Central Asian Journal of Medical Sciences
CAJMS

Original Article

Cent Asian J Med Sci. 2019 Dec;5(4):289-299. https://doi.org/10.24079/CAJMS.2019.12.006

The Screening, Awareness, Treatment, and Control of Dyslipidemia Among Adults in Ulaanbaatar, Mongolia

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Submitted: September 11, 2019
Revised: November 11, 2019
Accepted: December 7, 2019

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Objective: The prevalence of dyslipidemia continues to increase in recent decades in Mongolia; however, little is known about awareness, treatment, and control of dyslipidemia. The aim of this study was to assess the awareness, treatment, and control of dyslipidemia in adults in Ulaanbaatar, Mongolia. **Methods:** This cross-sectional study was conducted between June 2017 and March 2018. A total of 326 people in Ulaanbaatar participated in this study. **Results:** Out of the 326 participants, 224 (68.7%, 64.9 in females; 75% in males) had dyslipidemia, and around the one third 113 (34,7%) were aware of the condition. Out of the 224 dyslipidemia individuals, only 27 (8.3%) were on statin treatment. Among those individuals receiving treatment, 19 (70.4%) serum lipid level was under the desired level. **Conclusion:** Our study revealed an alarmingly high prevalence of dyslipidemia, low level of awareness, insufficient treatment, yet a comparatively high level of control of dyslipidemia among the adults aged 20-69 in Ulaanbaatar relative to some other countries. The awareness, treatment, and control of dyslipidemia in the rural parts of Mongolia are unknown.

Keywords: Dyslipidemias, Awareness, Therapy, Prevention and Control, Mongolia

Introduction

The report of the Health Development Center of Mongolia in 2016 showed that in the last 20 years, the prevalence of cardiovascular diseases among the population had increased five times from 210 to 1010 per 10000 population, and cardiovascular death was the prime etiology [1]. Dyslipidemia is a major risk factor of atherosclerotic cardiovascular diseases such as coronary heart disease, ischemic cerebrovascular disease, and peripheral vascular disease [2].

The term dyslipidemia covers a broad spectrum of lipid abnormalities, especially elevation of total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), which are directly associated with adverse cardiovascular outcomes

yet manageable through lifestyle modification and medical treatment [3]. The third national STEPS survey in 2013 of non-communicable diseases (NCD) reported that the prevalence of hypercholesterolemia among the Mongolian adult population was 62.7% [4]. This survey revealed that 17.1% of women and 22.4% of men had elevated triglyceride level whereas 30.9% and 36.2% of men and women had low levels of HDL-C.

The prevalence of dyslipidemia continues to rise in recent decades in Mongolia; however, little is known about awareness, treatment, and control (lipid profile reached normal range via the effect of treatment) of dyslipidemia [4-6]. The early screening of dyslipidemia and effective lipid management substantially reduce the burden of atherosclerotic cardiovascular disease [7]. The U.S. Preventive Services Task Force strongly recommends screening all men 35 years and older and all women 45 years and older for lipid disorders and screening men 20 to 35 years of age and women 20 to 45 years for lipid disorders if they are at increased risk of coronary heart disease [8]. We chose to study dyslipidemia in Mongolia because we are not aware of peer-reviewed data regarding risk factors, treatments, and control rates for dyslipidemia in Mongolians. The aim of this study is, through screening of adults in Ulaanbaatar, to assess the awareness, treatment, and control of dyslipidemia.

Materials and Methods

Study Subjects

This cross-sectional study was conducted in Ulaanbaatar, Mongolia, between June 2017 and March 2018. Following the U.S. Preventive Services Task Force recommendation, adults ages from 20 to 70 years, had no clinical atherosclerotic cardiovascular diseases were eligible. We included a total of 350 volunteers in the study. However, 24 volunteers did not provide a completed questionnaire, or their blood tests were missing. Consequently, in this study, we analyzed the data from 326 participants.

Clinical and Biochemical Data Collection

All subjects completed a lifestyle and medical history questionnaire and were examined for risk factors. The questionnaire contained demographic information (age, gender), health behaviors (such as smoking, drinking, diet, physical activity), family history of dyslipidemia (volunteer anamnesis whether their parents or their siblings have dyslipidemia), personal history of dyslipidemia in the past year, and their current treatment of dyslipidemia.

