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# Epidemiology and Risk Factors of Menopause Syndrome Among Uyghur, Han, and Kazak Women in Xinjiang, China

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**Background:** This study analyzed the epidemiology and the risk factors of menopause syndrome (MPS) among Uyghur, Han, and Kazak women in Xinjiang.

**Material/Methods:** This was a cross-sectional study. The stratified-cluster random-sampling method was used. A total of 3382 women aged 40 to 60 years of age were included from Urumqi City, Kashgar City, Altay City, Ili Kazakh Autonomous Prefecture, Künes County, Mongolkure County, Tekes County, Taledo town, Alemale Township, and Ulugchat County (Kashgar Prefecture) in Xinjiang Province. A questionnaire was used to survey the clinical characteristics of MPS. Logistic regression analysis was used to analyze the MPS risk factors among Uyghur, Han, and Kazak women.

**Results:** Oral contraceptives, negative life events, and menopause stages can influence MPS in Han women. In addition, occupation, body weight, mental illness, drug or alcohol abuse, and income level also affect the MPS of Uyghur women. In contrast to Han and Uyghur participants, education, menopausal pattern (natural or artificial), reproductive factors, and smoking are risk factors of MPS in Kazakh women.

**Conclusions:** The menopausal stages and the risk factors for MPS are different among Uyghur, Han, and Kazak women.

**MeSH Keywords:** **Ethnic Groups • Menopause • Risk Factors**

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## Background

Menopause syndrome (MPS) results from the gradual depletion of follicles, presenting as declining ovarian function and fluctuations or decline in estrogen levels [1,2]. The symptoms include hot flashes, sweating, distress, depression, insomnia, dizziness, and palpitations [3]. In addition, the long-term effects of ovarian function depletion include cognitive disorders, cardiovascular diseases, neurological diseases, osteoporosis, urogenital atrophy, and metabolic disorders [4]. These symptoms may appear 3–10 years after menopause [5]. MPS may influence not only women's health, but also their work, family, and interpersonal relationships, further causing increased economic burden. According to a 2012 World Health Organization (WHO) survey, the number of perimenopausal women is expected to reach 1.2 billion in 2030, and nearly 76% of them will be in developing countries [6]. Currently, the number of perimenopausal women has reached 120 million in China and is the highest among all developing countries, accounting for 10% of the Chinese population and 23% of all perimenopausal women [7]. It is estimated that the number of women over age 50 will increase to 280 million in China by 2030 [8,9]. Therefore, the WHO has included care of perimenopausal women and improving the quality of life of women in the 21st century as a major focus [1,10].

MPS is a physiological process that is affected by genetics, race, ethnicity, environment, lifestyle, economy, food, culture, and religion [11]. Women of different ethnic and racial groups may have different MPS symptoms at different menopausal ages [12]. Many ethnic groups are currently living in Xinjiang Province, with Uyghur, Han, and Kazak being the largest ethnic groups [13]. These 3 ethnic groups have different genetic backgrounds, lifestyle characteristics, and cultural customs that may influence MPS. However, there have been no studies concerning the epidemiology features of MPS among Uyghur, Han, and Kazak women in Xinjiang.

Therefore, we conducted an epidemiology study of Uyghur, Han, and Kazak women in Xinjiang in order to identify MPS characteristics and risk factors.

## Material and Methods

### Participants

In this study, stratified random sampling was used for geography (southern or northern), ethnic groups (Uyghur or Han or Kazak), and economic status (urban or rural). Women of 3 different ethnic groups (Uyghur, Han, and Kazak) were enrolled from different regions of Xinjiang, including Urumqi City, Kashgar City, Altay City, Ili Kazakh Autonomous Prefecture,

Künes County, Mongolkure County, Tekes County, Taledo Town, Alemale Township, and Ulugchat County (Kashgar Prefecture). Kashgar is a city in the southern area of Xinjiang, while Altay and Ili are cities in the northern part of Xinjiang.

