. In Model 1, the current 139 study investigated the paths from the average land slope to the intercept and the slope of the 140 frequency of going out-of-home. In Model 2, the paths from driving status at Wave 1 and the 141 paths from the interaction term of driving status with the average land slope were added. In 142 Model 3, the paths from demographic factors at Wave 1 were added. Corresponding models 143 included the correlations among the average land slope, driving status, the interaction term, 144 and demographic factors. The average land slope was mean-centered prior to create the 145 interaction term. If the path from the average land slope to the intercept of the frequency of 146 going out-of-home and the path from it to the slope of the frequency of going out-of-home 147 were negative and significant in all models, Hypotheses 1A and 1B would be supported, 148 respectively. If the path from the interaction term to the intercept of the frequency of going 149 out-of-home and the path from the interaction term to the slope of it were positive and 150 significant in both models 2 and 3, Hypotheses 2A and 2B would be supported, respectively.

151 The present study also conducted multi-group modeling to improve the robustness of 152 the findings for the moderating effect of driving status. First, the study developed the 153 unconstrained model, which did not have any equality constraints for the parameters between 154 non-drivers and drivers. Next, the study developed constrained models, which treated the path 155 coefficients from the average land slope to the intercept and the slope of the frequency of 156 going out-of-home as equal between non-drivers and drivers. The current study compared the 157 model fit indices of the unconstrained and constrained models. If the chi-square of the model 158 with an equality constraint on the path to the intercept of going out-of-home was significantly 159 different from the unconstrained model, and the other model fit indices of the constrained 160 model were worse than the unconstrained model, Hypothesis 2A would be supported. In the 161 same vein, if the chi-square of the model with an equality constraint on the path to the slope 162 was significantly different from the unconstrained model, and the other model fit indices of 163 the constrained model were worse, Hypothesis 2B would be supported. Both the 164 unconstrained and constrained models included paths from demographic factors to the 165 intercept and the slope of the frequency of going out-of-home. 166 The missing data were handled using full information maximum likelihood 167 estimation. The model fit indices were the chi-square, the comparative fit index (CFI), the 168 Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and 169 Akaike's information criterion (AIC). IBM SPSS AMOS 25.0 was utilized to develop both 170 models. Statistical significance was set at p < 0.05. 171 Results

172 The characteristics of the participants at Wave 1

173 Compared with individuals excluded from the analyses (Table 1), those included 174 were more likely to be younger, to have a higher education level, to live with others, to 175 perceive their household economic status as good, to be in a non-frail state, to drive cars 176 and/or bikes, and to go out-of-home more frequently.

177 Longitudinal associations of the average land slope and driving status with the frequency 178 of going out-of-home

The mean frequencies of going out-of-home per week at Wave 1 (*n*=842) were 5.3 days (SD, 2.4 days), Wave 2 (*n*=768) were 5.3 days (SD, 2.3 days), and Wave 3 (n=716) were 5.2 days (SD, 2.4 days), respectively.

In the latent growth model (Table 2), since the intercept variances were statistically significant in all models (p<0.001), individual variabilities were relevant for the initial level of frequency of going out-of-home. In contrast, the slope mean (p=0.099–0.860) and slope variance (p=0.083–0.114) of the frequency of going out-of-home were insignificant, indicating that the frequency did not change significantly across the waves, and the individual

187 differences of its change were limited.

188 Across all models, the path from the average land slope to the intercept of the

189 frequency of going out-of-home was negative and significant (Table 2;-0.05 to -0.07

190 [p=0.010-0.038]). However, the path from average land slope to the slope of the frequency of

191 going out-of-home was insignificant (-0.01 to $0.00 \ [p=0.510-0.824]$). All paths from the

192 interaction term to the intercept (Model 2, 0.03 [p=0.456]; Model 3, 0.02 [p=0.588]) and slope

193 of its frequency were insignificant (Model 2, 0.00 [*p*=0.821]; Model 3, 0.00 [*p*=0.824]). Thus,

194 Hypotheses 1B, 2A, and 2B were not supported, whereas Hypothesis 1A was supported.

The multi-group modeling showed that the chi-squares of the constrained models (p=0.667-0.911) were not significantly different from the unconstrained model, and that the AIC of the constrained models (AIC=283.02-285.02) was better than that of the unconstrained model (AIC=286.84; Table 3). Thus, Hypotheses 2A and 2B were not supported.

