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Prevalence of hysterectomy and its determinants in northern Iran: enrollment results of the Tabari cohort study

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Abstract

Background To the best of our knowledge, no population-based studies have provided insights into the prevalence of hysterectomy and its risk factors among northern Iranian females. Thus, the present study aimed to investigate the prevalence and sociodemographic determinants of hysterectomy in a large cohort of northern Iranian females.

Methods This cross-sectional study included data from the enrollment phase of the Tabari cohort study (TCS). The TCS consists of 10,255 adults (4,149 males and 6,106 females) aged 35–70 years who reside in Sari, Mazandaran, Iran, of which 6103 females were included in the study. Multiple logistic regression analysis was used to search for hysterectomy determinants.

Results Our results revealed that the prevalence of hysterectomy among northern Iranian females was 9.7% (595/6103). Additionally, 50–59 (OR: 4.63, 95% CI: 3.57–6.01) and 60–70 (OR: 5.83, 95% CI: 4.28–7.95) age groups, higher socioeconomic levels (OR: 1.66, 95% CI: 1.13–2.42), a history of tubectomy (OR: 1.27, 95% CI: 1.05–1.53), and more gravida (OR: 5.35, 95% CI: 1.62–17.63) were found to increase the odds of hysterectomy, whereas living in mountainous areas (OR: 0.57, 95% CI: 0.43–2.75) and having a job (OR: 0.62, 95% CI: 0.45–0.86) were found to decrease the odds of hysterectomy.

Conclusion Older age groups, living in urban areas, higher socioeconomic levels, not having a job, a history of tubectomy, and more gravida were found to increase the odds of hysterectomy.

Keywords Hysterectomy, Risk factor, Prevalence, Cohort, Iran

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Background

Hysterectomy, which is frequently performed in women, involves surgical removal of the uterus and can be classified as partial, total, or radical based on the extent of the operation [1]. Approximately 90% of these procedures address noncancerous gynecological conditions, including uterine fibroids, endometriosis, and pelvic organ prolapse [2]. This surgery provides symptom relief, prevents life-threatening conditions, and enhances quality of life. However, it is associated with risks such as surgical complications, extended recovery periods, hormonal imbalances, emotional effects, and other potential issues [3–5]. Thus, recognizing the prevalence and risk factors associated with hysterectomies is vital for identifying high-risk individuals, facilitating early intervention, and guiding healthcare planning and patient education to achieve optimal outcomes.

Understanding the potential consequences of an increase in hysterectomy incidence is critical. On the one hand, increased access to hysterectomies may lead to improved healthcare services, allowing more women to address debilitating gynecological conditions effectively. This could lead to enhanced quality of life, reduced morbidity from untreated conditions, and potentially even lower healthcare costs due to fewer hospital admissions for complications of untreated gynecological diseases [6–8].

On the other hand, a rise in hysterectomy rates could also signify overutilization of the procedure, possibly driven by factors such as socioeconomic disparities, variations in clinical practice, or lack of access to alternative treatments [9]. Hysterectomy has been associated with significant negative consequences, including increased risk of cardiovascular disease, osteoporosis, fractures, and mental health disorders, mostly due to estrogen and progesterone insufficiency, especially when performed at a relatively young age [10–13]. Additionally, there are concerns about the impact on fertility and incomplete family planning and the psychological effects of undergoing such life-altering surgery [13]. Therefore, while hysterectomy can be life-saving and improve the quality of life for many women, an unnecessary increase in its prevalence could have profound public health implications.

Various studies have assessed the prevalence of hysterectomy in different parts of the world for a variety of reasons. In a meta-analysis in 2023, the pooled incidence of emergency peripartum hysterectomy was estimated to be 1.1 per 1000 births, with the highest rates in lower- and middle-income nations [14]. However, a population-based study in Canada reported a prevalence of 15.4% in women with hysterectomy (WWH) [15], whereas in India, the prevalence was reported to be 11.35% [16]. Other studies conducted in other nations reported different results in terms of the prevalence of hysterectomy. Recent studies have shown a prevalence of 21.1% in the United States [1], 10% in Scotland [17], 10.4% in Denmark [18], and 9.7% in the United Kingdom [19]. Even within the same country, the prevalence of hysterectomy may differ across different provinces. For example, in India, the prevalence of hysterectomy was estimated to be 7.05% in West Bengal [20], 8.7% in Telangana, 4% in Gujarat, and 0.8% in Sikkim [21]. In Germany, the prevalence was 24.3% in Essen, 21.8% in Dortmund, 18.7% in Bavaria, and 10.8% in West Pomerania [22]. Thus, further research may be necessary to determine the prevalence of hysterectomies in other parts of the world, especially in lower- and middle-income countries (due to their possibly increased prevalence).

