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Original article

Changes in the configuration and patterns of physical activity among Mongolian adults, 2005–2013

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Abstract

Objective: This study examined the change in physical activity status and patterns and their associations with urban and rural residence and employment status in Mongolia.

Methods: We analyzed data from 7,738 adults aged from 20 to 64 years (n = 2,877 and 4,861 for 2005 and 2013, respectively) from the Mongolian STEPS Survey on the Prevalence of Non-Communicable Disease Risk Factors (NCD-STEPS survey). Physical activity in three domains, including work (occupational and household work); transport (walk or cycling); and leisure (sport or fitness) was measured by Global Physical Activity Questionnaire (GPAQ). Physical activity levels were classified into three groups: low, moderate, and high according to the GPAQ analysis framework. The associations between physical activity time, residential area, and employment status were examined using a multivariate negative binomial regression model.

Results: The percentage of respondents with low-level physical activity increased from 10.9% in 2005 to 27.2% in 2013. The median minutes of physical activity time per week were 1,020 in 2005 and 600 in 2013. Physical activity time at work, transport and overall decreased in 2013. Work-related physical activity was the most dominant component of physical activity time (55.6% in 2005 and 54.6% in 2013), the transport domain was the second-highest contributor of physical activity time in 2005 (24.0%) and was replaced by the leisure domain (26.8%) in 2013. Rural residents practiced more physical activity at work, transport, and leisure than urban residents did in 2005 (prevalence ratio [PR]: 1.33, 95% confidence interval [CI]: 1.20–1.47; PR: 1.21, 95%CI: 1.14–1.29; and PR: 1.21, 95%CI: 1.13–1.30, respectively), but there was no significant difference by residential area in 2013. Mongolian adults with higher educational attainment, employee status, and non-employment status were less likely to engage in physical activity compared to those among adults with lower educational attainment and self-employed status.

Key words: physical activity, urbanization, lifestyle changes, non-communicable disease risk factor.

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Introduction

Physical inactivity is a leading risk factor for global mortality due to non-communicable diseases[1, 2]. The prevalence of physical inactivity is rising in both high and low-middle income countries[3]. Regular physical activity has been indicated to decrease the risks of breast, colon, and rectal cancer, diabetes mellitus, and ischemic heart diseases[4]. The measurement of physical activity levels and patterns, therefore, has been one of the essential aspects of non-communicable disease prevention programs[5].

Physical activity is undertaken throughout living dimensions, including work, household chores, care for family members, commuting, and sports and fitness. These dimensions are influenced by economic growth and urbanization, which affect lifestyle and occupational patterns including decreased occupational workloads, increased use of labor-saving devices, sedentary-style work and transportation, public transportation system development, and increased automobile ownership[6, 7]. Physical inactivity is associated with high urban levels in low- and middle-income countries[8, 9], and in low urban levels in high-income countries[10].

Mongolia has experienced drastic socio-economic changes and urbanization during the last 15 years with a

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shift to a market economy. The annual average national gross domestic product (GDP) growth rate, which was 8.7% from 2005 to 2008 prior to the deep recession in 2009, has recovered since 2011 with 11.6% growth rate in 2013[11]. The country's dependence on the mining industry has destabilized the economy recently due to fluctuations in world market prices. The average inflation rates during the same period before the recession were 9.2% and were 10.5% in 2011 to 2013[11, 12]. The urban population increased from 57.1% in 2000 to 62.5% in 2005 and 70.4% in 2013, with its highest annual growth rate of 3.2% in 2012[12, 13]. Concurrent with these socio-economic changes as well as changes to Mongolia's unique nomadic lifestyle, an increased obesity risk and associated transitional and traditional dietary patterns has been reported[14, 15]; however, few studies have assessed the physical activity levels and patterns among Mongolian adults.

The objectives of this study were to 1) examine the levels and patterns of physical activity in the work, transport, and leisure domains and 2) to elucidate the relationships between physical activity engagement and residence, educational status, and employment status among Mongolian adults aged 20 to 64 years in 2005 and 2013.

