

## Epidemiology of endometriosis in Ukraine: results a multicenter study (2019-2021)

Aidyn G. Salmanov<sup>1,2</sup>, Oleksandr M. Yuzko<sup>3</sup>, Bohdan Yu. Tofan<sup>3</sup>, Svitlana M. Korniyenko<sup>4</sup>, Boleslav M. Lysenko<sup>5</sup>, Anastasia S. Padchenko<sup>6</sup>, Vitalii S. Strakhovetskyi<sup>7</sup>, Ihor Paliga<sup>8</sup>, Oleksandr A. Voloshyn<sup>1,9</sup>, Khrystyna V. Zarichanska<sup>1</sup>

<sup>1</sup>SHUPYK NATIONAL HEALTHCARE UNIVERSITY OF UKRAINE, KYIV, UKRAINE.

<sup>2</sup>INSTITUTE OF PEDIATRICS, OBSTETRICS AND GYNECOLOGY OF THE NATIONAL ACADEMY OF MEDICAL SCIENCES OF UKRAINE, KYIV, UKRAINE

<sup>3</sup>BUKOVINIAN STATE MEDICAL UNIVERSITY, CHERNIVTSI, UKRAINE

<sup>4</sup>ODESA NATIONAL MEDICAL UNIVERSITY, ODESA, UKRAINE

<sup>5</sup>STATE SCIENTIFIC INSTITUTION "SCIENTIFIC AND PRACTICAL CENTER OF PREVENTIVE AND CLINICAL MEDICINE" OF THE AGENCY OF STATE AFFAIRS, KYIV, UKRAINE

<sup>6</sup>KYIV PERINATAL CENTER, KYIV, UKRAINE

<sup>7</sup>MEDICAL CENTRE "ASHERA", KHARKIV, UKRAINE

<sup>8</sup>ANDREI KRUPYNSKYI LVIV MEDICAL ACADEMY, LVIV, UKRAINE

<sup>9</sup>KYIV REGIONAL MATERNITY HOSPITAL, KYIV, UKRAINE

### ABSTRACT

**Aim:** To estimate the prevalence and incidence of endometriosis, and to evaluate risk factors associated with endometriosis in Ukraine

**Materials and Methods:** The multicenter cohort study was performed partly as a cross-sectional study to estimate occurrence of endometriosis, partly as a case-control study to look for factors associated with endometriosis. The study was carried out during the period from January 1st, 2019 to December 31st, 2021. This study included adolescent girls and adult women from 15 Ukrainian regions.

**Results:** Among 15,458 patients, 4,397 (28.4%) endometriosis were observed. Of all endometriosis cases, 48.5% were peritoneal/superficial endometriosis (SPE), 34.6% were ovarian endometriotic cyst/endometrioma (OMA), and 16.9% were deep infiltrating endometriosis (DIE). The prevalence of the three types of endometriosis was: SPE, 13.8%; OMA, 9.8%; and DIE, 4.8%. The factors associated with an increased risk for endometriosis include age 23-32 years, parity (small number of births), age of first sexual intercourse <20 years, history of healthcare-associated infection after gynecological surgery (pelvic abscess or cellulitis, salpingitis and oophoritis), history of infertility, early menarche (before the age of 11), dysmenorrhea, dyspareunia, pelvic pain, intermenstrual bleeding, heavy uterine bleeding and dysmenorrhea, and heavy uterine bleeding.

**Conclusions:** Endometriosis is a common gynecological disease in Ukraine and the relative frequency of different types of endometriosis: the most common were ovarian and peritoneal endometriosis. Healthcare services and public health strategies need to be strengthened to ensure timely endometriosis diagnosis in adolescent girls and adult women and treatment.

**KEY WORDS:** endometriosis, prevalence, risk factors, menstrual cycle, reproductive health, Ukraine

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### INTRODUCTION

One of the important diseases in female worldwide is endometriosis. Female reproductive disorders as endometriosis significantly affect physical and emotional health, disability, and fertility for women and those assigned female at birth. Endometriosis often misdiagnosed and have prolonged diagnostic timeframes and limited therapeutic options [1]. Due to its complexity, the variety of its clinical presentations, and the still unclear physio-pathobiological origin, endometriosis represents, nowadays, a big challenge in the field of benign gynecological disorders [2]. Endometriosis symptoms often start at a young age, and

the time between symptom onset and endometriosis diagnosis can be several years. It is not clear whether the symptoms that are experienced by adolescents differ from adults [3].