Additionally, some studies have delved into the determinants and predictors of hysterectomy. Rout et al. [16] suggested that urban residence, having a job, higher socioeconomic level, cancer, hypertension, and diabetes may be considered determinants of hysterectomy in India. However, Kumari et al. [21] reported that rural residence and older age were determinants of hysterectomy. Furthermore, age at menarche, triglyceride levels, education, and history of previous cesarean section were also found to be related to hysterectomy [23–26].

In addition to geographical variations, studies suggest that other variables, such as ethnicity and age, may also be involved in the significant differences in the prevalence of hysterectomies among different nations [27]. Unlike Brett et al. [28], Lawson et al. [29] reported that Hispanic women were more likely to undergo hysterectomy, whereas Bower et al. [30] reported that African-American women were more likely to undergo hysterectomy. In the Persian population, only a few studies have investigated the prevalence of hysterectomies, with many limitations in terms of study design and sample size. Among Iranian female adults, Jalalian et al. [31] reported a 3.8% prevalence among 150 women in Ilam Province, Gurtani et al. [32] reported an incidence of 1.39 per 1000 births in Isfahan Province, and Peivandi et al. [33] reported an incidence of 2.81 per 1000 births in Mazandaran Province. However, to the best of our knowledge, no studies have assessed the determinants and prevalence of hysterectomy on the basis of different demographic variables in Iran.

Despite numerous studies assessing the prevalence of hysterectomies in various countries, significant research gaps remain. Much of the literature has focused on Western populations, with limited attention given to Middle Eastern regions, including Iran. Studies in these regions are often hampered by small sample sizes, a lack of comprehensive data on sociodemographic determinants, and insufficient exploration of geographic variations within the same country. Furthermore, there is a paucity of research exploring the implications of hysterectomy

prevalence in diverse socioeconomic and cultural contexts, which are likely to influence both the rates and outcomes of the procedure. Thus, the present study aimed to investigate the prevalence and sociodemographic determinants of hysterectomy in a large cohort of northern Iranian females.

Methods

Study design, setting, and participants

This study was conducted as a cross-sectional analysis of data from the recruitment phase of the TABARI cohort study (TCS), which is a subset of the larger Iranian national cohort study known as "Prospective Epidemiological Research Studies in Iran (PERSIAN). The enrollment phase of the TCS involved 10,255 participants (4,149 males and 6,106 females) between the ages of 35 and 70. These participants resided in the urban and mountainous areas of Sari, Mazandaran Province, in northern Iran. The enrollment phase took place from 2015–2017. The data were gathered via a census-based sampling approach and implemented through the TCS registration system. The researchers used a standardized questionnaire to collect demographic data, as outlined in the appropriate methodology and cohort profile articles [34–36]. The questionnaire was delivered by trained interviewers who had received national and provincial seminars. The administration was performed either in person or via standardized web-based platforms, following the PERSIAN cohort protocol. Please refer to the cohort profile and methodology papers for more comprehensive information on the PERSIAN and TCS techniques [34–36]. This study included the entire female population of the TCS, with the exception of people whose data were insufficient.

Variables and measurements

The investigation involved extracting demographic data from the TCS data repository. The data included demographic information such as age, residential area (urban or mountainous), marital status, socioeconomic status (ranging from lowest to highest), occupation, education level, physical activity (PA) level measured by metabolic equivalent (MET), and anthropometric assessments. Standardized instruments were used to collect anthropometric data, including height, weight, and body mass index (BMI). Height was measured via the SECA 226 stadiometer from SECA, a company based in Hamburg, Germany. Weights were recorded via the SECA 755 analog standing scale, also from the SECA Company. In addition, the TCS database captured data regarding whether participants had undergone hysterectomy and/or tubectomy procedures, as well as other obstetric factors such as age at menarche (AAM), age at which a woman becomes pregnant for the first time, and the number of pregnancies (Gravida) thus far.