Methods

Data collection

We analyzed physical activity engagement among adults in Mongolia aged 20 to 64 years using the data from the Mongolian STEPS Survey on the Prevalence of Non-Communicable Disease Risk Factors (NCD-STEPS survey) conducted in 2005 and 2013. The Mongolian NCD-STEPS is a nationwide survey designed to determine the prevalence of major non-communicable disease risk factors and to establish a non-communicable disease surveillance system applying the NCD-STEPS survey methodology developed by the World Health Organization (WHO)[16].

The Mongolian NCD-STEPS survey was implemented by the Ministry of Health of Mongolia and Mongolia's National Center for Public Health among residents aged 15 to 64 years living in urban and rural areas. The survey team consisted of a team leader, interviewer, anthropometric measurement and laboratory technician, and local assistants recruited by the survey team from local health centers. Interviewers who had completed a five-day training workshop conducted face-to-face interviews using the standardized WHO STEPS Instruments questionnaire.

The survey protocol and methodology were reviewed and approved by the Scientific Committee at the National Center for Public Health of Mongolia and the Medical Ethical Committee at the Ministry of Health of Mongolia. The survey materials and protocol were further reviewed and approved by the Ethical Review Committee of the WHO Western Pacific Regional Office (WRC-WPRO). Permission to use 2005 and 2013 Mongolia NCD-STEPS survey data for the analysis of physical activity status of adults was obtained from Mongolia's National Center for Public Health.

Subjects

Multi-stage cluster sampling was performed to provide estimates for indicators for urban and rural areas in Mongolia. The primary unit was district in urban areas and county (soum) in rural areas, while the secondary sampling units were sub-district (khoroo) and township (bagh), respectively. The 2005 survey covered 40 clusters, 20 clusters each from urban and rural areas, while the 2013 survey 2013 covered 65 clusters, 33 from urban and 32 from rural areas.

We analyzed data from 2,877 adults aged 20 to 64 years in 2005 and 4,861 adults in 2013. Respondents under 20 years of age, students, and respondents who did not complete the physical activity assessment were excluded from the analyses.

Measurements

The variables of sex, residential area, age, educational attainment, employment status, body mass index (BMI), and physical activity status were used for the analysis.

Age was divided into three categories: 20–34, 35–49, and 50–64 years. Education level was classified into three categories according to the highest level of school the subjects had completed: basic education under high school; high school; and college, university, or graduate school education. Employment status was classified into self-employed, employee (working at governmental and nongovernmental organizations or companies), and not employed (house worker, non-paid worker, retired, or not working). Self-employed included workers in agriculture, hunting, forestry, wholesale retailers, and construction with relatively high physical workloads. Employees were governmental and non-governmental workers mainly engaged in office work. Non-employed included both those who were able and those who were unable to work.

The body weights and heights of all participants were measured using electronic scales (GIMA2723) and a Somatometre-Stanley 04–116 device, respectively, by trained survey team members. BMI was calculated as weight (kg) divided by the square of height (m) and was categorized into three groups, < 25.0, 25.0–29.9, and ≥ 30.0 kg/m^2 according to the international classification of adult overweight and obesity[17].

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) which comprises 16 ques-

tions about physical activity performed in a typical week[18]. The GPAQ was developed by WHO to measure physical activity across on three different domains in work, transport, and leisure-recreation settings. The GPAQ questions were translated into Mongolian, adapting country specifics, and then back-translated into English. Show cards with examples of local activities were used to help participants understand the questions on the GPAQ.

The GPAQ asks about physical activity performed for more than 10 minutes, including the frequency (days) and duration (hours and minutes) in three domains: (1) work-related vigorous and moderate-intensity physical activity (paid and unpaid work including household chores, harvesting crops or hunting); (2) transport physical activity (to get to and from places by walking and cycling); and (3) leisure-time recreational vigorous and moderate-intensity physical activity. One question on the GPAQ about sedentary behavior not included in the 2005 survey was excluded from the present study analysis. Energy expenditure was estimated in Metabolic Equivalents (METs). The GPAQ assessment guide assigns eight and four METs for vigorous-intensity and moderate-intensity activity, respectively. Individual physical activity levels were classified as low, moderate and high according to the GPAQ guideline classification[18].