199

200

Discussion

As Hypothesis 1A was supported, the present study found that a higher average land

201 slope was associated with a lower frequency of going out-of-home at the initial level among 202 older adults. However, since Hypothesis 1B was not supported, it was not associated with 203 changes in the frequency of going out-of-home over time among older adults. These findings 204 indicate that a hilly environment inhibits older adults from going out-of-home frequently, 205 although it would not accelerate the decline in the frequency of going out-of-home over time. 206 While previous studies have reported that certain environmental factors are associated with 207 going out-of-home among older adults [7-11], they have not examined a hilly environment. 208 The current study advances our understanding of the environmental determinants of the 209 frequency of going out-of-home. The finding regarding the association of a hilly environment 210 with a lower frequency of going out-of-home is consistent with the results of previous physical activity studies [4-16]. Regarding the potential mechanisms for their association at 211 212 the initial level, traversing a hilly environment would require more effort than traveling in a 213 flat environment; thus, older adults living in a hilly environment might refrain from going 214 out-of-home frequently. For the null association of a hilly environment with changes in the 215 frequency of going out-of-home over time, the insignificance of the slope mean and the slope 216 variances in the latent growth modeling suggests that the habit of going out-of-home was 217 stable, and that most respondents did not change their habit across the three-year period of the 218 study. A more stable habit might lead to the null association of a hilly environment with 219 changes in the frequency of going out-of-home. In other words, more observations longer 220 than three years might be more desirable for detecting the influence of a hilly environment on 221 changes in the frequency of going out-of-home.

Since hypotheses 2A and 2B were not supported, the moderating effect of driving status was not revealed in the present study. This finding indicates that a hilly environment would influence the initial level of the frequency of going out-of-home, regardless of older adults' driving status. One potential reason for its insignificant moderating effect might be 226 because driving in a hilly environment requires more psychological effort than driving in a flat environment [25], and walking in a hilly environment requires more physical effort [12, 227 228 13] than walking in a flat environment. The other reason might be that a considerable number 229 of drivers in urban areas commonly use the public transportation system, instead of using 230 private cars. The present study did not measure the usage frequencies of public transportation 231 and private cars, and a lack of them would influence the null-results. The current study does 232 not align with the research trends of physical activity studies, which have shown the 233 moderating effect of driving status [18-20]. Thus, more extensive studies are essential to 234 confirm the moderating effect of driving status on the relationship between a hilly 235 environment and the frequency of going out-of-home.

236 One strength of this study is its longitudinal design with three waves. However, the 237 current study also has some limitations. First, the study has selection bias. The study analyzed 238 data obtained from one urban city. Moreover, the participants excluded from this study, based 239 on the criteria, were less likely to go out-of-home frequently than the participants included. 240 Referring to Japanese nationwide data [26] of the frequency of going out-of-home (5.0 days 241 per week, on average, among Japanese adults aged 65 to 74), the included participants (5.3 242 day per week, on average) would be more biased than the excluded participants (4.9 day per 243 week, on average). The excluded participants might also be at higher risks for health 244 problems. Selection bias weakens the generalizability (external validity) of the findings. There 245 is a possibility that Hypotheses 2A and 2B will be observed if the selection bias is weakened. 246 Further studies with lower selection bias are necessary. Second, the study measured the 247 frequency of going out-of-home via a questionnaire only. Measuring the frequency of going 248 out-of-home through diaries [19] or a global positioning system [5, 9] would provide more 249 accurate data. Third, as mentioned above, more long-term observations would be better for 250 detecting changes in the frequency of going out-of-home over time. Finally, we did not

