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Original Article

Trends in Behavioral and Biological Non-Communicable Diseases Risk Factors among Adults in Mongolia: Results from National Cross-Sectional Surveys in 2005, 2009, 2013 and 2019

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Abstract

Background: Understanding national trends in noncommunicable disease (NCD) risk factors may have health policy implications. We aimed to evaluate trends in the prevalence and correlates of eight risk factors for NCD from 2005 to 2019 in Mongolia.

Methods: Cross-sectional data were analyzed from 9,356 individuals (15-64/69 yr, mean age=37.3 yr) who participated in the Mongolia STEPS 2005, 2009, 2013 or 2019 surveys and had complete measurement of the risk factor for NCD.

Results: The proportion of having 3-8 NCD risk factors significantly decreased from 59.1% in 2005 to 49.4% in 2019, and the mean number of NCD risk factors significantly decreased from 2.8 in 2005 to 2.6 in 2019. In linear regression analyses by study year, older age and male sex were across all study years positively associated with eight NCD risk factors. The prevalence of low physical activity increased from 8.2% in 2005 to 28.4% in 2019, overweight/obesity from 49.6% in 2005 to 64.0% in 2019, and raised total cholesterol from 23.9% in 2005 to 27.6% in 2019, there was a significant decrease in inadequate fruit and vegetable intake from 85.1% in 2005 to 79.5% in 2019, current smoking from 26.6% in 2005 to 24.1% in 2019, hypertension from 28.2% in 2005 to 23.2% in 2019, while the prevalence of diabetes remained unchanged from 2005 to 2019.

Conclusion: The prevalence of eight risk factors for NCD decreased in the last 15 years in Mongolia. Several associated variables for eight and individual NCD risk factors were identified that can help guide interventions.

Keywords: Trends; Risk factors; Non-communicable diseases; Mongolia

Introduction

Majority (>85%) of death from non-communicable diseases (NCDs) occur in low- and middle-income countries (1). In Mongolia, a lower middle-income country in East Asia, majority (80%) of all deaths in 2016 are caused by NCDs (2). Considering the increase of NCDs in low- and middle-income countries in the East and Southeast Asian region, it is important to

gain insight in the trends and local determinants of NCDs (3-5). Against this backdrop national community-based trend data on NCD risk factors among adults in Mongolia are needed.

A population-based study among adults in Mongolia in 2005 found " 3.2 servings/day of fruit and vegetables intake, 24.2% were current daily smokers was, 66.5% used alcohol beverages over the past 12 months, 23.1% had low physical activity, 22.2% had elevated blood pressure, 31.6% was overweight/obese, 12.5% had impaired fasting glucose (IFG), and 7.0% had elevated blood cholesterol levels (6). In Nepal in 2013 (15-69 yr), 27.7% of the population had 3-8 NCD risk factors (98.9% inadequate fruit and vegetable intake, 25.7% raised blood pressure, 22.6% raised total cholesterol, 21.4% overweight or obesity, 18.5% current smoking, 3.6% raised blood glucose, 3.4% low physical activity, and 2.0% harmful alcohol use) (7). In a population (35-64 yr) in the urban region of Dehli, India, the prevalence of overweight increased from 42.2% in 1991-1994 to 56.0% in 2010-2012, hypertension from 23.0% to 42.2%, raised fasting blood glucose from 12.7% to 20.2%, smoking from 16.1% to 17.4%, and total raised cholesterol decreased from 38.1% in 1991-1994 to 32.9% in 2010-2012 (8).

In studies on individual risk factors for NCDs, for example, in Mongolia, the prevalence of low physical activity increased from 10.9% in 2005 to 27.2% in 2013 (9), the prevalence of obesity (≥27 kg/m^2) increased from 26.4% in 2005 to 38.3% in 2013 (10), in China among adults, the prevalence of hypertension increased from 15.3% in 1991 to 27.2% in 2015 (11), in Myanmar (Yangon region), the prevalence of diabetes increased from 8.3% in 2004 to 10.2% in 2014 (12), and in Iran the prevalence of daily smoking decreased among men from 31.1% in 1990 to 19.5% in 2016, and decreased among women from 5.4% to 1.0% (13).