Statistical analyses

Physical activity times per week during work, transport, leisure, and overall were calculated. Time spent in physical activity was presented as medians and inter-quartile ranges due the non-normal distributions. Mean values were also reported. Mann-Whitney U tests were used to compare time spent in physical activity in urban and rural area. We applied multivariate negative binomial regression analysis with log-link function to estimate the relationships between physical activity engagement time and residency, education level, employment status, and time period. Model 1 and Model 2 estimated the associations for 2005 and 2013 separately. Data from 2005 and 2013 were merged in Model 3.

Table 1 Subject characteristics (n = 2,877 and 4,861 for 2005 and 2013, respectively)

	2005		2013	
	N	%	N	%
Sex				
Male	1406	48.9	2146	44.1
Female	1471	51.1	2715	55.9
Residence area				
Urban	1420	49.4	2445	50.3
Rural	1457	50.6	2416	49.7
Age (years)				
20–34	839	29.2	2042	42.0
35–49	1139	39.6	1796	36.9
50–64	899	31.2	1023	21.0
Education				
Not completed high school	946	32.9	1133	23.3
High school completed	584	20.3	1344	27.6
College and above	1347	46.8	2384	49.0
Employment status				
Self-employed	602	20.9	1274	26.2
Employee	996	34.6	2029	41.7
Not employed	1279	44.5	1558	32.1
Body Mass Index (kg/m^2)				
<25.0	1735	60.6	2523	53.3
25–29.9	756	26.4	1388	29.3
≥ 30.0	373	13.0	820	17.3
Physical activity level				
Low	315	10.9	1322	27.2
Moderate	686	23.8	1253	25.8
High	1876	65.2	2286	47.0

Physical activity levels were grouped into three levels: low, moderate, and high using Global Physical Activity Questionnaire (GPAQ) analysis framework classifications.

Results

The characteristics of the study subjects are shown in Table 1. Educational attainment with high school completion rose to 76.6% in 2013. The percentage of subjects with BMI was above 25.0 kg/m^2 was 39.4% in 2005 and 46.7% in 2013. The proportion of low-level physical activity increased from 10.9% in 2005 to 27.2% in 2013.

Table 2 shows the times spent in physical activity during work, transport, leisure, and overall per week. The median times in minutes of all respondents' total physical activity time per week were 1,020 in 2005 and 600 in 2013. Rural residents in 2005 spent more time in physical activity at work and transport domains compared to those in urban residents. Urban female residents in 2013 were more likely to engage in leisure-time physical activity compared to rural female residents (140 vs. 120 median minutes).

The compositions of physical activity times at work, transport and leisure domain by sex, area and survey year is presented in Figure 1. The major component of physical activity was the work domain (55.6% in 2005 and 54.6% in 2013). The second-most common component of physical activity time was transport in 2005 (24.0%) and leisure in 2013 (26.8%).

Table 3 shows the adjusted prevalence ratios (PRs) of physical activity time according to residential area, educational status, and employment status by negative binomial regression. Rural residence in 2005 was associated with more physical activity during work, transport, and leisure

Table 2 Time (minutes) spent in three domains of physical activity in a typical week by gender and residence in Mongolia, 2005 and 2013

Sex	Physical activity domains		2005		2013	
Male			Urban (n = 701)	Rural (n = 705)	Urban (n = 1,065)	Rural (n = 1,081)
	Work-related	Mean	708	930	621	682
		Median	240	480**	30	90*
		(25th, 75th)	(0, 1260)	(0, 1680)	(0, 900)	(0, 1080)
	Transport	Mean	294	343	193	182
		Median	210	420**	120	105
		(25th, 75th)	(75, 420)	(30, 420)	(0, 300)	(0, 300)
	Leisure	Mean	219	283	215	253
		Median	70	120	90	120
		(25th, 75th)	(0, 360)	(0, 420)	(0, 355)	(0, 360)
	Total	Mean	1220	1555	1029	1117
		Median	900	1230**	585	630
		(25th, 75th)	(420, 1890)	(575, 2340)	(210, 1500)	(180, 1775)
Female			Urban (n = 719)	Rural (n = 752)	Urban (n = 1,380)	Rural (n = 1,335)
	Work-related	Mean	586	800	430	521
		Median	140	360**	0	10**
		(25th, 75th)	(0, 900)	(0, 1432)	(0, 420)	(0, 720)
	Transport	Mean	297	369	193	186
		Median	210	420**	140	120
		(25th, 75th)	(100, 420)	(140, 472)	(0, 280)	(0, 300)
	Leisure	Mean	277	323	317	283
		Median	120	140	140	120*
		(25th, 75th)	(0, 420)	(0, 540)	(0, 540)	(0, 420)
	Total	Mean	1160	1492	940	990
		Median	855	1260**	600	530
		(25th, 75th)	(420, 1740)	(572, 2175)	(196, 1320)	(150, 1445)

* $p<0.05$; ** $p<0.01$.