The inclusion criteria were: 1) Uyghur or Han or Kazak women aged 40–60 years, born in Xinjiang; 2) had 2 or more menstrual disorders; 3) had uterus and at least 1 side of the ovary; and 4) were physically and mentally capable of understanding and signing the informed consent of the evaluation.

The exclusion criteria were: 1) history of thyroid cancer, breast cancer, endometrial cancer, atypical endometrial hyperplasia or severe neurological disorders (such as intracranial tumors and severe Parkinson's disease); 2) received estrogens in the past 3 months; 3) incapable of understanding the contents of the questionnaire; 4) impaired vision, hearing, or language function; 5) history of alcohol or drug abuse in the past 6 months, and 6) immigrants from other regions.

Informed consents were obtained from the participants and the study was approved by the Ethics Review Board of the First Affiliated Hospital of Xinjiang Medical University (ethics approval code number 81660249).

### Questionnaire

In this study, questionnaire method was used to investigate the epidemiology and risk factors of menopause syndrome among Uyghur, Han, and Kazak women in Xinjiang. Based on the ethnic characteristics and population distribution characteristics of the Xinjiang region and the lifestyle characteristics of Xinjiang's ethnic groups, the original questionnaire was designed by our group and was written in Chinese. It contained information on demographics, menstrual history, reproductive history, and menopausal stages. To better perform this research, the questionnaire was translated into Kazak and Uyghur languages. Local medical workers also assisted us in the interpretation of some items in this questionnaire when performing the investigation.

All enrolled women were surveyed using this questionnaire. The modified Kupperman Index (KI) score (range 0–63) was used to do further evaluation. The KI <6 was considered as normal; KI of 6–15 was mild MPS; KI of 16–30 was moderate MPS; KI > 30 was severe MPS; and patients with KI ≥17 was diagnosed as having MPS.

### Statistical analysis

The database was established using EpiData3.1. All data were input and verified by 2 people for accuracy. SPSS 17.0 software (IBM, USA) was used for statistical analysis. The mean ±

**Table 1.** Menopausal syndromes of Uyghur women (N=941), Han women (N=1019), and Kazak women (N=1422).

Menopausal syndromes	Uyghur women (N=941) (%)	Han women (N=1019) (%)	Kazak women (N=1422) (%)
Flushing and sweating	545 (57.9%)	898 (88.1%)	800 (56.3%)
Palpitations	617 (71%)	723 (71%)	949 (66.7%)
Headache	527 (69%)	703 (69%)	902 (63.4%)
Insomnia	549 (58.3)	697 (68.4%)	919 (64.6%)
Distress	592 (62.9%)	693 (68%)	906 (63.7%)
Fatigue	692 (64.8%)	660 (64.8)	1057 (74.3%)
Urinary disorders	262 (58.1%)	592 (58.1%)	391 (27.5%)
Muscle and/or joint pain	668 (55.6%)	567 (55.6%)	983 (69.1%)
Dizziness	317 (51.3%)	523 (51.3)	644 (45.3%)
Formication	329 (45.7%)	466 (45.7%)	720 (50.6%)
Depression	225 (33.2%)	338 (33.2%)	394 (27.7%)
Paresthesia	223 (23.7%)	287 (28.2%)	416 (28.6%)
Vaginal symptoms	166 (22.5)	229 (22.5%)	412 (29%)

standard deviation was used for continuous variables. Group comparison of categorical data used analysis of variance or rank sum test. Group comparison of quantitative data used analysis of variance. Group comparison of ordinal data used Mann-Whitney U test or Kruskal-Wallis H test. Binary logistic regression was used to evaluate risk factors for MPS.  $P < 0.05$  was considered as significant.

## Results

### Demographics

At first, a total of 3500 women were sampled in this study. However, 62 women refused to participate in the survey and 56 women dropped out. Finally, 3382 (96.63%) women completed the questionnaire, including 941 Uyghur, 1019 Han, and 1422 Kazak women. The sampled women were ages 40–60 years old and their education ranged from elementary school to college.