Several sociodemographic factors, such as older age (7,14-17), men (7,15), education (7,15), and urban residence (15,17), have been found to increase the odds of multiple biological and behavioral NCD risk factors. The study aimed to assess trends in the prevalence and correlates of eight NCD risk factors among people 15 yr of age and older from 2005 to 2019 in Mongolia.

Methods

Secondary data from four cross-sectional STEPS surveys in Mongolia in 2005, 2009, 2013, and 2019 (18) with complete NCD risk factor measurements were analyzed; the overall response rate was 95.0% in 2005, 95.0% in 2009, 97.4% in 2013, and 98.1% in 2019 (19-22). "A multi-stage stratified sampling process was carried out to randomly select participants from the target population (15-64 yr in 2005-2013, and 15-69 yr in 2019) (19-22). For the STEP-3 laboratory analysis, one-third of the selected participants in 2005, 2009 and 2013 were recruited, while in 2019 all participants were included (19-22).

Data collection followed the "WHO three STEPS methodology: step 1 included administration of a structured questionnaire (sociodemographics, medical history, medication use, and health risk behavior), step 2 consisted of blood pressure and anthropometric measurements, and step 3 included biochemical tests (blood glucose and blood lipids)."(18). Of the three blood pressure measurements using "OMRON Model M5 automatic blood pressure monitor," the last two readings were averaged (18). "Blood glucose, and total cholesterol were measured in peripheral (capillary) blood at the data collection site using dry chemical methods, biochemical analysis and automated analyzer." (19-22).

Measures

Outcome variables: NCD risk factors were included based on previous studies (7,14,23,24), as follows: *Behavioral NCD risk* included fruit/vegetable consumption (<5 servings/day), low physical activity ("Global Physical Activity Questionnaire") (25), current smoking, and frequent alcohol use (≥3 days/week) (19-22). *Biological risk factors for NCD:* Diabetes was defined as "fasting plasma glucose levels ≥7.0 mmol/L, and/or currently taking insulin or oral hypoglycemic drugs." (18) Hypertension: "based on measured blood pressure (BP)

(mean of the last two of three readings) defined as systolic BP ≥140 mm Hg and/or diastolic BP ≥90 mm Hg or currently on antihypertensive medication" (26); raised total cholesterol (TC) ("fasting TC ≥5.0 mmol/L"); Body Mass Index (measured 23.0-24.9 kg/m^2 overweight and ≥25 kg/m^2 obesity) (27).

Sociodemographic information included, age, education, sex, residence status and ethnicity (19-22).

Data analysis

Statistical analyzes were performed with STATA software ver. 15.0. The proportion of NCD risk factors was grouped as based on previous studies (17,24), 3-8 NCD risk factors (versus 0-2 risk factors), and the description of the NCD risk factors by study year are shown in bar graphs. Adjusted logistic regression were used to assess predictors of each of the eight NCD risk factors, and linear regression was used to estimate the determinants of the number of NCD risk factors, by study year. Missing values were not included in the analysis. P<0.05 was accepted as significant. Taylor linearization methods were applied to all statistical procedures to account for sample weighting and complex study design.

Ethics and consent

The Medical Ethics Committee of the Mongolian Ministry of Health approved the study and written informed consent was obtained from all participants.

Results

Sample characteristics

The sample included 9,356 (≥15 yr), with a mean age of 37.3 yr (SD=13.1 yr), 647 in 2005, 1,311 in 2009, 1,716 in 2013, and 5,682 in 2019. The proportion of older age decreased, and higher education and urban residence increased from 2005 to 2019. Further sociodemographic characteristics of the sample by study year are described in Table 1.