(PR: 1.33, 95% confidence interval [CI]: 1.20–1.47; PR: 1.21, 95%CI: 1.14–1.29; and PR: 1.21, 95%CI: 1.13–1.30, respectively); none of these were related to residential area in 2013. Physical activity time of 2013 at work, transport and overall was less than those of 2005 after combining data from 2005 and 2013 in Model 3. Respondents who completed high school (PR: 0.90, 95%CI: 0.84–0.96) and college and above (PR: 0.77, 95%CI: 0.70–0.86) were likely to spend less time engaging in physical activity compared to those who did not complete high school education (Model 3). The PRs of work-related physical activity time was lower among employees (PR: 0.82, 95%CI: 0.72–0.94) and non-employees (PR: 0.49, 95%CI: 0.42–0.56) than that in self-employed adults. Leisure-time physical activity engagement was more frequent among women (PR: 1.26, 95%CI: 1.17–1.36) and employees (PR: 1.18, 95%CI: 1.06–1.32) and was less among respondents who completed high school (PR: 0.90, 95%CI: 0.81–0.99) and college and above (PR: 0.83, 95%CI: 0.75–0.92).

Discussion

This study presented the changes in physical activity levels and patterns of adults aged 20 to 64 years in urban and rural Mongolia between 2005 and 2013. During this period, physical activity engagement decreased at work, transportation, and overall. Work-related physical activity was the most dominant component of physical activity time in 2005. The proportion of leisure-time physical activity increased in 2013. Rural residence was associated with longer physical activity time at all of three domains in 2005, but it was not significantly related with physical activity time in 2013. Higher educational attainment and employee or non-employment status were associated with lower physical activity times.

The present study used a standardized questionnaire and protocol developed by WHO, which have been applied in more than one hundred countries[16, 19–21]. The subjects were randomly selected from urban and rural areas by three-

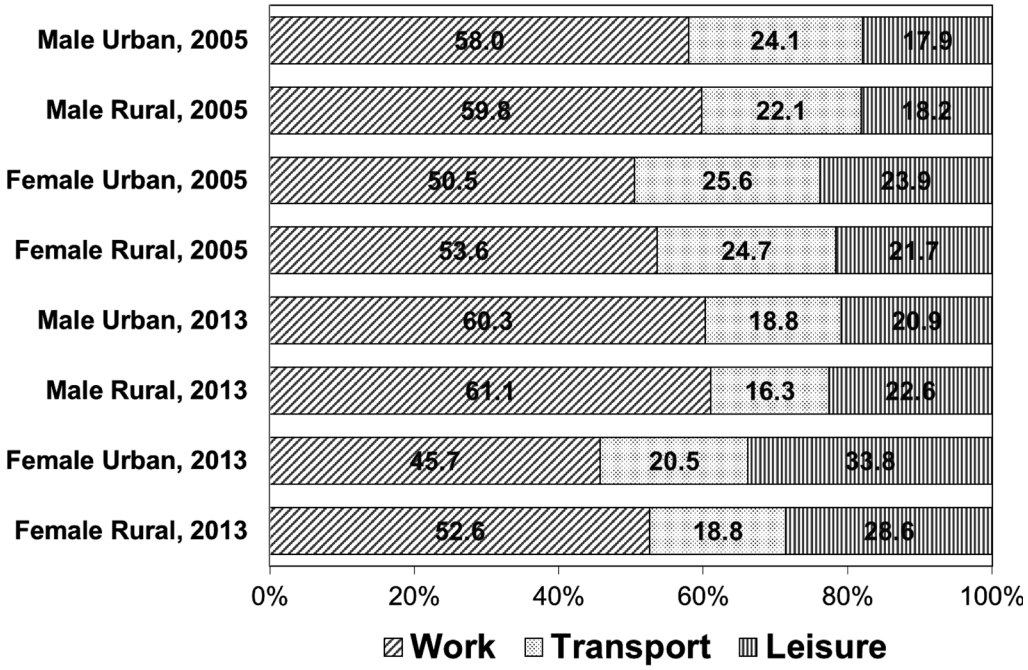

Figure 1 Compositions of physical activity as person-time minutes per week (%).