The World Health Organization has identified endometriosis as a global public health problem. Prevalence of endometriosis is often underestimated given the clinical difficulty of identifying the condition without invasive laparoscopic surgery and the often years-long lag between symptom onset and diagnosis [4, 5]. The prevalence and incidence of endometriosis are usually underestimated because of its difficulty in diagnosis. The overall prevalence was known to

be about 10% in reproductive-age (premenopausal) women and girls globally, and up to 50% of symptomatic women with infertility or pain in high-risk population [6]. Currently, there is no curative treatment for endometriosis. Medical management and surgical treatment do not provide long-term relief. A detailed understanding of its pathophysiology is mandatory in order to facilitate both the diagnosis and treatment [7]. Due to their widespread prevalence and substantial impact on daily life, ways to more easily identify endometriosis as well as viable therapeutic approaches for endometriosis are highly sought after.

Despite the high prevalence of endometriosis among women of reproductive age, risk factors or markers for developing the condition remain largely unknown. Many of the published studies are based on small selected samples. Knowing the risk factors can help us in earlier risk stratification, prevention as well as diagnosis of the endometriosis patients. The relative importance of these causes of endometriosis may differ from country to country. However, it is sometimes not possible to explain the causes of endometriosis. Understanding the magnitude of endometriosis is critical for interventions, for monitoring access to quality medical care, and for mitigating risk factors for and consequences of endometriosis in worldwide.

Ukraine currently does not gather statistics on the incidence of endometriosis, but, at a rough estimate, this number is approximately 280 thousand women and the real number may be higher [8]. Endometriosis has known significant social, medical and economic impact. However, there has been no study to explore the prevalence and risk factors of endometriosis in Ukraine.

## AIM

The aim this study to estimate the prevalence and incidence of endometriosis, and to evaluate risk factors associated with endometriosis in Ukraine.

## MATERIALS AND METHODS

### STUDY DESIGN, SETTING AND POPULATION

The study was performed partly as a cross-sectional study to estimate occurrence of endometriosis, partly as a case-control study to look for factors associated with endometriosis. The study was carried out during the period from January 1st, 2019 to December 31st, 2021. The population-based cohort was recruited from 18 government and private clinics from 15 regions (Lviv, Vinnytsia, Zhytomyr, Rivne, Kyiv, Sumy, Cherkasy, Poltava, Dnipro, Kharkiv, Kherson, Dnipro, Odesa, Kropyvnytskyi, and Zaporizhzhia) of Ukraine.

Participants included adolescent girls (at <18 years old) and adult women (at ≥18 years) who were enrolled into study. Inclusion criteria: patients complaining of gradually increasing acute premenstrual pain, pelvic pain, pain in the sacral region of the spine, dysmenorrhea, painful ovulation, pain during intercourse, pain when defecating, pain when urinating, pain radiating to the back, abundant irregular menstruation, blood in the stool, diarrhea or constipation, infertility and chronic fatigue, subfebrile conditions, nausea, dizziness and headaches, symptoms

of depression, anxiety, hypoglycemia, rectal bleeding, hematuria during menstruation or susceptibility to infections and allergies. Pregnant women, cancer, positive serological test for syphilis or other sexually transmitted infections, women with urinary tract infection and gastrointestinal infections were excluded from the study. Any adolescent girls or adult women who refused to sign the informed consent form or withdrew during the study were excluded.