251	consider walkable distance and other environmental factors as potentially important
252	confounders. Although walkable distance is associated with frequency of going out-of-home,
253	car use, and land slope among older adults [27], we did not measure it. Environmental factors
254	such as population density, the accessibility of public transportation, and mixed land use
255	might also be confounders. We plan to report the relative influences of these environmental
256	factors on the frequency of going out-of-home in another paper.
257	As for the practical implications of the findings, older adults living in a hilly
258	environment would be a high-priority group for providing interventions to promote going out-
259	of-home. Previous studies have reported several intervention programs such as an
260	intergenerational volunteer program [28], a community-based educational program [29], and a
261	self-monitoring program [30], which can encourage going out-of-home among older adults.
262	These programs should preferentially be provided to older adults living in a hilly
263	environment.
264	
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273	Disclosure statement
274	The authors declare no conflict of interest.
275	

276		Data availability statement
277	The	e data supporting the findings of this study are available from the corresponding author
278	upo	n reasonable request.
279		
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377	Figure captions
378	Figure 1. Flowchart of the participants and procedure
379	Figure 2. Conceptual diagram of latent growth modeling for the associations of average land
380	slope and driving status with the frequency of going out-of-home. This conceptual diagram
381	corresponds to the results presented in Table 2. The intercept and slope of frequency of going
382	out-of-home represents the initial level of and longitudinal change in its frequency,
383	respectively. If the paths from average land slope to the intercept and slope of frequency of
384	going out-of-home were negative and significant, Hypotheses 1A and 1B would be supported,
385	respectively. If the paths from the interaction terms of driving status with average land slope
386	to the intercept and slope of the frequency of going out-of-home were positive and significant,
387	Hypotheses 2A and 2B would be supported, respectively. The demographic factors were age,
388	gender, education level, living alone, employment status, perceived household economic
389	status, and frailty. Driving status (no=0, yes=1), gender (male=0, female=1), education level
390	(junior to high school =0, more than high school=1), living alone (no=0, yes=1), current
391	employment (no=0, yes=1), and frailty (no=1, yes=1) were dummy variables. Cross-sectional
392	correlations among the demographic factors were included in the model.

Table 1. The characteristics of the participants in Wave 1

	Excluded from analyses		Included in analyses		
-		M (SD) or %	n	M (SD) or %	<i>p</i> -value
Age (years), M (SD)	928	68.4 (4.1)	856	67.8 (4.3)	0.008 †
Gender (female), %	928	39.1%	856	40.5%	0.540‡
Education level (more than high school), %		42.3%	853	53.3%	<0.001‡
Perceived household economic status (score, 1-5), M (SD)		2.8 (0.9)	855 3.1 (0.9)		<0.001 †
Living alone (yes), %	916	8.8%	850	6.2%	0.039‡
Employment status, (yes), %	865	44.9%	824	49.4%	0.062‡
Frailty (yes), %	883	14.5%	848	7.9%	<0.001‡
Driving status (yes), %	908	45.3%	856	55.8%	<0.001‡
Average land slope (degrees), M (SD)	928	5.6 (4.2)	856	5.9 (4.2)	0.083†
Frequency of going out-of-home (days per week), M (SD)	894	4.9 (2.5)	842	5.3 (2.4)	0.001 †

†t-test, *‡chi-square test*

The sample size of each variable varies due to missing values.

	Model 1		Model	2	Model 3		
	Estimate (SE)	<i>p</i> -value	Estimate (SE)	<i>p</i> -value	Estimate (SE)	<i>p</i> -value	
Mean and variance of the frequency of going out-of-home (days per week)						
Intercept mean	5.29 (0.08)	<0.001	5.22 (0.12)	<0.001	4.35 (1.47)	0.003	
Intercept variance	2.78 (0.28)	<0.001	2.78 (0.28)	<0.001	2.70 (0.27)	<0.001	
Slope mean	-0.05 (0.03)	0.099	-0.07 (0.05)	0.136	-0.11 (0.60)	0.860	
Slope variance	0.15 (0.09)	0.114	0.15 (0.09)	0.105	0.16 (0.09)	0.083	
Unstandardized path coefficients to the intercept of the frequ	ency of going out	of-home					
Path from the average land slope	-0.05 (0.02)	0.010	-0.07 (0.03)	0.038	-0.07 (0.03)	0.034	
Path from driving status at Wave 1	_		0.10 (0.15)	0.516	0.10 (0.17)	0.550	
Path from driving status at Wave $1 \times$ average land slope	_		0.03 (0.04)	0.456	0.02 (0.04)	0.588	
Path from age at Wave 1	_		_		0.00 (0.02)	0.940	
Path from gender at Wave 1	_		_		0.15 (0.18)	0.409	
Path from education level at Wave 1	_		_		0.06 (0.16)	0.709	
Path from perceived household economic status at Wave 1	_		_		0.26 (0.09)	0.004	