Awareness of dyslipidemia was defined as a self-report of any prior diagnosis of dyslipidemia by a medical doctor. Treatment of dyslipidemia was defined as the use of pharmacological treatment to manage dyslipidemia during the previous two weeks. Dyslipidemia was considered to be controlled among the participants having dyslipidemia and being treated with medication if the total cholesterol was < 5.2 mmol/l, low-density lipoprotein cholesterol (LDL-C) < 3.5 mmol/l, high -density lipoprotein cholesterol (HDL-C) ≥ 1.0 mmol/l and triglyceride < 2.3 mmol/l.

Smoking status was defined by self-reported current smoking status. Alcohol usage was defined as drinking any purchased or homemade alcohol-containing beverages on average more than once a week. Physical activity was defined as walking, running, going to the gym, or other conscious exercises, not less than three times a week. Participants with a family history of dyslipidemia and those who like to eat animal-based foods and salted foods were ascertained by questionnaire. We used a stadiometer (Acryl Medic, Russia) to measure height and electronic weighing scale (Beurer, Germany). Body mass index (BMI) was calculated as weight (kg) divided by the square of their height (m^2). Using BMI 25 kg/m^2 as the cut-off point, participants were broadly categorized into three main groups: obesity defined as BMI ≥ 30 kg/m^2, overweight defined as BMI ≥ 25 kg/m^2, and normal weight defined as BMI < 24.9 kg/m^2. Two blood pressure readings (systolic and diastolic) were obtained with 2 minutes between each reading.

Laboratory Assays

Fasting blood samples of each respondent were drawn by venipuncture to measure serum Total Cholesterol (TC), High-Density Lipoprotein Cholesterol (HDL-C), Low-Density Lipoprotein Cholesterol (LDL-C), Triglycerides (TG) and fasting blood glucose (FBG). Blood samples were analyzed using an automated biochemistry analyzer (Chem Well 2910, USA).

Diagnostic Criteria and Risk Assessment

Using national guidelines [9], participants were defined as having dyslipidemia if they satisfied one or more of the following criteria: total cholesterol >5.2 mmol/L, LDL-C>3.5 mmol/L, HDL-C<1.0 mmol/L, triglycerides ≥2.3 mmol/L, or self-reported treatment. National guidelines recommended the use of the American Heart

Table 1. Comparison of demographics and baseline risk factors in study patients by dyslipidemia

		Normal		Dyslipidemia		p-value‡
		n	%	n	%	
Gender						.055
Female		710	35.1%	131	64.9%	
Male		31	25.0%	93	75.0%	
Age groups (years)						.0001
20-29		10	47.6%	11	52.4%	
30-39		32	57.1%	24	42.9%	
40-49		29	29.3%	70	70.7%	
50-59		21	22.1%	74	77.9%	
60-69		10	18.2%	45	81.8%	
Physical activity						
Inactive		32	27.1%	86	72.9%	.221
Active		70	33.7%	138	66.3%	
Diet						.326
Healthy		15	25.9%	43	74.1%	
Unhealthy		87	32.5%	181	67.5%	
Alcohol						
	No	65	29.7%	154	70.3%	.342
	Yes	36	35.0%	67	65.0%	
Smoking						
	No	87	34.4%	166	65.6%	.025
	Yes	15	20.5%	58	79.5%	
Family history of cardiovascular diseases						.196
	No	73	33.6%	144	66.4%	
	Yes	29	26.6%	80	73.4%	
Hypertension						.003
	No	64	38.6%	102	61.4%	
	Yes	37	23.3%	122	76.7%	
Hypertension medication						.027
	No	78	35.3%	143	64.7%	
	Yes	24	23.1%	80	76.9%	
Diabetes mellitus						.067
	No	94	33.1%	190	66.9%	
	Yes	8	19.0%	34	81.0%	
Family history of dyslipidemia						.018
	No	86	34.8%	161	65.2%	
	Yes	16	20.5%	62	79.5%	
Aspirin						
	No	87	33.6%	172	66.4%	.078
	Yes	15	22.4%	52	77.6%	
Statin						
	No	94	31.4%	205	68.6%	.846
	Yes	8	29.6%	19	70.4%	
Obesity						
	Normal Weight	46	41.1%	66	58.9%	.004
	Overweight	37	31.4%	81	68.6%	
	Obese	19	19.8%	77	80.2%	
Central obesity						.102
	Normal	31	38.8%	49	61.3%	
	Abnormal	71	29.0%	174	71.0%	