### DEFINITION OF ENDOMETRIOSIS

Endometriosis is defined as an inflammatory disease characterized by the presence of endometrium-like epithelium and/or stroma outside the endometrium and myometrium, usually with an associated inflammatory process [9-11]. Peritoneal/superficial endometriosis (SPE) is defined as endometrium-like tissue lesions involving the peritoneal surface. The lesions can have different appearances and colour e.g. clear, black, etc. [12]. Ovarian endometriotic cyst/endometrioma (OMA) is defined as endometrium-like tissue in the form of ovarian cysts. They may be either invagination cysts or true cysts with the cyst wall also containing endometrium-like tissue and dark blood-stained fluid, the colour and consistency of which gives rise to the name 'chocolate cysts' [9]. Deep endometriosis (deep infiltrating endometriosis (DIE)) is defined as endometrium-like tissue lesions in the abdomen, extending on or under the peritoneal surface. They are usually nodular, able to invade adjacent structures, and associated with fibrosis and disruption of normal anatomy [9-11]. Bowel endometriosis is defined as endometriosis situated inside the bowel wall. Although mostly affecting the rectosigmoid area, lesions can be found also in other parts of the gastrointestinal system, including the appendix. Lesions on the peritoneal surface of the bowel are considered peritoneal endometriosis [12]. Bladder endometriosis is defined as endometriosis involving the detrusor muscle and/or the bladder epithelium. Lesions on the peritoneal surface of the bladder are considered peritoneal endometriosis. Extra-abdominal endometriosis is defined as endometrium-like tissue outside the abdominal cavity. Iatrogenic endometriosis is defined as lesions resulting from direct or indirect dissemination of endometrium during surgery. Adhesions (peritoneal) is defined as bands of fibrous scar tissue that may bind the abdominal and pelvic organs, including the intestines and peritoneum, to each other. They can be dense and thick or filmy and thin. Adhesions can be induced by endometriosis as a result of the inflammatory process of the disease [11]. Endometriosis can present similarly to other gynecological disorders including primary dysmenorrhea, pelvic inflammatory disease, and pelvic adhesions presenting as chronic pelvic pain, painful menses, tubal pregnancies, and infertility.

### DATA COLLECTION

In this study, data were collected for three different forms of endometriosis in the pelvis: (1) peritoneal, (2) ovarian, and (3) rectovaginal endometriosis. All patients were surveyed at their usual appointments with the physicians. Endometriosis is diagnosed using medical interview, physical, clinical, and ultrasound examination. Ultrasound examination

included a systematic assessment of the uterus, ovaries, Fallopian tubes, anterior and posterior compartments of the pelvis, and distal ureters. All endometriotic lesions and other pelvic abnormalities were described, measured and recorded. The pelvic organs were also examined for tenderness and mobility. A detailed demographic and clinical history were obtained for all participants. This study includes interviews and questionnaires of women, also analyses medical records, anthropometrics (height, weight), adolescents and adult women. Participants completed standard clinical questionnaire that included items regarding menstrual history, associated symptoms, and pain, sociodemographic background, behavioral factors, physical activity assessment, habits (consumption of alcohol and smoking) and employment status, dietary diversity, common health problems, gynecological complaints, history of healthcare-associated infection after gynecological surgeries and reproductive events. The questionnaire was prepared by reviewing several relevant published articles.

In our study Body Mass Index (BMI) is defined as an estimation of human body fat based on height and weight. BMI is expressed in  $\text{kg}/\text{m}^2$ , resulting from dividing body mass in kilograms by height in meters. Thin' means that BMI is less than  $18.5 \text{ kg}/\text{m}^2$ . 'Normal' means  $18.5 \text{ kg}/\text{m}^2 \leq \text{BMI} < 24 \text{ kg}/\text{m}^2$ . 'Overweight' means  $24 \text{ kg}/\text{m}^2 \leq \text{BMI} < 28 \text{ kg}/\text{m}^2$ . 'Obesity' means that BMI is more than  $28 \text{ kg}/\text{m}^2$  [13]. Menstrual characteristics were defined as per the revised International Federation of Gynecology and Obstetrics criteria: regularity of menstrual bleeding (regular: shortest-to-longest cycle variation of up 7-9 days, depending on age; irregular: shortest-to-longest cycle variation exceeding 8-10 days, depending on age); frequency of menstrual bleeding (absent: amenorrhea; infrequent:  $> 38$  days; normal: 24-38 days; frequent:  $< 24$  days); duration of menstrual bleeding (normal:  $\leq 8$  days; prolonged:  $> 8$  days) [14]. Infertility was defined as the failure to establish a clinical pregnancy after 12 months of regular, unprotected sexual intercourse due to disease or impairment of a person's capacity to reproduce either as an individual or with her partner [11].

## ETHICS

This study was approved by the Ethic Committee of Shupyk National Healthcare University of Ukraine. The research on humans has been performed by respecting of all the relevant national regulations and institutional policies, in accord to the tenets of the Helsinki Declaration. Women included in the study signed a general consent form for using their clinical data for scientific purposes.