### MPS symptoms

To determine MPS symptoms among different ethnic groups, the MPS symptom frequency of Uyghur, Han, and Kazak women was analyzed. The primary MPS symptom for Han women was autonomic dysfunctions, such as flushing and sweating, palpitations, and headaches, followed by urogenital atrophy and somatic symptoms (Table 1). The primary MPS symptom for Uyghur and Kazak women was somatic symptoms, followed

by autonomic dysfunctions and urogenital atrophy symptoms (Table 1).

### MPS incidence

To determine the MPS incidence in different ethnic groups, the KI scores of Uyghur, Han, and Kazak women were analyzed. Patients with  $KI \geq 17$  were diagnosed as having MPS [9]. There were 82.92% of Han women, 65.78% of Uyghur women, and 66.53% of Kazakh women diagnosed with MPS (Table 2).

### MPS risk factors

To determine the MPS risk factors of the different ethnic groups, the education, menopausal pattern, reproductive factors, occupation, weight, drug abuse, smoking, alcohol abuse, negative life events, mental illness, and income of Uyghur, Han, and Kazak women were analyzed.

As shown in Table 3, among Han MPS women, the risk of higher KI score in women with artificial menopause was 3.029 (1.469–6.244) times higher compared with those with natural menopause. The risk of higher KI score in women taking oral contraceptives was 0.465 (0.309–0.699) times higher compared with those without birth control. The risk of higher KI score in women with drug abuse history was 0.416 (0.196–0.885) times higher compared with those without. The risk of higher KI score in women with negative life events was 0.469 (0.306–0.719) times compared with those without. The risk of higher

**Table 2.** KI score of MPS in Uyghur, Han, and Kazak women.

KI score Groups	<6		6–16		16–30		> 30		Total	
	N	%	N	%	N	%	N	%	N	%
Uyghur	62	6.6	260	27.6	441	46.9	178	18.9	941	27.82
Han	12	1.2	162	15.9	485	47.6	360	35.3	1019	30.13
Kazak	112	7.9	364	25.6	599	42.1	347	24.4	1422	42.05
Total	186	5.5	786	23.2	1525	45.1	885	26.2	3382	100.00

KI – Kupperman index; MPS – Menopause symptom.

**Table 3.** Logistic regression of MPS in Han women (N=1019).

Variables	B	SE	Wald	P	OR (95%CI)
Contraceptive methods			23.532	<0.001	
$x_7$ No contraceptive	-2.191	1.443	2.307	0.129	0.112 (0.007, 1.889)
Oral contraceptive	-0.765	0.208	13.533	0.000	0.465 (0.309, 0.699)
$x_8$ Menopausal pattern	1.108	0.369	9.014	0.003	3.029 (1.469, 6.244)
$x_{13}$ History of drug abuse	-0.877	0.385	5.179	0.023	0.416 (0.196, 0.885)
$x_{18}$ Negative events	-0.756	0.218	12.071	0.001	0.469 (0.306, 0.719)
Menopause staging			16.732	<0.001	
$x_{22}$ Premenopausal period	-0.859	0.227	14.324	<0.001	0.424 (0.271, 0.661)
Menopause	-2.657	1.358	3.830	0.045	0.070 (0.005, 1.004)
Constant	0.115	1.594	0.005	0.943	1.121

KI score in women at premenopausal stage was 0.424 (0.271–0.661) times higher compared with those with menopause. The risk of higher KI score in women at perimenopausal stage was 0.070 (0.005–1.004) times higher compared with those with menopause.