stage cluster sampling to provide an equal distribution for these areas. The levels and patterns of physical activity for three different domains relevant to daily life were assessed by GPAQ. The self-administrated GPAQ has been validated to assess moderate physical activity compared to other assessments using accelerometers[22]; however, its validity for sedentary physical activity, which was not included in the present study, has not yet been proved.

The proportion of low-level physical activity among Mongolian adults, 10.9% in 2005 and 27.2% in 2013, was similar to that in a study from Thailand, which reported a proportion of 26.0% in 2014[23] and lower than those reported in studies from Bangladesh[24], India[25], and Vietnam[21, 26]. Physical activity time of Mongolian adults was similar to the study from Vietnam[21] and longer than those of Bangladesh[24], India[25]. The comparatively high level and longer time of physical activity of Mongolian adults were attributed to long leisure physical activity time compared to other study subjects[27]. Our results showed that work-related activity was the leading component of all domain of physical activity time, which was consistent with findings from studies from middle-income countries[26, 28]. Inversely, the proportion of transportation activity time was less than those in other studies.

Work-related activity time decreased during the study period while still accounting for more than half of the physical activity component. The range of quintile values of physical activity engagement time at work in this study suggested polarized physical activity and inactivity patterns at work. Popkin *et al*.[29] reported that urban services and infrastructure impact occupational physical activity patterns and reduce activity intensities[29]. The proportion of workers engaging in agriculture, hunting, and forestry, with levels amount of occupational activity[30] categorized as self-employed in the present study, decreased from 39.8% in 2005 to 29.8% in 2013[11, 31]. These changes in occupational patterns could have reduced work-related physical activity time. Our results indicated that employee workers engaged in less work-related physical activity than did self-employed workers. This finding may reflect the occupational workloads related to employment status.

Physical activity associated with transport was common in Mongolian adults in 2005, with a 25th percentile value above zero minutes per week, contrary to those in the work and leisure domains. In 2013, however, the 25th percentile values of the transport and the other two physical activity domains were zero. Private car ownership increased and the number of registered passenger automobile tripled from 87,792 in 2005[31] to 259,309 in 2013[11] . The number of registered buses, which is the most common commuting transportation in Mongolia, also increased from 11,067 to 20,400 during the same period. Mongolia has shifted its active transportation to motorized travel not only in urban but also in rural areas. Herders in rural areas now ride motorbikes

Table 3 Associations of residence, education attainment, and employment status with physical activity time during work, transport, leisure, and total among Mongolian adults in 2005 and 2013