## STATISTICAL ANALYSIS

Statistical analysis was performed using Stata version 15.1 (StataCorp., College Station, TX, USA). All descriptive statistics were reported in numbers and percentages. 95 percent binomial confidence intervals (95% CI) were suggested for both prevalence and incidence. Only first ever diagnoses were considered. Means of continuous variables were compared between groups using Students-t-test. The associations between categorical variables were assessed by Chi square test. Factors associated with endometriosis

were investigated using logistic regression analysis model. P-values of  $< 0.05$  were considered statistically significant.

## RESULTS

### PREVALENCE OF ENDOMETRIOSIS

The study population included 15,458 patients (adolescent girls and adult women), 4,397 (28.4%) of whom had an endometriosis diagnosis recorded between 2019 and 2021. The mean age of the patients was  $36.9 \pm 8.0$  years. Of the total endometriosis cases, 48.5% (95% CI: 48.1-48.9) were peritoneal/superficial endometriosis (SPE), 34.6% (34.1-35.0) were ovarian endometriotic cyst/endometrioma (OMA), and 16.9% (16.6-17.2) were deep infiltrating endometriosis (DIE). The prevalence of endometriosis in study period in Ukraine was 28.4% (95% CI 28-28.8), and the prevalence of the three types of endometriosis was: SPE, 13.8% (13.5-14.1); OMA, 9.8% (6.6-10.0); and DIE, 4.8% (4.6-5.0).

There was an increase in the rate of endometriosis during the study period ( $P < 0.001$ ), largely associated with increased rates of SPE and OMA. The prevalence of endometriosis varied widely within Ukraine, from  $< 10\%$  in three regions (Sumy, Cherkasy, Poltava) to  $\geq 30\%$  in eight, mostly in southern (Kherson, Odesa, Dnipro, Kropyvnytskyi, Zaporizhzhia), eastern (Kharkiv), and central (Kyiv, Zhytomyr) Ukraine. An increase in the incidence of endometriosis was observed in 12 out of 15 regions, mostly in southern (Kherson, Odesa, Dnipro, Kropyvnytskyi, Zaporizhzhia), eastern (Kharkiv), and central (Kyiv, Zhytomyr, Vinnitsia) Ukraine. The prevalence of endometriosis in Lviv, Rivne, and Chernivtsi varied from 10% to 30%. We observed an increase in endometriosis between 2019 and 2021 in all age groups except for the 13-17 years age group. Higher endometriosis among women aged 28-32, 33-37, and 38-42 years were observed throughout the entire study period (Table 2). Prevalence trends showed (Tables 1-2) a constant increase during the 2019-2021 period ( $p < 0.001$ ). Socio-demographic, gynecological and clinical characteristics of study participants are presented in Tables 3-4, respectively.

### RISK FACTORS FOR ENDOMETRIOSIS

In this study to identify the endometriosis predictor factors among patients, a logistic multivariate regression analyses were used. Table V showed the odds ratio (OR) and 95% confidence interval (CI) for the factors associated with endometriosis in logistic multivariate regression analyses. The results found that the endometriosis was associated with age 23-32 years ( $p < 0.001$ ), parity (small number of births) ( $p < 0.001$ ), age of first sexual intercourse  $< 20$  years ( $p < 0.001$ ), history of healthcare-associated infection after gynecological surgery (pelvic abscess or cellulitis, salpingitis and oophoritis) ( $p < 0.001$ ), history of infertility ( $p = 0.006$ ), early menarche (before the age of 11) ( $p < 0.001$ ), dysmenorrhea ( $p < 0.001$ ), dyspareunia ( $p = 0.04$ ), pelvic pain ( $p < 0.001$ ), intermenstrual bleeding ( $p = 0.05$ ), heavy uterine bleeding and dysmenorrhea ( $p = 0.002$ ), and heavy uterine bleeding ( $p = 0.02$ ) as shown in logistic regression analysis (Table 5).

**Table 1.** Distribution of 4,397 endometriosis cases in Ukraine, 2019-2021

Type of endometriosis	All cases		95% CI	Trend 2019-2021
	n	%		
Peritoneal/superficial endometriosis	2,133	48.5	48.1-48.9	↑
Ovarian endometriotic cyst/endometrioma	1,521	34.6	34.2-35.0	↑
Deep infiltrating endometriosis	743	16,9	16.6-17.2	↑

CI, confidence interval.