Participants were eligible for inclusion in the TCS if they were female, between 35 and 70 years of age, and provided informed consent to participate in the study. Data from individuals who met these criteria were gathered via a census-based sampling approach from the TCS data registry and were included in the study regardless of their health status or previous medical history. For this specific analysis, since the aim of the study was to assess the prevalence of hysterectomy, all the subjects were included, with the exception of three female participants, who were excluded because of incomplete or missing data on key variables necessary for the analysis. Importantly, the broader TCS study initially had its own set of inclusion and exclusion criteria, which are detailed in the cohort profile and methodology papers [34–36].

Statistics

The statistical analysis was conducted via SPSS software version 26 (IBM SPSS Corp, United States). We initially computed descriptive statistics, including frequencies and percentages, to characterize the study population. The associations between different variables and the likelihood of undergoing a hysterectomy were first explored via univariate analysis, with the calculation of crude odds ratios (ORs) via logistic regression. Following the univariate analysis, multiple logistic regression analysis was performed to adjust for potential confounders and to estimate adjusted ORs for hysterectomy. In this model, hysterectomy status (yes/no) was the dependent variable. The results are presented as ORs with 95% confidence intervals (CIs), and a P value of less than 0.05 was considered statistically significant.

Results

Participant characteristics

The mean ages of the participants and WWH were 49.61 ± 9.24 and 44.01 ± 6.78 years, respectively. The overall prevalence of hysterectomy was 9.7% (595/6103). The majority of WWH were in the age group of 60–70 years. Approximately 72% of WWH were urban area residents. Approximately 66% of WWH belonged to middle and lower economic levels. Three-fifths of WWH had received less than 5 years of education or were illiterate. A significant 92% of WWH did not have a job with income. Furthermore, 86% of WWH were married. The menarche age was between 12 and 15 years for more than three-quarters of WWH patients. A history of tubectomy was reported in 53% of WWHs. According to the BMI criteria, 87% of WWH were classified as obese or overweight, and 56% of them were physically inactive. The age at first pregnancy for 53% of WWH was less than 20

years, and 50% of WWH had been pregnant five times or more (Table 1).

Risk factors for hysterectomy

A total of 6103 females were included in the study. Age was found to be a risk factor for undergoing hysterectomy, with women aged 60–70 years being 5.8 times more likely to undergo the procedure than those aged 35–39 years (OR=5.83, 95% CI: 4.28–7.95, $P<0.001$). Compared with urban residents, living in mountains decreased the chance of undergoing a hysterectomy by 53% (25-57%). Additionally, as the socioeconomic level rose, the chance of undergoing a hysterectomy followed a specific upward trend. The chance of hysterectomy was 1.66 times greater at socioeconomic level 5 than at level 1 (OR=1.66, 95% CI: 1.13–2.42, $P=0.009$) (Table 2).

While the crude OR suggested a significant increase in the chance of hysterectomy on the basis of education level (e.g., illiterate participants compared with those with an academic education showed a more than threefold increase in the chance of hysterectomy (OR=3.35, 95% CI: 2.38–4.71, $P<0.001$) (Table 1), the adjusted