As shown in Table 4, among Uyghur MPS women, the risk of higher KI score in women with low or no education was 4.509 (1.516–13.406) times higher compared with those with at least college education. The risk of higher KI score in women with primary school education was 3.415 (1.178–8.399) times higher compared with those with at least college education. The risk of higher KI score in women with artificial menopause was 3.567 (2.464–5.164) times higher compared with those with natural menopause. The risk of higher KI score in women with no reproduction was 4.651 (1.138–19.009) times higher compared with those with reproduction of  $\geq 3$  times. The risk of higher KI score in women with only 1 reproduction was 1.879 (1.205–2.930) times higher compared with those with reproduction of  $\geq 3$  times. The risk of higher KI score in women with 2 reproductions was 1.150 (0.724–1.827) times higher compared with those with reproduction of  $\geq 3$  times. The risk of higher KI score in professional women was 0.086 (0.012–0.625)

times higher compared with those of other occupations. The risk of higher KI score in women with body mass index (BMI)  $\leq 18.5$  kg/m<sup>2</sup> was 0.493 (0.287–0.847) times higher than those with BMI  $\geq 30$  kg/m<sup>2</sup>. The risk of higher KI score in women with BMI of 18.5 to 25 kg/m<sup>2</sup> was 0.403 (0.261–0.624) times higher than in those with BMI  $\geq 30$  kg/m<sup>2</sup>. The risk of higher KI score in women with BMI of 25 to 30 kg/m<sup>2</sup> was 0.598 (0.367–0.975) times higher than in those with BMI  $\geq 30$  kg/m<sup>2</sup>. The risk of higher KI score in women without drug abuse was 0.567 (0.319–1.008) times higher than in those with drug abuse. The risk of higher KI score in women without smoking was 0.283 (0.125–0.638) times higher than in those with smoking. The risk of higher KI score in women without drinking was 0.456 (0.227–0.917) times higher than in those with drinking. The risk of higher KI score in women without negative life events was 0.473 (0.309–0.723) times higher than in those with negative life events. The risk of higher KI score in women without mental illness was 0.226 (0.110–0.466) times higher than in those with mental illness. The risk of higher KI score in women with monthly income of 500 Yuan was 0.463 (0.243–0.882) times higher than in those earning  $\geq 3000$  Yuan. The risk of higher KI score in women with monthly income of 2000 Yuan was 0.554 (0.289–1.063) times higher than in those earning  $\geq 3000$ .

**Table 4.** Logistic regression of MPS in Uyghur women (N=941).

	Variables	B	SE	Wald	P	OR (95%CI)
	Number of reproduction			12.714	0.005	
x <sub>4</sub>	0	1.537	0.718	4.578	0.032	4.651 (1.138, 19.009)
	1	0.631	0.227	7.749	0.005	1.879 (1.205, 2.930)
	≥3	0.140	0.236	0.349	0.555	1.150 (0.724, 1.827)
x <sub>8</sub>	Menopausal pattern	1.272	0.189	45.396	<0.001	3.567 (2.464, 5.164)
	Occupation			11.104	0.025	
x <sub>10</sub>	Cadre	-2.457	1.014	5.871	0.015	0.086 (0.012, 0.625)
	Worker	-1.590	0.959	2.746	0.097	0.204 (0.031, 1.337)
	Farmer	-1.167	0.948	1.517	0.218	0.311 (0.049, 1.994)
	Freelancer	-0.680	1.061	0.411	0.521	0.507 (0.063, 4.051)
	BMI (kg/m <sup>2</sup> )			17.129	0.001	
x <sub>11</sub>	18.5	-0.708	0.276	6.567	0.010	0.493 (0.287, 0.847)
	25	-0.908	0.223	16.578	<0.001	0.403 (0.261, 0.624)
	≥30	-0.514	0.250	4.241	0.039	0.598 (0.367, 0.975)
	Education			8.522	0.036	
x <sub>12</sub>	University and above	1.506	0.556	7.338	0.007	4.509 (1.516, 13.406)
	High school	1.146	0.501	5.229	0.022	3.145 (1.178, 8.399)
	Primary school and below	0.493	0.404	1.490	0.222	1.638 (0.742, 3.616)
x <sub>13</sub>	History of drug abuse	-0.567	0.293	3.732	0.043	0.567 (0.319, 1.008)
x <sub>15</sub>	History of smoking	-1.263	0.415	9.251	0.002	0.283 (0.125, 0.638)
x <sub>16</sub>	History of drinking	-0.785	0.357	4.846	0.028	0.456 (0.227, 0.917)
x <sub>18</sub>	Negative events	-0.749	0.217	11.947	0.001	0.473 (0.309, 0.723)
x <sub>19</sub>	History mental illness	-1.488	0.369	16.232	<0.001	0.226 (0.110, 0.466)
	Monthly income (Yuan)			6.321	0.176	
x <sub>21</sub>	<500	-0.534	0.378	1.996	0.158	0.586 (0.280, 1.229)
	=500	-0.770	0.328	5.493	0.019	0.463 (0.243, 0.882)
	=2000	-0.519	0.322	2.594	0.107	0.595 (0.316, 1.119)
	=3000	-0.591	0.333	3.151	0.076	0.554 (0.289, 1.063)
	Constant	3.157	1.247	6.404	0.011	23.494