**Table 2.** Distribution of endometriosis cases among different age group patients in Ukraine, 2019-2021

Age group (years)	2019	2020	2021	Total (2019-2021)		Trend 2019-2021
	%	%	%	n/%	95% CI	
13-17	3.8	3.3	3.4	30/3.5	3.4-3.7	↓
18-22	14.6	14.2	13.5	331/14.1	13.8-14.4	↓
23-27	27.7	28.8	32.6	1,593/29.7	29.3-30.1	↑
28-32	37.1	41.8	42.9	949/40.6	40.2-41.0	↑
33-37	29.6	38.5	41.4	779/36.5	36.1-36.9	↑
38-42	37.6	38.5	40.9	438/38.7	36.3-39.1	↑
43-47	20.8	23.7	23.9	225/22.8	22.5-23.1	↑
48-52	11.8	16.3	21.4	52/16.5	16.2-16.8	↑
Total	23.9	27.6	33.7	4,397/28.4	28.0-28.8	↑

CI, confidence interval.

## DISCUSSION

This multicentre cohort study is the first Ukrainian study to estimate the prevalence of endometriosis and risk factors for endometriosis in different regions of the country. This study also provides information about the relative proportion of procedures for the different types of endometriosis. The association between demographic factors, menstrual and reproductive characteristics, and clinical profile for women with endometriosis was analyzed in this study. Our study shows the relative frequency of the different types of endometriosis: the most frequent were ovarian and peritoneal endometriosis. Estimating the exact prevalence of endometriosis is a challenge since many women with this pathology are asymptomatic, while others may report non-specific symptoms.

There are large variations in prevalence estimates among studies that are driven by heterogeneity in study populations, sampling scheme, endometriosis case definition, and indications for evaluation for the presence of endometriosis. In addition, all studies of endometriosis frequency document only those women who successfully achieve an evaluation and diagnosis. Prevalence estimates for endometriosis widely varied from 0.2% to 71.4% depending on the population sampled. The prevalence reported in general population studies ranged from 0.7% to 8.6%, whereas that reported in single clinic- or hospital-based studies ranged from 0.2% to 71.4%. When defined by indications for diagnosis, endometriosis prevalence ranged from 15.4% to 71.4%

among women with chronic pelvic pain, 9.0% to 68.0% among women presenting with infertility, and 3.7% to 43.3% among women undergoing tubal sterilization [15]. It might be interesting to compare our findings with those in other countries to see if the relative proportions are the same or if endometriosis has different patterns.

The prevalence of endometriosis in study period in Ukraine was 28.4%, and the prevalence of the three types of endometriosis was: SPE, 13.8%; OMA, 9.8%; and DIE, 4.8%. Prevalence rates found in our research are not consistent with previous cohort studies. Prevalence trends showed a constant increase during the 2019-2021 period. Other studies have found prevalence rates of 2% (including diagnoses of endometriosis in Italy [16], 1.9% in the United States [17], 1.5% in the United Kingdom [18], 1.5% in hospitalized women of childbearing age in France [19], 1.08% in Israel [20], 0.1% in Germany [21], and 2.12-3.56 in South Korea [22]. Increasing trends in prevalence rates in our study could be attributed to improvements in the detection and treatment of endometriosis in Ukrainian healthcare systems or to the population's and healthcare professionals' increased awareness of endometriosis.

The adolescent endometriosis prevalence changes according to the inclusion criteria of each study's population (i.e., overall vs. symptomatic adolescents) and the diagnostic employed, which includes imaging, with detection of ultrasonographic or magnetic resonance imaging (MRI) features suggestive of endometriosis, and surgery, with

**Table 3.** Comparison of socio-demographic characteristics of the difference between patients with and without endometriosis in Ukraine, 2019-2021