Table 1: Sociodemographic characteristics of individuals 15 years and older in Mongolia, 2005, 2009, 2013, and 2019

Variable	*Study year*				*P-value*
	2005 N=647 N (%)	2009 N=1311 N (%)	2013 N=1716 N (%)	2019 N=5682 N (%)	
Age (yr)					
15-29	50 (7.7)	261 (19.9)	309 (18.0)	1209 (21.3)	<0.001
30-44	254 (39.3)	591 (45.1)	780 (45.5)	2109 (37.1)	0.628
45-64 or 69	343 (53.0)	459 (35.0)	627 (36.5)	2364 (41.6)	<0.001
Gender					
Female	337 (52.1)	784 (59.8)	986 (57.5)	3153 (55.5)	0.634
Male	310 (47.9)	527 (40.2)	730 (42.5)	2529 (44.5)	0.482
Education (in years)					
0-9	50 (7.7)	383 (29.2)	397 (23.1)	1629 (28.7)	<0.001
10-11	254 (39.3)	382 (29.1)	492 (28.7)	1464 (25.8)	<0.001
≥12	343 (53.0)	546 (41.6)	827 (48.2)	2589 (45.6)	<0.001
Ethnic group					
Other	104 (16.4)	206 (15.7)	324 (18.9)	836 (14.8)	0.754
Khalkh	543 (83.9)	1104 (84.3)	1390 (81.1)	4821 (85.2)	0.478
Residence					
Rural	309 (47.8)	690 (52.6)	844 (49.2)	2036 (35.8)	<0.001
Urban	388 (52.2)	621 (47.4)	872 (50.8)	3646 (64.2)	0.028

Unweighted percent

Distribution of NCD risk factors from 2005 to 2019

Table 2 shows the trends of NCD risk factors over the four study years, overall and by gender.

Across the study years, the prevalence of having zero NCD risk factors was 2.1%, 1 16.5%, 2 25.9%, 3 28.5%, 4 18.4%, 5 6.6%, 6 1.9%, 7 0.1% and 8 risk factors 0%; the distribution by study year is shown in Fig. 1.