‡using Pearson's chi-square test

Association cardiovascular risk calculator [10,11]. The calculator estimates the risk of a person having heart disease or stroke in the next ten years in people between 40 and 79 years of age with no previous history of heart attack or stroke. Patients with ≥ 7.5% risk patients are to be considered for statin treatment.

Statistical Analysis

All statistical analyses were performed using STATA-12 software. Continuous variables presented as mean ± standard deviation (SD) were compared using the t-test, while categorical variables presented as numbers and proportions were compared using the chi-square test. The independent t-test was used to test for differences between the two groups of normally distributed continuous variables, but we used the Mann-Whitney test when the distribution was not normal, or the standard deviation was high. The multivariable logistic regression model was used to calculate odds ratios (OR) and 95% CI between the potential influencing factors and the prevalence, awareness, treatment, and control of dyslipidemia. All tests were two-tailed, and a p-value of $< .05$ was considered statistically significant.

Ethical Statements

The Ethics Committee of the Mongolian National University of Medical Sciences approved our study, and all subjects participating in the study provided written informed consent.

Results

A total of 326 people participated in this study, of whom 202 (61.9%) were female, and 124 (38.8%) were males. The mean age of participants was 48.2 ± 8.6 years.

Dyslipidemia Prevalence and the Risk Factors

Hypercholesterolemia (high total cholesterol level) was most prevalent (47.9%) dyslipidemia followed by elevated LDL cholesterol in 35.7%, hypertriglyceridemia in 23.6%, and low HDL cholesterol in 8.0% of the study population. The prevalence of self-reported treatment for dyslipidemia was 8.3% (Figure 1).

The prevalence of measured dyslipidemia increased with age ($p < .0001$) and was more common in males compared to females ($p = .055$). Smoking ($p = .025$), arterial hypertension ($p = .003$), self-reported hypertension medication ($p = .027$), family history of dyslipidemia ($p = .018$) and obesity ($p = .004$) were significantly higher in dyslipidemia group compared to the normal group (Table 1).

We used the independent sample t-test to compare continuous variables. Participants categorized as having dyslipidemia were more obese compared to the control group in several different measures. Table 3 indicates that age ($p < .0001$), body weight ($p < .001$), and body mass index ($p = .002$) were significantly higher in the dyslipidemia group compared to the normal group (Table2).

Table 2. Mean values of some characteristics of study sample

Characteristic	Normal (mean ± SD)	Dyslipidemia (mean ± SD)	p-value†
Age (years)	44 ± 12	50 ± 11	.0001
Height (cm)	163.1 ± 8.7	164.2 ± 7.9	.267
Weight (kg)	70.6 ± 15.2	76.8 ± 15.8	.001
BMI (kg/m$^{2)}$	26.5 ± 5.0	28.3 ± 4.9	.002
SBP (mmHg)	119.4 ± 16.4	123.1 ± 15.7	.053
DBP (mmHg)	80.0 ± 10.5	81.4 ± 10.9	.281
TC (mmol/L)	4.2 ± 0.6	5.9 ± 5.4	.001
TG (mmol/L)	0.9 ± 0.4	1.6 ± 1.6	.0001
LDL-C (mmol/L)	2.3 ± 0.6	3.4 ± 1.2	.0001
HDL-C (mmol/L)	1.5 ± 0.4	1.5 ± 0.5	.607
Glucose (mmol/L)	5.4 ± 2.3	5.6 ± 2.3	.701

†using the independent sample t-test

Abbreviations: mean ± SD - mean ± standard deviation, BMI- body mass index, SBP - systolic blood pressure, DBP - diastolic blood pressure, TC -total cholesterol, TG - triglyceride, LDL-C - low-density lipoprotein cholesterol, HDL-C - high-density lipoprotein cholesterol

To identify the main risk factors for dyslipidemia, we used binary multivariate logistic regression analysis and identified age (p < .0001), smoking (p = .035), and obesity as the main influencers of dyslipidemia (Table 3).