As shown in Table 5, among Kazakh MPS women, the risk of higher KI score in women with artificial menopause was 2.553 (1.866–3.494) times higher compared with those with natural menopause. The risk of higher KI score in women with no education was 8.745 (2.213–34.555) times higher compared with those with higher than college education. The risk of higher KI score in women taking oral contraceptives was 0.290

(0.184–0.458) times higher compared with those not taking contraceptives. The risk of higher KI score in professional women was 0.045 (0.013–0.160) times higher compared with those of other occupations. The risk of higher KI score in women with farming occupation was 0.269 (0.087–0.832) times higher than in non-farmers. The risk of higher KI score in women with BMI of 25kg/m<sup>2</sup> was 0.492 (0.340–0.711) times higher compared

**Table 5.** Logistic regression of MPS in Kazak women (N=1422).

	Variables	B	SE	Wald	P	OR (95%CI)
	Contraceptive methods			28.994	<0.001	
x <sub>7</sub>	No contraceptive	-0.185	1.179	0.025	0.875	0.831 (0.082, 8.376)
	Oral contraceptive	-1.236	0.232	28.310	<0.001	0.290 (0.184, 0.458)
x <sub>8</sub>	Menopausal pattern	0.937	0.160	34.308	<0.001	2.553 (1.866, 3.494)
	Occupation			39.893	<0.001	
x <sub>10</sub>	Cadre	-3.104	0.649	22.895	<0.001	0.045 (0.013, 0.160)
	Worker	-0.420	0.711	0.349	0.555	0.657 (0.163, 2.649)
	Farmer	-1.313	0.576	5.191	0.023	0.269 (0.087, 0.832)
	Freelancer	0.344	0.946	0.132	0.716	1.411 (0.221, 9.003)
	BMI (kg/m <sup>2</sup> )			20.626	<0.001	
x <sub>11</sub>	18.5	-0.178	0.230	0.600	0.439	0.837 (0.533, 1.313)
	25	-0.710	0.188	14.256	<0.001	0.492 (0.340, 0.711)
	≥30	-0.160	0.212	0.566	0.452	0.852 (0.562, 1.292)
	Education			34.568	<0.001	
x <sub>12</sub>	University and above	2.168	0.701	9.568	0.002	8.745 (2.213, 34.555)
	High school	0.949	0.639	2.203	0.138	2.583 (0.738, 9.047)
	Primary school and below	0.271	0.629	0.186	0.667	1.311 (0.382, 4.497)
x <sub>14</sub>	History of drug abuse	-2.601	1.185	4.817	0.028	0.074 (0.007, 0.757)
x <sub>16</sub>	History of drinking	-0.956	0.253	14.311	<0.001	0.384 (0.234, 0.631)
x <sub>18</sub>	Negative events	-0.989	0.197	25.299	<0.001	0.372 (0.253, 0.547)
x <sub>19</sub>	History mental illness	-1.015	0.265	14.687	<0.001	0.362 (0.216, 0.609)
	Monthly income (Yuan)			27.660	<0.001	
x <sub>21</sub>	<500	-0.343	0.402	0.730	0.393	0.709 (0.323, 1.560)
	=500	-1.068	0.386	7.651	0.006	0.344 (0.161, 0.733)
	=2000	-0.907	0.390	5.412	0.020	0.404 (0.188, 0.867)
	=3000	0.065	0.449	0.021	0.884	1.067 (0.443, 2.572)
	Menopausal pattern			26.521	<0.001	
x <sub>22</sub>	Premenopausal period	-0.526	0.186	8.009	0.005	0.591 (0.410, 0.851)
	Menopause	-0.844	0.176	23.115	<0.001	0.430 (0.305, 0.606)
	Constant	5.162	1.017	25.752	<0.001	174.456