Characteristic	All patients (n=15,458)	Endometriosis				p value
		Yes (n=4,397)		No (n=11,061)		
		n	%	n	%	
Age group (years)						
13-17	846	30	0.7	816	7.4	< 0.001
18-22	2,344	331	7.5	2,013	18.2	
23-27	5,358	1,593	36.2	3,765	34.0	
28-32	2,337	949	21.6	1,388	12.5	
33-37	2,136	779	17.7	1,357	12.3	
38-42	1,133	438	10.0	695	6.3	
43-47	988	225	5.1	763	6.9	
48-52	316	52	1.2	264	2.4	
Residence						
Urban	7281	2,071	47.1	5,210	48.9	0.66
Rural	8,177	2,326	52.9	5,851	51.1	
Educational level						
Middle school	2,521	574	13.0	1,947	17.6	0.39
High school	2,164	695	15.8	1,469	13.3	
Junior college degree	3,224	989	22.5	2,235	20.2	
Bachelor's degree and above	7,549	2,139	48.7	5,410	48.9	
Occupational status						
Unemployed	2,333	563	12.8	1,770	16.0	0.54
State institutions worker	2,306	602	13.7	1,704	15.4	
Professional worker	5,252	1,723	39.2	3,529	31.9	
Merchant	483	184	4.2	299	2.7	
Service worker	2,129	602	13.7	1,527	13.8	
Agricultural and related worker	511	101	2.3	410	3.7	
Students	87	31	0.7	56	0.5	
Other	2,357	591	13.5	1,766	16.0	
Alcohol intake						
Lifetime abstainer	2,564	915	20.8	1,649	14.9	0.57
Former drinker	2,340	769	17.5	1,571	14.2	
Current drinker	10,554	2,713	61.7	7,841	70.9	
Body Mass Index (kg/m <sup>2</sup> )						
Thin weight	1,126	374	8.5	753	6.8	0.49
Normal weight	9,717	2,573	58.5	7,146	64.6	
Overweight	3,523	1,122	25.5	2,401	21.7	
Obese	1,092	328	7.4	764	6.9	
Marital status						
Married	13,934	3,438	78.2	10,497	94.9	0.053
Single	1,182	761	17.3	421	3.8	
Free union	385	141	3.2	144	1.3	
Divorced/separated/Widowed	57	57	1.3	0	0	

**Table 4.** Comparison of characteristics of gynecological and clinical characteristics of the difference between patients with and without endometriosis in Ukraine, 2019-2021

Characteristic	All patients (n=15,458)	Endometriosis				p value
		Yes (n=4,397)		No (n=11,061)		
		n	%	n	%	
Parity						
0	8,951	2,946	67.0	6,003	54.3	0.001
1	2,606	770	17.5	1,837	16.6	0.75
≥ 2	3,901	681	15.5	3,221	29.1	< 0.001
Age of marriage (yrs.)						
≤20	7,631	1,825	41.5	5,806	52.5	0.197
21-29	7,180	2,291	52.1	4,889	44.2	
≥30	647	281	6.4	366	3.3	
Age of first sexual intercourse (yrs.)						
<20	6,643	2,152	49.0	4,491	40.6	0.04
20-25	3,240	1,133	25.8	2,107	19.0	0.03
>25	5,575	1,112	25.3	4,463	40.4	< 0.001
History of healthcare-associated infection after gynecological surgery						
Pelvic abscess or cellulitis	873	563	12.8	310	2.8	<0.001
Salpingitis	1,664	911	20.7	753	6.8	
Oophoritis	884	651	14.8	233	2.1	
History of infertility	2,629	1,113	21.6	1,516	13.7	0.006
Early menarche (before the age of 11)	2,173	2,014	18.2	159	3.6	< 0.001
Dysmenorrhea	2,324	2,058	18.6	266	6.0	< 0.001
Dyspareunia	187	155	1.4	32	0.7	0.04
Pelvic pain	1,465	1,284	11.6	181	4.1	< 0.001
Abnormal uterine bleeding						
Intermenstrual bleeding	1,678	317	7.2	1,361	12.3	0.05
Heavy uterine bleeding and dysmenorrhea	1,276	567	12.9	709	6.4	0.002
Heavy uterine bleeding	2,556	498	11.3	2,058	18.6	0.02