Table 1 Participants characteristics

Variables		Number of participants	WWH		Univariate logistic regression		
			n	%	OR	95% CI	P-value
Age	35–49	3175	100	3.1	Ref.	Ref.	Ref.
	50–59	1869	301	16.1	5.90	4.67–7.46	< 0.001
	60–70	1059	194	18.3	6.89	5.36–8.89	< 0.001
Area residence	Urban	4066	431	10.6	Ref.	Ref.	Ref.
	Mountainous	2037	164	8.1	0.74	0.61–0.89	0.002
Social, economic level	1	1395	111	8	Ref.	Ref.	Ref.
	2	1255	141	11.2	1.46	1.13–1.90	0.004
	3	1235	141	11.4	1.49	1.15–1.94	0.003
	4	1136	98	8.6	1.09	0.82–1.45	0.543
	5	1082	104	9.6	1.23	0.93–1.63	0.147
Education level	University/College	1041	45	4.3	Ref.	Ref.	Ref.
	9–12 years in school	1568	134	8.5	2.07	1.46–2.93	< 0.001
	6–8 years in school	618	67	10.8	2.69	1.82–3.98	< 0.001
	1–5 years in school	1657	189	11.4	2.85	2.04–3.98	< 0.001
	No schooling	1219	160	13.1	3.35	2.38–4.71	< 0.001
Has Job	No	4996	547	10.9	Ref.	Ref.	Ref.
	Yes	1107	48	4.3	0.37	0.27–0.50	< 0.001
Marital status	Single/widow	771	81	10.5	Ref.	Ref.	Ref.
	marriage	5332	514	9.6	0.91	0.71–1.16	0.449
AAM	≤ 11	528	52	9.8	1.03	0.76–1.40	0.836
	12–15	4797	459	9.6	Ref.	Ref.	Ref.
	≥ 16	778	84	10.8	1.14	0.89–1.46	0.284
Tubectomy	No	4200	314	7.5	Ref.	Ref.	Ref.
	Yes	1903	281	14.8	2.14	1.81–2.54	< 0.001
BMI	< 25	1070	80	7.5	Ref.	Ref.	Ref.
	25-29.9	2447	219	8.9	1.22	0.93–1.59	0.150
	≥ 30	2586	296	11.4	1.60	1.24–2.07	< 0.001
MET	< median	3120	331	10.6	Ref.	Ref.	Ref.
	≥ median	2983	264	8.9	0.82	0.69–0.97	0.021
Age at first pregnancy	Without pregnancy	364	8	2.2	Ref.	Ref.	Ref.
	< 20	2265	313	13.8	7.14	3.50-14.52	< 0.001
	20–24	2287	217	9.5	4.67	2.28–9.53	< 0.001
	25–29	842	47	5.6	2.63	1.23–5.62	0.013
	≥ 30	345	10	2.9	1.33	0.52–3.41	0.554
Gravida	0 or 1	733	11	1.5	Ref.	Ref.	Ref.
	2	1370	58	4.2	2.90	1.51–5.56	< 0.001
	3	1306	114	8.7	6.28	3.36–11.73	< 0.001
	4	925	117	12.6	9.50	5.08–17.78	< 0.001
	≥ 5	1769	295	16.7	13.14	7.15–24.14	< 0.001

WWH: Women with Hysterectomy, AAM: Age at Menarche, BMI: Body Mass Index, MET: Metabolic Equivalent

Table 2 Results of the multiple logistic regression model for risk factors of hysterectomy

Variables		Multiple logistic regression		
		OR	95% CI	P-value
Age	35–49	Ref.	Ref.	Ref.
	50–59	4.63	3.57–6.01	< 0.001
	60–70	5.83	4.28–7.95	< 0.001
Area residence	Urban	Ref.	Ref.	Ref.
	Mountainous	0.57	0.43–0.75	< 0.001
Social, economic level	1	Ref.	Ref.	Ref.
	2	1.42	1.06–1.90	0.017
	3	1.58	1.15–2.18	0.005
	4	1.55	1.08–2.22	0.018
	5	1.66	1.13–2.42	0.009
Education level	University/College	Ref.	Ref.	Ref.
	9–12 years in school	1.37	0.94–2.01	0.100
	6–8 years in school	1.44	0.92–2.26	0.114
	1–5 years in school	1.50	0.99–2.27	0.052
	No schooling	1.30	0.82–2.06	0.262
Has Job	No	Ref.	Ref.	Ref.
	Yes	0.62	0.45–0.86	0.004
Tubectomy	No	Ref.	Ref.	Ref.
	Yes	1.27	1.05–1.53	0.015
BMI	< 25	Ref.	Ref.	Ref.
	25-29.9	0.87	0.66–1.16	0.349
	≥ 30	0.92	0.69–1.22	0.554
MET	< median	Ref.	Ref.	Ref.
	≥ median	0.97	0.79–1.19	0.785
Age at first pregnancy	Without pregnancy	Ref.	Ref.	Ref.
	< 20	0.76	0.19-3.00	0.697
	20–24	0.55	0.14–2.15	0.390
	25–29	0.44	0.11–1.74	0.241
	≥ 30	0.30	0.07–1.27	0.103
Gravida	0/1	Ref.	Ref.	Ref.
	2	3.50	1.07–11.45	0.038
	3	4.98	1.53–16.20	0.008
	4	4.98	1.51–16.36	0.008
	≥ 5	5.35	1.62–17.63	0.006