with those with BMI ≥30 kg/m<sup>2</sup>. The risk of higher KI score in women without drug abuse was 0.074 (0.007–0.757) times higher than in those with drug abuse. The risk of higher KI score in women without alcohol abuse was 0.384 (0.234–0.631) times higher than in those with. The risk of higher KI score in women without negative life events was 0.372 (0.253–0.547)

times higher compared to those negative life events. The risk of higher KI score in women without mental illness was 0.362 (0.216–0.609) times higher compared with those with mental illness. The risk of higher KI score in women with monthly income of 500 Yuan was 0.344 (0.161–0.733) times higher than in those earning ≥3000 Yuan. The risk of higher KI score in

women with monthly income of 1000 Yuan was 0.404 (0.188–0.867) times higher than in those earning  $\geq 3000$  Yuan. The risk of higher KI score in women at premenopausal stage was 0.591 (0.410–0.851) times higher compared with those with menopause. The risk of higher KI score in women at perimenopausal stage was 0.430 (0.305–0.606) times higher compared with those with menopause.

## Discussion

MPS results from ovarian dysfunction, which leads to excessive estrogen reduction, hypothalamic-pituitary-ovarian axis or adrenal dysfunction, and imbalance of neurotransmitters, hormones, and cytokines [14,15]. These hormonal imbalances can result in a series of abnormal vasomotor symptoms, such as urogenital atrophy symptoms, somatic symptoms, and mental illness [16]. Prior investigations showed that 90% of perimenopausal women show clinical symptoms, 70%–90% show menstrual disorders with varying severity of somatic dysfunctions, and 10–30% show severe symptoms [17]. About 1/3 of women reach a new balance by self-regulated neuroendocrine, and 2/3 of women show progressive symptoms and persistent diseases for many years, influencing health and leading to huge economic burdens [18,19]. With advances in healthcare, life expectancy is reaching 80 years old in China, indicating that 1/3 of female life (i.e., 30 years) is in the perimenopausal period [20]. Therefore, MPS care is urgently needed to improve the quality of life in perimenopausal women.

In recent years, it has been shown that MPS is determined by a wide range of factors, including race, ethnicity, genetics, social background, environment, geographical location, age, education level, living conditions, employment, physical activity, BMI, marital status, hormonal status, spouse's health conditions, and sexual life [21,22]. A survey in Finland showed that 95% of women aged 52–56 years and 64% of women aged 42–46 years experience MPS, and different races may have different symptom severities [16]. It was reported that MPS symptoms were the least serious among Chinese and Japanese women, vasoconstriction symptoms (flushing and sweating) were the highest among black women, and sleep disorders were the highest among white women [23,24]. Different countries and different races may have significantly different frequency, duration, and severity of symptoms. For example, the SWAN (Study Women's Health Across the Nation) study has shown that the most common MPS symptom, vasoconstriction, occurs in 45.6% of black women, 31.2% of whites, 20.5% of Chinese, and 17.6% of Japanese [25].