Awareness, Treatment, and Control of Dyslipidemia

Table 4 shows the prevalence of dyslipidemia awareness, treatment, and control in the study population stratified by their demographic characteristics, risk factors, awareness, and therapeutic inventions. Among participants with dyslipidemia, only one-third 113 (34.7%) were aware of their condition, and the overall rate of dyslipidemia treatment was 8.3%. Among the 27 patients receiving statin treatment for dyslipidemia, 19 (70.4%) were under control.

The awareness of dyslipidemia increased with age (p <.001), with the 60 -69-year-oldage group having the highest level of awareness, 23(41.8%). There were no gender differences regarding awareness of their dyslipidemia (p >.05). Only the high alcohol consumption group (higher than average drinkers) had lower awareness of dyslipidemia (p=.017).On the other hand, those with a family history of cardiovascular diseases(p = .0001) and dyslipidemia (p = .0001), medical preconditions such as hypertension (p= .0001), diabetes mellitus (p = .0001) and anti-hypertensive medication users (p= .0001) had higher rate of dyslipidemia awareness. Overweight or obese participants were more aware of their dyslipidemia condition than those body mass index was within the normal range (p < .0001) (Table 4).

The treatment rates differed significantly by gender (p=.018), with males having higher treatment rates compared to females. The prevalence of dyslipidemia treatment was significantly associated with awareness of dyslipidemia (p < .001), a family history of dyslipidemia (p =.009), and patients with other medical conditions seemed to have a higher treatment rate as well. For instance, the overweight (BMI ≥ 24.9 kg/m) (p = .01), diabetic (p <.0001) and hypertensive (p <.0001) participants reported that they are using medical treatment. In our study, treatment of dyslipidemia was not significantly associated with age, physical inactivity, smoking, drinking (Table 5).

Estimation of 10-Year Risk of Atherosclerotic Cardiovascular Diseases and Optimal Statin Use

Although high level evidence-based medical treatments are

Table 3. Multivariate binary logistic regression on factors associated with dyslipidemia.

Variables		OR	95% CI		p-value
			Lower	Upper	
Age		1.05	1.02	1.07	.0001
Gender					
	Female	1			
	Male	1.14	0.63	2.05	.658
PIA					
	Active	1			
	Inactive	1.46	0.85	2.5	.175
Smoke					
	No	1			
	Yes	2.17	1.06	4.45	.035
Family history of dyslipidemia					
	No	1			
	Yes	1.37	0.78	2.38	.27
HTN					
	No	1			
	Yes	1.46	0.86	2.48	.156
DM					
	No	1			
	Yes	1.61	0.68	3.85	.28
Obesity					
	Normal	1			
	Over	1.38	0.77	2.48	.274
	Obese	2.05	1.03	4.08	.04

Abbreviations: OR - odds ratio, CI - confidence interval, PIA - physical inactivity, HTN – hypertension, DM - diabetes mellitus

Table 4. The association of dyslipidemia awareness, statin treatment, and control with gender, hereditary, and behavioral risk factors.