direct visualization of the disease. Collection of medical history, especially regarding painful symptoms associated with endometriosis, is not diagnostic but may drive towards an early diagnosis. According to the literature, prevalence of endometriosis in adolescents varies between 1-17% [23]. Other studies based on 15 selected studies, the prevalence of visually confirmed endometriosis among girls with severe dysmenorrhea was 62% [24]. The overall prevalence of endometriosis among the adolescent girls as reported by the American Society of Reproductive Medicine classified moderate-severe endometriosis was 32% [24]. This disparity of incidence of endometriosis can be explained by the population studied, the sample size used, and the method of diagnosis. In our study adolescent endometriosis prevalence was 3.5%. Among clinical symptoms, dysmenorrhea is experienced in Ukrainian adolescents affected by endometriosis. The main finding in this study was a relatively low prevalence of endometriosis

among adolescence girls with severe dysmenorrhea (11.9%). Painful menses with a variable degree of severity were reported in 49.1% patients. Dysmenorrhea may be primary or secondary, and the distinction between the two forms is essential for clinicians.

Despite such frequent occurrence of endometriosis among adolescent girls and adult women, the mechanism of its formation remains unexplained, and a good marker of this disease has still not been discovered. Many of the published studies are based on small selected samples. Recent literature has shown that many factors contribute to the growth and development of endometriosis: socio-economic, genetic, hormonal, and immunological factors play a role. Social class and family history apart, the factors most consistently associated with endometriosis are early age at menarche and long and heavy menstrual cycles. The other main risk factors are alcohol intake, active smokers, low BMI, use of oral contraceptives, and

**Table 5.** Logistic multivariate regression analyses of factors associated with in endometriosis in Ukraine, 2019-2021

Characteristics	p-value	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)
<b>Age (years)</b>				
	< 0.001		< 0.001	
13-17		Ref.		Ref.
18-22	0.003	0.563 (0.386–0.822)	0.002	0.517 (0.342–0.781)
23-27	0.276	2.297(0.515–10.249)	0.587	1.523 (0.334–6.942)
28-32	0.011	6.618(1.549–28.274)	0.031	5.038 (1.163–21.830)
33-37	0.003	9.379 (2.165–40.622)	0.011	6.862 (1.557–30.248)
38-42	0.025	5.577 (1.244–25.007)	0.109	3.49 (0.758–16.070)
43-47	0.035	5.500 (1.131–26.756)	0.174	3.096 (0.607–15.798)
48-52	0.024	2.102 (1.103–4.005)	0.373	1.434 (0.649–3.168)
<b>Parity</b>				
	< 0.001		< 0.001	
0		Ref.		Ref.
1	0.867	1.098 (0.371–3.248)	0.648	1.302 (0.42–4.035)
≥ 2	0.018	3.752 (1.257–11.201)	0.017	4.696 (1.326–16.635)
<b>Age of first sexual intercourse (years)</b>				
	< 0.001		< 0.001	
< 20		Ref.		Ref.
20–25	0.867	1.098 (0.371–3.248)	0.648	1.302 (0.42–4.035)
> 25	0.018	3.752 (1.257–11.201)	0.017	4.696 (1.326–16.635)
<b>History of healthcare-associated infection after gynecological surgery</b>				
	< 0.001		< 0.001	
Pelvic abscess or cellulitis		Ref		Ref
Salpingitis	0.003	9.379 (2.165–40.622)	0.011	6.862 (1.557–30.248)
Oophoritis	< 0.001	7.117 (2.651–19.107)	0.002	6.258 (1.962–19.956)
<b>History of infertility</b>				
No		Ref		Ref
Yes	0.006	3.364 (1.407–8.045)	0.005	3.987 (1.52–10.456)
<b>Early menarche (before the age of 11)</b>				
No		Ref		Ref
Yes	< 0.001	3.690 (1.913–7.114)	< 0.002	3.145 (1.532–6.455)
<b>Dysmenorrhea</b>				
No		Ref		Ref
Yes	< 0.001	5.131 (2.662–9.889)	< 0.001	3.835 (1.908–7.711)
<b>Dyspareunia</b>				
No		Ref		Ref
Yes	0.04	2.297(0.515–10.249)	0.031	1.523 (0.334–6.942)
<b>Pelvic pain</b>				
No		Ref		Ref
Yes	< 0.001	3.611 (2.235–5.832)	< 0.001	3.063 (1.819–5.159)
<b>Abnormal uterine bleeding</b>				
	< 0.001		< 0.001	
Intermenstrual bleeding		Ref		Ref
Heavy uterine bleeding and dysmenorrhea	0.002	6.618(1.549–28.274)	0.011	5.038 (1.163–21.830)
Heavy uterine bleeding	0.02	2.102 (1.103–4.005)	0.031	1.523 (0.334–6.942)

environmental factors [25]. Additionally, identified risk factors for endometriosis vary based upon cohort selection and diagnostic accuracy.