	Work-related				Transport				Leisure				Total			
	aPR	95% CI		P	aPR	95% CI		P	aPR	95% CI		P	aPR	95% CI		P
Model 1 (2005)																
Area																
Urban		1.00				1.00				1.00				1.00		
Rural	1.33	1.20	1.47	<0.01	1.21	1.14	1.29	<0.01	1.21	1.13	1.30	<0.01	1.25	1.17	1.33	<0.01
Sex																
Male		1.00				1.00				1.00				1.00		
Female	0.97	0.89	1.06	0.53	1.03	0.97	1.10	0.31	1.20	1.12	1.29	<0.01	1.02	0.97	1.07	0.47
Age (years)																
20-29		1.00				1.00				1.00				1.00		
35-49	0.96	0.86	1.08	0.51	0.99	0.91	1.07	0.72	0.99	0.89	1.09	0.82	0.97	0.91	1.03	0.28
50-64	0.95	0.83	1.07	0.39	1.05	0.96	1.14	0.30	0.97	0.84	1.12	0.68	0.96	0.89	1.04	0.33
Education																
Not complete high school		1.00				1.00				1.00				1.00		
High school completed	0.88	0.78	1.00	0.05	1.03	0.94	1.14	0.52	1.05	0.92	1.21	0.46	0.96	0.89	1.03	0.26
College and above	0.72	0.64	0.81	<0.01	1.00	0.92	1.08	0.94	0.96	0.86	1.07	0.46	0.83	0.78	0.89	<0.01
Occupation																
Self-employed		1.00				1.00				1.00				1.00		
Employee	0.80	0.70	0.91	<0.01	1.04	0.96	1.14	0.34	1.14	1.01	1.30	0.04	0.90	0.83	0.98	0.01
Not-employed	0.49	0.43	0.56	<0.01	1.11	1.02	1.20	0.01	1.03	0.90	1.17	0.70	0.70	0.64	0.76	<0.01
Body Mass Index (kg/m^2)																
<25.0		1.00				1.00				1.00				1.00		
25.0-29.9	1.00	0.90	1.11	0.99	1.01	0.94	1.08	0.80	1.07	0.98	1.17	0.12	1.02	0.96	1.08	0.55
≥30	0.99	0.85	1.15	0.92	1.02	0.95	1.10	0.50	1.05	0.93	1.20	0.42	1.02	0.94	1.12	0.62
Model 2 (2013)																
Area																
Rural	1.13	0.72	1.77	0.60	0.94	0.81	1.09	0.41	0.99	0.75	1.31	0.95	1.03	0.77	1.39	0.83
Sex																
Female	0.85	0.77	0.94	<0.01	1.04	0.96	1.13	0.39	1.30	1.17	1.44	<0.01	0.97	0.91	1.05	0.47
Age (years)																
35-49	0.91	0.81	1.01	0.08	1.04	0.97	1.12	0.29	1.05	0.96	1.16	0.27	0.96	0.90	1.03	0.29
50-64	0.79	0.68	0.91	<0.01	1.27	1.15	1.39	<0.01	1.10	0.95	1.27	0.21	0.95	0.87	1.04	0.29
Education level																
High school completed	0.88	0.75	1.03	0.12	0.85	0.76	0.95	0.01	0.80	0.70	0.92	<0.01	0.87	0.79	0.96	<0.01
College and above	0.73	0.57	0.93	0.01	0.83	0.74	0.93	<0.01	0.75	0.65	0.87	<0.01	0.75	0.64	0.88	<0.01
Occupation																
Employee	0.83	0.69	0.99	0.04	0.93	0.83	1.04	0.23	1.22	1.06	1.42	<0.01	0.92	0.83	1.03	0.16
Non-employee	0.47	0.38	0.58	<0.01	1.03	0.91	1.18	0.61	1.18	1.01	1.39	0.04	0.71	0.63	0.81	<0.01
Body Mass Index (kg/m^2)																
25.0-29.9	1.09	0.90	1.31	0.40	1.02	0.93	1.11	0.72	0.94	0.83	1.07	0.30	1.03	0.91	1.17	0.66
≥30.0	1.03	0.82	1.28	0.81	1.14	1.03	1.25	0.01	1.08	0.91	1.27	0.40	1.06	0.91	1.22	0.46
Model 3 (2005 and 2013)																
Year																
2005		1.00				1.00				1.00				1.00		
2013	0.67	0.52	0.86	<0.01	0.59	0.54	0.64	<0.001	0.97	0.83	1.15	0.76	0.73	0.62	0.85	<0.01
Area																
Rural	1.19	0.90	1.59	0.22	1.03	0.94	1.14	0.52	1.07	0.89	1.28	0.49	1.10	0.92	1.33	0.30
Sex																
Female	0.89	0.83	0.96	<0.01	1.04	0.98	1.10	0.21	1.26	1.17	1.36	<0.01	0.99	0.94	1.04	0.72
Age (years)																
35-49	0.92	0.84	1.00	0.05	1.03	0.97	1.09	0.31	1.03	0.97	1.11	0.34	0.96	0.91	1.01	0.16
50-64	0.85	0.76	0.94	<0.01	1.16	1.08	1.25	<0.01	1.04	0.93	1.15	0.50	0.95	0.89	1.02	0.14
Education level																
High school completed	0.87	0.78	0.97	0.01	0.91	0.84	0.99	0.03	0.90	0.81	0.99	0.03	0.90	0.84	0.96	<0.01
College and above	0.71	0.61	0.83	<0.01	0.88	0.82	0.96	<0.01	0.83	0.75	0.92	<0.01	0.77	0.70	0.86	<0.01
Occupation																
Employee	0.82	0.72	0.94	<0.01	0.97	0.89	1.06	0.51	1.18	1.06	1.32	<0.01	0.92	0.85	0.99	0.03
Non-employee	0.49	0.42	0.56	<0.01	1.05	0.96	1.16	0.25	1.11	0.99	1.24	0.08	0.71	0.65	0.77	<0.01
Body Mass Index (kg/m^2)																
25.0-29.9	1.06	0.93	1.20	0.40	1.01	0.96	1.08	0.66	0.98	0.90	1.08	0.74	1.03	0.95	1.12	0.52
≥30.0	1.01	0.87	1.18	0.87	1.10	1.02	1.18	0.01	1.07	0.95	1.20	0.28	1.05	0.95	1.16	0.39