	Awareness (N)		p value‡	Treatment (N)		p value‡	Control (N)		p value†
	Yes	No		Yes	No		Yes	No	
Total	113	213		27	299		19	307	
gender			.229			.018			.675
Female	65	137		11	191		7	4	
Male	48	76		16	108		12	4	
Physical activity			.79			.747			1
Inactive	42	76		9	109		6	3	
Active	71	137		18	190		13	5	
Diet			.236			.343			1
Healthy	24	34		3	55		2	1	
Unhealthy	89	179		24	244		17	7	
Alcohol			.017			.117			.616
No	85	136		22	199		16	6	
Yes	26	79		5	100		3	2	
Smoking			.452			.154			.676
No	85	168		18	235		12	6	
Yes	28	45		9	64		7	2	
Hereditary			.0001			.034			1
No	59	158		13	204		9	4	
Yes	54	55		14	95		10	4	
Hypertension			.0001			.002			1
No	37	129		6	160		4	2	
Yes	76	83		21	138		15	6	
Medication			.0001			.0001			.102
No	58	163		10	211		5	5	
Yes	54	51		17	88		14	3	
Diabetes mellitus			.0001			.0001			.405
No	84	200		16	268		10	6	
Yes	29	13		11	31		9	2	
Knowledge						.0001			1
No				3	210		2	1	
Yes				24	89		17	7	
Hereditary[a]			.0001			.009			.236
No	62	185		15	232		9	6	
Yes	51	28		12	67		10	2	
Aspirin[b]			.0001			.0001			.42
No	69	190		14	245		11	3	
Yes	44	23		13	54		8	5	
Age groups			.236			.864			.283
20-29 years	6	15		1	20		1	0	
30-39 years	17	39		3	53		1	2	
40-49 years	28	71		9	90		5	4	
50-59 years	39	56		9	86		8	1	
60-69 years	23	32		5	50		4	1	

Total cholesterol			.003			0.711		.003
	Normal	46	27.1%	15	8.8%	7	46.7%	
	Abnormal	67	42.9%	12	7.7%	12	100.0%	
LDL-C			.015			.269		.069
	Normal	62	147	20	189	12	8	
	Abnormal	50	66	7	109	7	0	
HDL-C			.655			.416		1
	Normal	102	197	25	274	17	8	
	Abnormal	10	16	1	25	1	0	
Triglycerides			.0001			.0001		.001
	Normal	70	179	13	136	5	8	
	Abnormal	43	34	14	63	14	0	
Obesity			.0001			.015		.066
	Normal Weight	22	90	4	108	1	3	
	Overweight	46	72	9	109	8	1	
	Obese	45	51	14	82	10	4	

‡Pearson's Chi-square test; †-Fisher's exact test

[a]Hereditary –indicates familial hypercholesterolemia,[b]Aspirin - indicates usage of aspirin with the last 10 days

Abbreviations: LDL-C- low-density lipoprotein cholesterol, HDL-C - high-density lipoprotein cholesterol

Table 5. The association of dyslipidemia awareness, statin treatment, and control with demographic, anthropometric, and laboratory values.

	Awareness			**Treatment**			**Control**		
	Yes Mean ± SD§	No Mean ± SD§	p value‡	Yes Mean ± SD§	No Mean ± SD§	p value‡	Dyslipidemia Mean ± SD§	Normal Mean ± SD§	p value†
Age	50 ± 12	47 ± 11	47 ± 11	50 ± 11	50 ± 11	0.428	51 ± 11	45 ± 13	0.163
Height	164.3 ± 8.5	163.6 ± 8.0	163.6 ± 8.0	167.0 ± 8.1	167.0 ± 8.1	0.037	167.8 ± 7.2	165.1 ± 10.1	0.449
Weight	79.8 ± 17.5	72.2 ± 14.2	72.2 ± 14.2	87.2 ± 16.9	87.2 ± 16.9	0.0001	89.5 ± 15.4	81.8 ± 19.9	0.283
Body mass index	29.4 ± 5.1	26.9 ± 4.6	26.9 ± 4.6	31.3 ± 5.6	31.3 ± 5.6	0.0001	31.8 ± 5.2	30.0 ± 6.7	0.449
Waist	96.0 ± 14.6	89.5 ± 11.8	89.5 ± 11.8	102.0 ± 15.5	102.0 ± 15.5	0.0001	103.0 ± 13.2	99.6 ± 20.9	0.449
SBP	122.2 ± 16.5	121.8 ± 15.8	121.8 ± 15.8	126.1 ± 14.5	126.1 ± 14.5	0.158	127.2 ± 13.3	123.8 ± 17.7	0.696
DBP	81.4 ± 12.1	80.8 ± 10.0	80.8 ± 10.0	84.8 ± 10.5	84.8 ± 10.5	0.053	85.5 ± 8.8	83.1 ± 14.4	0.389
Total cholesterol	5.4(4.4-6.1)	4.9(4.1-5.7)	4.9(4.1-5.7)	5.1(3.3-6.4)	5.1(3.3-6.4)	0.385†	5.4(4.2-6.6)	3.3(3.1-3.4)	0.001
Triglycerides	1.3(0.9-2.0)	0.9(0.6-1.3)	0.9(0.6-1.3)	1.8(1.0-2.8)	1.8(1.0-2.8)	0.0001†	2.2(1.2-4.2)	1.1(0.8-1.3)	0.005
LDL_C	3.4 ± 1.3	2.9 ± 1.0	2.9 ± 1.0	3.0 ± 1.4	3.0 ± 1.4	0.626	3.5 ± 1.4	1.8 ± 0.5	0.001
HDL_C	1.5 ± 0.5	1.5 ± 0.4	1.5 ± 0.4	1.5 ± 0.4	1.5 ± 0.4	0.56	1.5 ± 0.4	1.6 ± 0.5	0.938
Glucose	6.0 ± 2.8	5.3 ± 2.0	5.3 ± 2.0	7.7 ± 4.2	7.7 ± 4.2	0.0001	7.2 ± 4.1	8.8 ± 4.5	0.307