Table 2. Parameter estimates of the latent growth model for associations of the average land slope with the frequency of going out-of-home (n=856).

Path from living alone at Wave 1	—		—		-0.03 (0.32)	0.918			
Path from employment status at Wave 1	—		—		-0.07 (0.16)	0.642			
Path from frailty	—		—		-0.46 (0.29)	0.111			
Unstandardized path coefficients to the slope of the frequency of going out-of-home									
Path from the average land slope	-0.01 (0.01)	0.510	0.00 (0.01)	0.821	0.00 (0.01)	0.824			
Path from driving status at Wave 1	—		0.04 (0.06)	0.567	0.02 (0.07)	0.798			
Path from driving status at Wave 1 \times average land slope	—		0.00 (0.02)	0.813	0.00 (0.02)	0.922			
Path from age at Wave 1	—		—		0.00 (0.01)	0.669			
Path from gender at Wave 1	—		—		-0.10 (0.07)	0.188			
Path from education level at Wave 1	—		—		-0.05 (0.06)	0.428			
Path from perceived household economic status at Wave 1	—		—		0.01 (0.04)	0.871			
Path from living alone at Wave 1	—		—		-0.05 (0.13)	0.682			
Path from employment status at Wave 1	—		—		-0.07 (0.06)	0.256			
Path from frailty	_		_		0.03 (0.12)	0.810			

SE: standard error. The intercept and slope of frequency of going out-of-home represents the initial level of and longitudinal change in its frequency, respectively. If the paths from average land slope to the intercept and slope of frequency of going out-of-home were negative and significant, Hypotheses 1A and 1B would be supported, respectively. If the paths from the interaction terms of driving status with average land slope to the intercept and slope of the frequency of going out-of-home were positive and significant, Hypotheses 2A and 2B would be supported,

respectively. Driving status (*no*=0, *yes*=1), gender (*male*=0, *female*=1), education level (*junior to high school*=0, *more than high school*=1), living alone (*no*=0, *yes*=1), current employment (*no*=0, *yes*=1), and frailty (*no*=1, *yes*=1) were dummy variables. The model fit indices were $\chi^2(2)=1.80$, CFI>0.999, TLL>0.999, RMSEA<0.001, and AIC=25.80 in Model 1; $\chi^2(4)=2.92$, CFI>0.999, TLL>0.999, RMSEA<0.001, and AIC=48.92 in Model 2; and $\chi^2(11)=11.45$, CFI=0.999, TLI=0.998, RMSEA=0.007, and AIC=197.45 in Model 3.

	χ^2	$\Delta \chi^2$	<i>p</i> values	CFI	TLI	RMSEA	AIC
Unconstrained model	14.84	_		>0.999	>0.999	< 0.001	286.84
Model with an equality constraint on the path from the average land slope	15.02	0.19	0.667			0.001	285.02
to the intercept of the frequency of going out-of-home				>0.999	>0.999	<0.001	
Model with an equality constraint on the path from the average land slope	14.87	0.03	0.854				284.87
to the slope of the frequency of going out-of-home				>0.999	>0.999	< 0.001	
Model with equality constraints on the paths from the average land slope to	15.02	0.19	0.911				283.02
both the intercept and the slope of the frequency of going out-of-home				>0.999	>0.999	< 0.001	

Table 3. Model fit indices of the models with equality constraints of path coefficients between non-drivers and drivers.

 $\Delta \chi^{2}$, Changes in the chi-square An equality constraint was placed between non-drivers and drivers.



Figure 1.