aPR: Adjusted Prevalence Ratio, CI: Confidence interval. Model 1 estimated associations for data from 2005. Model 2 estimated associations for data from 2013. Model 3 estimated associations of the merged data from 2005 and 2013.

or drive automobiles to look for their livestock and travel to their neighbors rather than riding horses[32].

Leisure-related physical activity time increased especially in urban areas during the study period, while the difference was not significant in adjusted Model 3. Leisure-time activity accounted for the second-largest proportion of physical activity composition in 2013. These results were inconsistent with those of previous studies of middle-income and developing countries in Asia that reported very little contribution of leisure-time activity to the overall physical activity[23, 26, 33, 34], while the dominance of leisure-time physical activity is common in developed countries[35]. Employee workers were more likely to engage in leisure physical activity than were self-employed workers in the present study. Previous studies indicated affordability and accessibility affected leisure-time physical activity among white-collar workers[25, 36, 37, 38]. To our knowledge, there is no previous record of physical activity facilities in Mongolia; however, a national report published in 2017 on leisure-time physical activity facilities reported that Mongolia has 98 sport complex in the country and 18 swimming pools, 58% of sport complex and 77% of swimming pools are located in urban area[39].

This study has several limitations. First, this study used data from surveys conducted in 2005 and 2013 to explore the trend over time and was not designed to examine the temporal relations of the individual subjects. Data were collected between September 16 and October 14 in 2005 and from May 13 to June 20 in 2013. Considering that Mongolia has an extreme continental climate with sharp seasonal fluctuations, the reported physical activity duration and frequency in a typical week could have been during weeks of physically active seasons throughout a year with a severely cold and long winter. Physical activity was assessed by self-reporting GPAQ. The possibilities of over- or under-reporting physical activity due to recall biases in the duration and frequency of activity engagement cannot be ruled out.

The Mongolian government has developed prevention and control programs to tackle the emerging burden of non-communicable disease[40]. These programs stipulate the importance of monitoring of physical activity status and the creation of a supportive environment; however, action plans that specifically address physical activity are limited[40]. The National Programme on Prevention and Control of Non-communicable Diseases provided four recommendations to enhance physical activity, including walking or cycling for at least 30 minutes per day; fitness exercise three times per week for at least 20 minutes for children and youth; moderate exercise at least one hour per day; and regular active exercise during lunch breaks at school and the workplace[41]. These recommendations address transport and leisure domains to promote physical activity in daily lives. Our results indicated that physical activity involvement diminished at work and transportation during the study period and that the dominance of physical activity among rural residents in 2005 was eliminated in 2013. As these trends may be accelerating, the physical activity level of self-employed rural residents, whose leisure activity involvement was less than other employment statuses, is of concern.

In conclusion, physical activity among adults in Mongolia, particularly at work and transport, decreased from 2005 to 2013. The dominance of physical activity engagement among rural residents was eliminated during this period. Work-related physical activity was the major component of physical activity time and the proportion of leisure physical activity increased in 2013. Higher educational attainment and employee or non-employment status were associated with less physical activity time.

Conflict of interest: The authors declare that they have no competing interests.

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