§-standard deviation (SD), †-Mann Whitney U test, ‡- independent sample t-test

Abbreviations: SBP - systolic blood pressure, DBP - diastolic blood pressure, TC - total cholesterol, LDL-C - low-density lipoprotein cholesterol, HDL-C - high-density lipoprotein cholesterol

available for the treatment of dyslipidemia, not all patients having dyslipidemia are require medication. The first line approach should be self-awareness and lifestyle modifications. The AHA/ACC guideline for assessment of cardiovascular risk clearly stated how to evaluate patients' risk and which group of patients benefit from the medical treatment such as statin and aspirin [10]. Using the online risk calculator, we estimated each participant's 10-year risk of an atherosclerotic cardiovascular disease event and classified subjects into two risk categories: 10-year risk <7.5% and 10-year risk ≥7.5%.The rationale behind is this is that the group of people (10-year risk ≥7.5%) is considered as high-risk category and should be considered for statin treatment [10]. Table 5 indicates that out of 245 over 40 years old participants, 24.5% (60) people were in the high-risk category, yet only 13.3% (8) were taking statin treatment. At the same time, the 7% (13) of 185 moderate or low-risk holders are on statin treatment (Table 6).

Discussion

We aimed to assess the current state of dyslipidemia awareness, treatment, and control in Ulaanbaatar – the capital city of Mongolia. Because dyslipidemia is almost asymptomatic, the individuals are not aware of the condition until the physician refers them to the blood test specifically for analyzing lipid profiles. This study was conducted before the publication and application of the first-ever National Guidelines of Dyslipidemia in Mongolia. Consequently, our data can provide vital baseline reference data for evaluating the implementation and impact of the National Dyslipidemia Guideline.

According to our study, the dyslipidemia prevalence was 68.7% (224), which is higher than the 62.7% in the latest nationwide STEPs survey in Mongolia conducted in 2013 [4]. One explanation could be that the dyslipidemia prevalence has increased over the years, but also it can be explained by study population age differences. In our study, we recruited 20-70 years old people, while the national STEPs survey included Mongolians between 15-64 years of age. Our 68.7% prevalence of dyslipidemia is as high as in rural South Africa (67.3%) [15] and Luxembourg (69.9%) [16], while the prevalence in Canada, China, USA, Kazakhstan and Malaysia was 40% [11], 41.9% [13] 53% [17], 37.0% [18] and 47.7% [19] respectively.

Although, in general, hypertriglyceridemia seems more dominant among dyslipidemia studies [13,14], hypercholesterolemia, specifically, LDL-C increment, was most prevalent in our study population. LDL-C hypercholesterolemia is known to accelerate atherosclerosis and is linked with adverse cardiovascular outcomes [20]. Consistent with the other studies, dyslipidemia increased with age. This finding was similar to the results of the other survey of Mongolians [21]. According to our logistic regression model, smoking, aging, and obesity were the main risk factors for dyslipidemia. These results imply that to reduce dyslipidemia, our society and government need to promote smoking cessation, physical activity, and healthy eating habits.