BMI: Body Mass Index, MET: Metabolic Equivalent

OR did not yield a statistically significant effect. In the adjusted OR analysis, the observed slight increase in the chance of hysterectomy was not statistically significant, indicating a potential interaction effect based on this variable (e.g., more than 1.3 times greater for illiterate women than for those with an academic education (OR = 1.30, 95% CI: 0.82–2.06, $P = 0.262$)) (Table 2).

Women with a job had a 38% (14-55%) lower chance of undergoing a hysterectomy than those who did not have a job. A history of tubectomy increased the chance of undergoing a hysterectomy by 1.27 times compared with women without this history (OR = 1.27, 95% CI: 1.05–1.53, $P = 0.015$). The odds of undergoing a hysterectomy were greater for obese women than for those with a normal BMI according to the crude estimate (OR = 1.60, 95% CI: 1.24–2.07, $P < 0.001$) (Table 1), but this was reversed in the adjusted OR estimate (OR = 0.92, 95% CI: 0.69–1.22, $P = 0.554$) (Table 2).

There was no significant difference in the chance of undergoing a hysterectomy between women with sufficient and insufficient PA (OR = 0.97, 95% CI: 0.79–1.19; $P = 0.785$). There was no causal association between pregnancy age and hysterectomy compared with the group without a history of pregnancy (e.g., in the group whose pregnancy occurred at the age of 30 years and above compared with the group without a history of pregnancy) (OR = 0.30, 95% CI: 0.07–1.27, $P = 0.103$). As the number of pregnancies increased, the likelihood of undergoing a hysterectomy also increased. For example, women with a history of 5 or more pregnancies were 5.35 times more likely to have undergone a hysterectomy than those who had been pregnant only once or never (OR = 5.35, 95% CI: 1.62–17.63, $P = 0.006$) (Table 2).

Discussion

The present study aimed to investigate the prevalence and sociodemographic determinants of hysterectomies in a large cohort of northern Iranian females. Our results revealed that the prevalence of hysterectomy in the studied population was 10%. Additionally, older age groups, living in urban areas, higher socioeconomic levels, not having a job, a history of tubectomy, and more gravida were found to increase the odds of hysterectomy.

To the best of our knowledge, no previous studies have evaluated the prevalence of hysterectomy in northern Iran. Our results revealed that 10% of the population had a history of hysterectomy, while the burden of this procedure was different in other nations and other provinces in Iran. Previous studies have shown a prevalence of 3.8% in Ilam Province [31] and 1.39 per 1000 births in Isfahan Province [32]. Some studies reported a prevalence of 15.4% in Canada [15], 21.1% in the USA [1], 13.35% in India [16], 10.4% in Denmark [18], 10% in Scotland [17], and 9.7% in the UK [19]. These differences may be due to residents of various ethnicities (such as the USA), differences in the average socioeconomic level of the nation, and differences in the level of health awareness among individuals.

Our results can be explained and interpreted in various ways. With respect to age, older women are more likely to develop gynecological conditions (e.g., fibroids, prolapse, and cancer) that necessitate hysterectomy [37]. Additionally, as women age and have reached the desired number of offspring, the decision to undergo a hysterectomy for nonlife-threatening conditions may become easier. Similar to our findings, Kumari et al. [21], Harvey et al. [1], Shekhar et al. [38], and Prusty et al. [25] also demonstrated that the odds of hysterectomy increase in

older females. However, Rout et al. [16], Rajkumari et al. [23], and Kuppermann et al. [39] reported that age was not associated with the risk of hysterectomy, which may be due to differences in sample size, population ethnicity, and socioeconomic level.