An epidemiology study in Hawaii also showed that European and American women are more likely to have flushing and sweating compared with Asian women [18]. The incidence

of flushing and sweating ranged from 23.3% to 46.6% [25]. Chen et al. surveyed perimenopausal patients with menopause symptoms from 14 medical clinics in China, and showed that 78.43% of women presented with MPS symptoms, mostly mild to moderate [3]. The most common MPS symptoms were fatigue (71.48%), irritability (68.68%), insomnia (67.65%), joint and muscle pain (64.11%), and flushing (57.90%). In different stages of menopause, the severity of symptoms varied, especially for the late menopause (59.1%) and post-menopausal stages (51.1%) [23]. It was reported that 76.5% (750/981) of patients showed MPS during menstrual changes, 17.5% of patients showed MPS first and then underwent menstrual changes, and 6.0% of patients showed MPS after menopause. MPS was associated with the number of reproductions and pregnancies, as well as marital status [19,21].

In this study, we found that the primary MPS symptoms were autonomic dysfunction symptoms among Uyghur, Han, and Kazak women. However, different ethnic groups may have different symptoms and the number of symptoms increased with the development of premenopause, perimenopause, and menopause, in accordance with a previous report [26]. Women with higher education, professional occupation, and higher income tend to have milder MPS symptoms. It is reported that the severity of MPS was negatively correlated with education and income levels among all populations [24,27]. This may be because women in better economic conditions tend to have better access to high-quality medical resources and are in better physical health. Women with higher education tend to have more social resources and higher cognitive abilities to control MPS discomfort. In addition, women in better economic conditions tend to have higher education level and stable working environment; therefore, MPS is relatively mild. On the contrary, unemployed women may experience severe MPS due to dissatisfaction from work and loneliness. Gjelsvik showed that women with higher education tended to better control MPS due to better cognitive ability, strong mental capacity, and optimistic and positive attitudes [12].

Smoking and alcohol abuse are positively correlated with MPS [27]. This study showed that KI score was higher in women with smoking and alcohol abuse in Uyghur and Kazak women, indicating severe MPS. It has been reported that smoking can cause flushing, the main symptom of MPS [28,29]. Excessive drinking can lead to overweight and obesity, which is also a risk factor for flushing [9,30]. Increased BMI is associated with lipid metabolism, reduced activity, lower metabolism, and excess intake of calories, leading to severe MPS, cardiovascular and cerebrovascular diseases, diabetes, and even cancer [19,31]. The above was consistent with our study, especially for the Uyghur and Kazak women. A cross-sectional study in the UK showed that women of normal weight tend to have lower incidence of vasoconstriction symptoms and lower KI score

compared with overweight women, suggesting better quality of life [31]. A randomized control trial showed that an intensive weight intervention can relieve the severity of vasoconstriction symptoms [32].

This study showed that the MPS incidence was higher among Uyghur, Han, and Kazak women with negative life events compared with those without. This is consistent with a prior report [33] suggesting that negative life events cause a series of physiological-psychological stress to aggravate the MPS symptoms in perimenopausal women.

This study showed that the MPS incidence was higher among Uyghur, Han, and Kazak women taking oral contraceptives and with multiple pregnancies compared with those without, consistent with a previous report [34]. This may be because natural menopause is associated with oocyte loss rate and ovulation cycle. The increased number of pregnancies and use of oral contraceptives reduces the ovulation cycle, inhibits the release of follicle-stimulating hormones, and delays oocyte loss, leading to delayed menopause [35]. Therefore, the MPS

symptoms and incidence were lower in women taking oral contraceptives and having multiple pregnancies.

One limitation of this study is that the proportion and number of participants in different ethnic groups were not estimated before the survey, which may cause bias in different ethnic groups. Further studies are needed.

## Conclusions

In conclusion, our study demonstrated the menopausal stages and the risk factors of MPS are different in different ethnic groups. Therefore, gynecologists should conduct targeted health education and treatment to reduce the occurrence of MPS and improve the quality of life of perimenopausal women.

## Conflict of interests

None.

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