Our study revealed an alarmingly high prevalence of dyslipidemia, low level of awareness, insufficient treatment, and a surprisingly high control of dyslipidemia among the adults aged 20-69 in Ulaanbaatar, Mongolia. More specifically, out of the 326 participants 224 (68.7% total, 64.9% in females; 75% in males) had dyslipidemia, and approximately one-third (34.7 %, 113) were aware of their dyslipidemia, which was as high as in Canadians [11]. Mongolian's awareness was higher than in rural South Africa (1.05%) [14], China (10.93%) [13], and Luxemburg (14.9%) [12]. The awareness level is still low but suggests that doctors in Ulaanbaatar checking their patients for

Table 6. Characteristics of statin treatment based on 10-year risk of atherosclerotic cardiovascular disease.

Statin		Statin No		Statin Yes		Total		p-value
		n	%	n	%	n	%	
Risk								0.181
	10-year risk <7.5%	172	93.0%	13	7.0%	185	75.5%	
	10-year risk ≥7.5%	52	86.7%	8	13.3%	60	24.5%	
	Total	224	91.4%	21	8.6%	245	100.0%	

Note that the risk calculation is only used for people over 40 years of age, thereby reducing the number of participants reported here compared to the previous tables.

dyslipidemia and informing them about their condition.

Regarding treatment, out of the 224 people with dyslipidemia, only 27 (8.3%) were taking statins. This finding is consistent with other studies in the region but is lower than in developed countries. Among those individuals receiving treatment, in 19 (70.4%),their serum lipid levels were under control, which is as high as Canada [11] and higher than most of the studies reported, such as 3.53% [22] in China and 34.8% [23].

Although the treatment rate seems comparable to other countries, it is vital to recognize that nearly all patients who are eligible ultimately benefit from statin treatment. As we have shown in Figure 6, an insufficient number of people at high risk of heart attack and stroke are on statin treatment, while those with low and moderate risk are on statin treatment. The first-ever National Dyslipidemia guideline comprehensively addressed this issue, and now it is essential to improve the awareness of doctors and facilitate utilization. While to our knowledge, our study is the first to report on awareness, treatment, and control of dyslipidemia among the population of Ulaanbaatar, a nationwide study of dyslipidemia is crucial because our country has a large rural Mongolian population with a different lifestyle that also needs access to dyslipidemia management.

Our study suggests two ways to decrease dyslipidemia and thereby reduce adverse cardiovascular events. Most importantly, as shown in our logistic regression model results, the overweight/obesity and tobacco need to be addressed comprehensively. The government and city should provide education regarding the adverse effects of smoking and promote exercise for the citizens by establishing parks, bicycle roads, accessible sports centers [24], etc. as well as supporting the consumption of healthy low-fat less-processed foods [25]. Healthcare professionals and public health specialists need to educate the general population, and people have to make responsible choices for their own health. Secondly, health care professionals, especially primary care doctors, should regularly screen their community and evaluate their patient's atherosclerotic cardiovascular risks. A heart-healthy lifestyle should always be discussed, and lipid-lowering drug treatment prescribed for populations at high risk for adverse cardiovascular events.

Limitations

Our results are limited to Mongolians living in the urban center of the country with no history of clinical atherosclerotic cardiovascular diseases. There may have been some recruitment bias as homebound patients, and those working long hours may not have been able to participate. Our findings are likely not applicable to those living in rural locations.

Conclusion

Our study revealed an alarmingly high prevalence of dyslipidemia, low level of awareness, insufficient treatment, yet a comparatively high level of control of dyslipidemia among the adults aged 20-69 in Ulaanbaatar relative to some other countries. The awareness, treatment, and control of dyslipidemia in the rural parts of Mongolia are unknown.

Acknowledgment

The study was funded by the grant entitled "Hereditary Dyslipidemia" from the Science and Technology Fund of Mongolian National University of Medical Sciences.

Conflict of Interest

The authors declare that they have no competing interests.

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