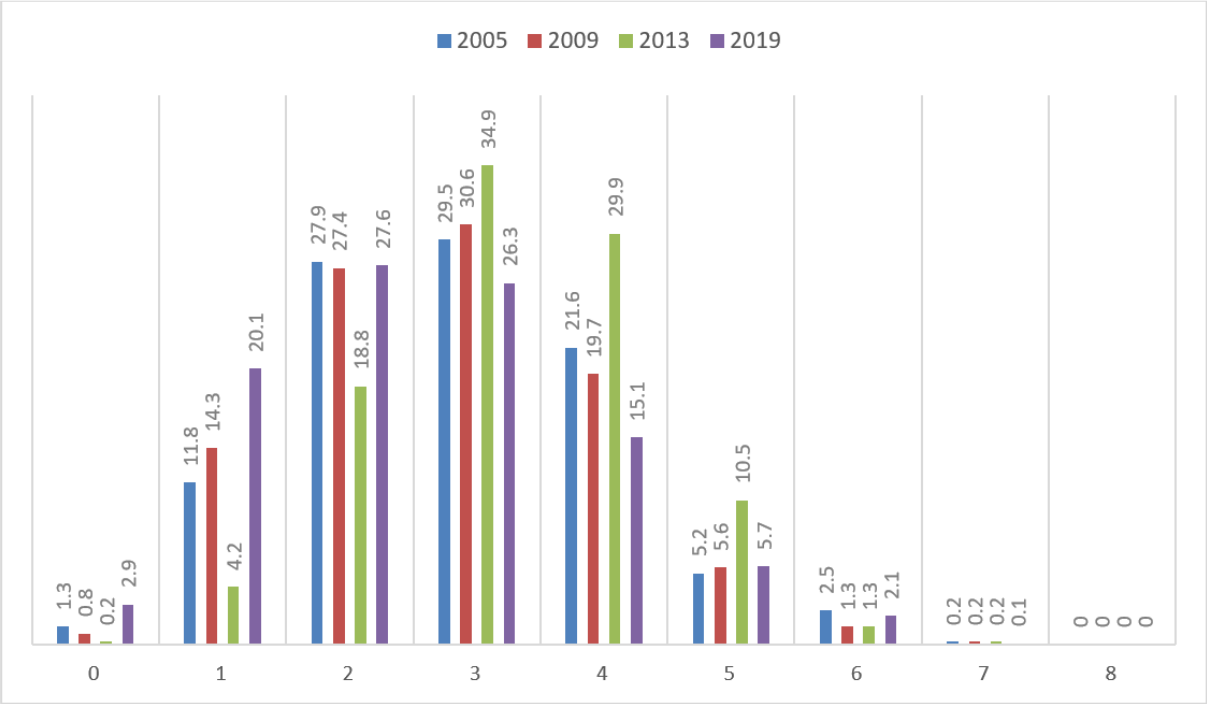

Fig. 1: Distribution of non-communicable diseases risk factors among adults in Mongolia from 2008 to 2019

Table 2: Distribution of non-communicable diseases (NCD) risk factors among individuals 15 years and older in Mongolia, 2005, 2009, 2013, and 2019

Non-communicable diseases (NCD) risk factors	***Study year***				
	2005 %	2009 %	2013 %	2019 %	
All					
Fruit and vegetable intake (<5 servings/day)	85.1	89.2	93.8	79.5	<0.001
Low physical activity	8.2	7.4	22.6	28.4	<0.001
Current smoking	26.6	27.7	27.1	24.1	<0.001
Frequent alcohol use	5.5	4.2	0.8	1.2	<0.001
General overweight/obesity	49.6	57.3	69.5	64.0	<0.001
Hypertension	28.2	27.3	27.4	23.2	<0.001
Diabetes	8.1	6.8	6.4	8.6	0.075
Raised total cholesterol	23.9	41.9	61.6	27.6	<0.001
3-8 NCD risk factors	59.1	64.9	76.8	49.4	<0.001
	M (SD)	M (SD)	M (SD)	M (SD)	
Total NCD risk factors	2.8 (1.2)	2.8 (1.2)	3.3 (1.1)	2.6 (1.3)	<0.001
Male					

Fruit/vegetable intake (<5 servings/day)	88.2	90.9	95.3	82.4	<0.001
Low physical activity	8.1	7.2	21.8	27.9	<0.001
Current smoking	48.7	48.0	49.1	43.7	<0.001
Frequent alcohol use	10.0	6.9	1.4	2.0	<0.001
General overweight/obesity	42.6	54.7	65.9	62.5	<0.001
Hypertension	30.0	31.4	30.3	25.3	<0.001
Diabetes	11.3	9.3	7.2	10.4	0.101
Raised total cholesterol	23.4	44.1	55.7	30.6	<0.001
3-8 NCD risk factors	67.0	73.0	83.2	58.3	<0.001
	M (SD)	M (SD)	M (SD)	M (SD)	
Total NCD risk factors	3.2 (1.3)	3.1 (1.2)	3.5 (1.0)	2.8 (1.4)	<0.001
Female					
Fruit/vegetable intake (<5 servings/day)	82.2	87.5	92.3	67.7	<0.001
Low physical activity	8.2	7.6	23.4	28.9	<0.001
Current smoking	6.0	6.9	5.3	5.6	<0.001
Frequent alcohol use	1.2	1.5	0.1	0.3	<0.001
General overweight/obesity	56.2	59.9	73.2	65.5	<0.001
Hypertension	26.9	23.1	24.6	21.0	<0.001
Diabetes	5.0	4.4	5.6	6.9	0.089
Raised total cholesterol	24.5	39.6	67.1	24.7	<0.001
3-8 NCD risk factors	50.8	52.9	70.9	40.6	<0.001
	M (SD)	M (SD)	M (SD)	M (SD)	
Total NCD risk factors	2.6 (1.1)	2.5 (1.1)	3.1 (1.1)	2.3 (1.2)	<0.001