Our results also revealed that participants living in urban areas are more likely to have undergone a hysterectomy. Urban residents typically have better access to healthcare facilities and specialists who can perform hysterectomies, and higher awareness and education levels in urban areas might lead to more frequent diagnoses and treatments [40, 41]. However, Chen et al. [24], Shekhar et al. [38], and Kumari et al. [21] reported that living in rural areas increases the odds of hysterectomy more than living in urban areas do. On the other hand, other studies, such as those of Desai et al. [42], Prusty et al. [25], and Rajkumari et al. [23], reported no difference between the two living areas in terms of the risk of hysterectomy. This may be due to different rural and urban living conditions in these study settings since the rural and mountainous areas of Mazandaran Province are very close to their urban areas.

In the present study and other studies by Prusty et al. [25], Shekhar et al. [38], and Kumari et al. [21], it was found that a higher socioeconomic level is associated with higher odds of hysterectomy, some papers have suggested otherwise. Desai et al. [42] and Kuppermann et al. [39] did not find any significant differences in the odds of hysterectomy between the lower, middle, and rich socioeconomic classes. These discrepancies may be due to different ethnicities, sample sizes, or different definitions of wealth in lower-, middle-, and high-income countries.

In the present study, occupation was also found to decrease the risk of hysterectomy. However, Prusty et al. [25] reported that having a job is associated with a greater risk of hysterectomy, whereas Kuppermann et al. [39] and Desai et al. [42] reported no difference. Our results may be explained by the association of unemployment with a greater burden of chronic conditions due to stress or a lack of preventive care, leading to a greater need for surgeries such as hysterectomy [43]. Additionally, unemployed individuals might access healthcare differently, potentially leading to delayed but more definitive treatments such as hysterectomy [44].

Implications for practice and/or policy

These findings highlight the need for a multifaceted approach to address the high prevalence of hysterectomies among women. By improving access to alternative treatments, supporting socioeconomically disadvantaged groups, and increasing awareness and education, both healthcare practices and policies can be better aligned to reduce unnecessary hysterectomies and improve women's health outcomes.

Strengths and limitations

The strengths of this study include its large, well-defined cohort from the Tabari Cohort Study, which provides a robust and representative sample of northern Iranian women. The use of comprehensive sociodemographic data allowed for a detailed analysis of the determinants of hysterectomy, contributing valuable insights to the limited body of research on this topic in the Middle East. However, the study also has limitations. The cross-sectional design limits the ability to establish causality between the identified determinants and hysterectomy. Additionally, the reliance on self-reported data may introduce recall bias, and the study's findings may not be generalizable to other regions of Iran or different cultural contexts.

Conclusion

This study revealed a 10% prevalence of hysterectomy among women in northern Iran, with higher odds associated with older age, urban residence, higher socioeconomic status, unemployment, a history of tubectomy, and greater gravidity. These findings indicate that hysterectomy is influenced by specific demographic and reproductive factors, emphasizing the need for targeted public health strategies to address these risks. By understanding these determinants, healthcare planning can be better tailored to optimize outcomes for women at greater risk of undergoing this procedure.

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Author contributions

Conceptualization: MM and MGT; Data curation: MP, MM and MG; Formal analysis: MM and MAA; Methodology: EG and MM; Project administration: MM and EG; Resources: MM; Software: MM, EG, and MG; Supervision: MGT and MM; Validation: MGT and MAA; Visualization: EG and MG; Writing–original draft: EG and MP; Writing–review & editing: All authors.

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Data availability

The data are available upon reasonable request from the corresponding author.

Declarations

Ethics approval and consent to participate

This study was conducted without commercial input or involvement in the design, implementation, analysis, or reporting. The Tabari Cohort Study was approved by the Research Ethics Committee of Mazandaran University of Medical Sciences (Ethics Approval Code: IR.MAZUMS.REC.95.2524). Written informed consent was obtained from all participants before they entered the study. All procedures performed in this study were in accordance with the ethical standards of the Institutional Research Ethics Committee of Mazandaran University of Medical Sciences and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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