M=Mean;SD=Standard Deviation

Sociodemographic determinants of individual behavioral NCD risk factors

Compared to study year 2005, study year 2019 had a significantly higher prevalence of low physical activity and significantly lower inadequate fruit and vegetable intake, current smoking and frequent alcohol use. Middle-aged and/or older age groups had an increased odds of low physical activity and current smoking. Male sex was associated with inadequate fruit and vegetable intake, current smoking and frequent alcohol use. Higher educational levels were inversely associated with inadequate fruit and vegetable consumption, current smoking, and frequent alcohol use. Urban residence was positively associated with low physical activity and current smoking and negatively associated with inadequate fruit and vegetable intake and frequent alcohol use. Belonging to the Khalkh ethnic group increased the odds of current smoking (Table 3).

Sociodemographic determinants of individual biological NCD risk factors

Compared to study year 2005, study year 2019 had a significantly higher prevalence of overweight/obesity, higher raised total cholesterol, and lower prevalence of hypertension. Older age was associated with overweight/obesity, hypertension, diabetes, and raised total cholesterol. The male sex was positively associated with hypertension and diabetes and negatively associated with overweight/obesity. Higher educational levels were associated with overweight/obesity and diabetes, and negatively associated with hypertension. Belonging to the Khalkh ethnic group increased the odds of diabetes. Residence status did not influence the prevalence of any of the four biological risk factors for NCD (Table 4).

Table 3: Determinants of behavioral non-communicable disease risk factors

Variable	*Inadequate fruit/vegetable intake*	*Low physical activity*	*Current smoking*	*Frequent alcohol use*
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Study year				
2005	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
2009	1.35 (0.90, 2.02)	0.89 (0.63, 1.27)	0.87 (0.71, 1.07)	0.75 (0.49, 1.14)
2013	2.28 (1.60, 3.25)***	3.17 (2.30, 4.39)***	0.70 (0.54, 0.89)**	0.12 (0.06, 0.25)***
2019	0.69 (0.57, 0.85)***	3.63 (2.92, 4.51)***	0.55 (0.46, 0.67)***	0.16 (0.10, 0.24)***
Age (years)				
15-29	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
30-44	0.98 (0.78, 1.23)	1.34 (1.13, 1.59)***	1.34 (1.12, 1.60)**	1.03 (0.70, 1.52)
45-64 or 69	1.19 (0.96, 1.47)	1.54 (1.29, 1.84)***	1.09 (0.88, 1.33)	0.69 (0.45, 1.04)
Gender				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	1.34 (1.17, 1.53)***	1.01 (0.87, 1.16)	14.90 (12.01, 18.50)***	5.17 (3.12, 8.56)***
Education (in years)				
0-9	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
10-11	0.67 (0.55, 0.83)***	1.03 (0.86, 1.23)	0.76 (0.64, 0.91)**	0.60 (0.38, 0.93)*
≥12	0.52 (0.41, 0.65)***	1.15 (0.94, 1.39)	0.61 (0.50, 0.74)***	0.92 (0.55, 1.54)
Ethnic group				
Other	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Khalkh	0.77 (0.53, 1.11)	1.29 (0.96, 1.73)	1.26 (1.06, 1.50)*	0.90 (0.45, 1.81)
Residence				
Rural	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Urban	0.51 (0.32, 0.80)**	2.22 (1.66, 2.96)***	1.32 (1.11, 1.58)**	0.58 (0.36, 0.93)*

***P<0.001; **P<0.01; *P<0.05; AOR=Adjusted Odds Ratio; CI=Confidence Interval

Table 4: Determinants of biological non-communicable disease risk factors

Variable	*General over-weight/obesity*	*Hypertension*	*Diabetes*	*Raised total choles-terol*
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Study year				
2005	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
2009	1.46 (1.26, 1.69)***	0.91 (0.77, 1.07)	0.85 (0.56, 1.26)	2.38 (1.92, 2.95)***
2013	1.93 (1.63, 2.28)***	0.66 (0.54, 0.80)***	0.73 (0.40, 1.33)	5.07 (3.71, 6.94)***
2019	1.32 (1.16, 1.50)***	0.57 (0.49, 0.66)***	1.17 (0.88, 1.58)	1.42 (1.16, 1.75)***
Age (years)				
15-29	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
30-44	2.61 (2.23, 3.06)***	2.51 (2.03, 3.10)***	1.66 (1.20, 2.30)**	1.80 (1.52, 2.13)***
45-64 or 69	3.93 (3.30, 4.70)***	7.37 (5.99, 9.07)***	2.99 (2.16, 4.13)***	2.56 (2.17, 3.01)***
Gender				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	0.87 (0.77, 0.98)*	1.45 (1.30, 1.61)***	1.70 (1.36, 2.14)***	0.99 (0.87, 1.12)
Education (in years)				
0-9	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
10-11	1.49 (1.28, 1.73)***	1.01 (0.87, 1.16)	1.12 (0.80, 1.57)	1.06 (0.91, 1.23)
≥12	1.59 (1.38, 1.83)***	0.87 (0.76, 0.98)*	1.50 (1.10, 2.05)*	1.03 (0.88, 1.22)
Ethnic group				
Other	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Khalkh	0.97 (0.81, 1.16)	1.00 (0.86, 1.16)	1.55 (1.03, 2.34)*	0.89 (0.71, 1.12)
Residence				
Rural	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Urban	0.96 (0.84, 1.10)	0.96 (0.82, 1.12)	1.10 (0.71, 1.70)	1.07 (0.85, 1.35)

***P<0.001; **P<0.01; *P<0.05; AOR=Adjusted Odds Ratio; CI=Confidence Interval

Associations with eight NCD risk factors

In linear regression analyses by study year, older age and male sex were across all study years positively associated with eight NCD risk factors. Furthermore, in 2005, 10-11 years of education and in 2019 urban residence were negatively associated with eight risk factors for NCD (Table 5).

Table 5: Associations with non-communicable diseases risk factors among individuals 15 years and older in Mongolia, 2005-2019

Variable	***Study year***			
	2005 Coef. (95% CI)	2009 Coef. (95% CI)	2013 Coef. (95% CI)	2019 Coef. (95% CI)
Age (yr)				
15-29	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
30-44	1.97 (1.37, 2.85)***	1.47 (1.15, 1.89)**	1.54 (1.31, 1.81)***	2.20 (2.03, 2.38)***
45-64 or 69	2.71 (1.94, 3.79)***	1.95 (1.49, 2.56)***	2.01 (1.66, 2.43)***	2.28 (2.05, 2.58)***
Gender				
Female	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Male	1.86 (1.56, 2.22)***	2.19 (1.75, 2.74)***	1.53 (1.40, 1.69)***	1.84 (1.71, 1.98)***
Education (in years)				
0-9	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
10-11	0.77 (0.60, 0.99)*	0.90 (0.71, 1.16)	1.05 (0.90, 1.22)	1.02 (0.93, 1.12)
≥12	1.03 (0.84, 1.26)	0.99 (0.76, 1.29)	0.89 (0.78, 1.02)	1.07 (0.99, 1.16)
Ethnic group				
Other	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Khalkh	0.79 (0.62, 1.01)	1.02 (0.84, 1.24)	1.02 (0.88, 1.17)	1.11 (0.99, 1.24)
Residence				
Rural	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Urban	1.07 (0.90, 1.28)	0.98 (0.81, 1.19)	1.02 (0.88, 1.17)	0.91 (0.84, 0.99)*

***P<0.001; **P<0.01; *P<0.05; Coef=Coeficient; CI=Confidence Interval

Discussion

We found that the proportion of eight NCD risk factors among Mongolian adults decreased from 2005 to 2019. Inadequate fruit and vegetable intake, current smoking, frequent alcohol use and hypertension decreased, and overweight/obesity, low physical activity, and raised total cholesterol increased from 2005 to 2019, and the prevalence of diabetes remained unchanged. Similarly, in previous trend studies, low physical activity and/or overweight/obesity increased and smoking decreased over time in urban India (8), Mongolia (9,10) and Iran (13). In our study the prevalence of hypertension decreased over time, while in urban India (8) and China (11), the prevalence of hypertension increased over time. The prevalence of diabetes increased over time in urban India (8), and in Myanmar (12), while it remained unchanged in our study. In the urban India study (8), the prevalence of total raised cholesterol reduced over time, while in this study total raised cholesterol increased. In Mongolia, the reduction in smoking, the reduction of high blood pressure, and the reduction of poor fruit and vegetable intake can be attributed to tobacco demand-reduction measures, the increase in tobacco excise taxes, national salt/sodium policies, the management of major NCDs, and the "drug therapy counselling for high-risk persons" (3,28). Fre-

quent alcohol use significantly reduced from 2006 to 2019, attributed to the strengthening of the national alcohol prevention and control programme (29), and the "Together for Alcohol-Free Mongolia" campaign in 2011 (30). However, body weight and physical inactivity have increased, which may in part be attributed to no change on public awareness on diet and/or physical activity (3). Comprehensive interventions may target promotion of body weight control, smoking cessation, healthy diets, and screening and control of high levels of blood sugar and blood pressure.

In comparison to other low- middle-income countries, the proportion of 3-8 NCD risk factors (59.1% in 2005 and 49.4% in 2019) in this study was higher than in Nepal (3-8 NCD risk factors, 27.7%) (7), in Malawi (3-7 NCD risk factors, 16.5%) (23), and in Uganda (3-5 NCD risk factors, 17.3%) (24). A high proportion of multiple NCD risk factors were found, increasing the odds of developing NCDs in Mongolia.

In line with previous research (7,14-17), this study shows that increasing age, men, rural residence in 2019, and lower education in 2005 were associated with a higher likelihood of having multiple NCD risk factors. Early screening targeting men, rural dwellers and those with lower education, should be promoted to prevent NCD risk factors in Mongolia.

Current smoking, frequent alcohol use, inadequate fruit and vegetable intake, hypertension and diabetes was significantly higher in men than in women, while general overweight/obesity was significantly higher in women than in men, and low physical activity, and raised total cholesterol did not differ by sex. The higher prevalence of substance use among men than among women and the higher rate of overweight/obesity among women than among men have been found in previous studies (14,23). Lower education was associated with inadequate fruit and vegatble intake, current smoking, frequent alcohol use and hypertension, while higher education was associated with with overweight/obesity and obesity. Rural residence was associated with inadequate fruit and vegetable intake and frequent alcohol use, while urban residence was associated with low physical activity and current smoking. These results show how the eight specific NCD risk factors can be differently targeted according to sex, educational level and regional status.

The cross-sectional repeat survey design hinders us to draw causative conclusions. Some of the data was assessed by self-report, such as alcohol use, biased some responses.

Conclusion

Based on four national community-based surveys in persons 15 yr and older from 2005 to 2019 in Mongolia, the prevalence of eight NCD risk factors decreased from 2005 to 2019. Inadequate fruit and vegetable intake, current smoking, frequent alcohol use and hypertension decreased, and overweight/obesity, low physical activity, and raised total cholesterol increased from 2005 to 2019, and the prevalence of diabetes remained unchanged.

Several factors associated with NCD risk factors were identified, including older age, male sex, level of education, and residence status, which can guide interventions.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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"The data source, the WHO NCD Microdata Repository (URL: https://extranet.who.int/ncdsmicrodata/index.php/catalog), is hereby acknowledged."

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Conflict of interest

The authors declare that there is no conflict of interests.

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