In this study to identify the endometriosis predictor factors among patients, a logistic multivariate regression analyses were used. The results found that the endometriosis was associated with age 23-32 years, parity (small number of births), age of first sexual intercourse <20 years, history of healthcare-associated infection after gynecological surgery (pelvic abscess or cellulitis, salpingitis and oophoritis), history of infertility, early menarche (before the age of 11), dysmenorrhea, dyspareunia, pelvic pain, intermenstrual bleeding, heavy uterine bleeding and dysmenorrhea, and heavy uterine bleeding. Our study found no overall statistically significant association between alcohol consumption, active smokers, low BMI and endometriosis risk.

#### STRENGTH AND LIMITATIONS

This work may be considered the first of more-detailed epidemiological studies of endometriosis in Ukraine in order to study risk factors and prevalence or for the different types of endometriosis in Ukraine. No other reports in the literature based on nationwide data collection describe the proportion of different types of endometriosis.

There may be some limitations to our study. There was a potential for underdetection-related biases for endometriosis. Pelvic ultrasound and MRI may lead to a suspicion of the disease but these are limited to moderate or severe forms of the disease and are not suitable for the detection of minimal or mild endometriosis. This means that assessing the prevalence of endometriosis in the general population is very difficult because of the complexity of the diagnosis; it may thus be underestimated. Due to inconsistent presentation, surgical visualization is needed to definitively diagnose

endometriosis, which is a barrier to diagnosis in Ukraine. Another limitation concerns the difficulty of analyzing all of the factors that may explain differences between the Ukrainian regions. There may be different types of endometriosis, possibly related to different etiologic factors in different geographic areas. Further research may be needed, including local investigations to collect information that is not available in our data.

#### CONCLUSIONS

Our study shows the high prevalence of endometriosis in Ukraine and the relative frequency of different types of endometriosis: the most common were ovarian and peritoneal endometriosis. It revealed a significant trend towards an increase endometriosis cases in Ukraine with time. The prevalence of endometriosis varies between Ukrainian regions. Healthcare services and public health strategies need to be strengthened to ensure timely endometriosis diagnosis in adolescent girls and adult women and treatment. Age 23-32 years, parity (small number of births), age of first sexual intercourse <20 years, history of healthcare-associated infection after gynecological surgery (pelvic abscess or cellulitis, salpingitis and oophoritis), history of infertility, early menarche (before the age of 11), dysmenorrhea, dyspareunia, pelvic pain, intermenstrual bleeding, heavy uterine bleeding and dysmenorrhea, and heavy uterine bleeding were associated with endometriosis. Understanding the magnitude of endometriosis is critical for developing appropriate interventions, for monitoring access to quality medical care, and for mitigating risk factors for and consequences of endometriosis among adolescent girls and adult women. Further studies are needed to find a relation between healthcare-associated infection after gynecological surgery and endometriosis.

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## ORCID AND CONTRIBUTIONSHIP

Aidyn G. Salmanov: 0000-0002-4673-1154 **A C - F**  
 Oleksandr M. Yuzko: 0000-0003-1270-9095 **B - D F**  
 Bohdan Yu. Tofan: 0000-0003-4176-4560 **B - D F**  
 Svitlana M. Korniyenko: 0000-0003-3743-426X **B - D F**  
 Boleslav M. Lysenko: 0000-0003-4020-5337 **B - D F**  
 Anastasia S. Padchenko: 0009-0007-6382-8955 **B - D F**  
 Vitalii S. Strakhovetskyi: 0000-0002-7528-1498 **B - D F**  
 Ihor Paliga: 0000-0001-8130-4185 **B - D F**  
 Oleksandr A. Voloshyn: 0000-0002-6586-5449 **B - D F**  
 Khrystyna V. Zarichanska: 0000-0003-0357-3261 **B - D F**

## CONFLICT OF INTEREST

The Authors declare no conflict of interest.

## CORRESPONDING AUTHOR

**Aidyn G. Salmanov**

Shupyk National Healthcare University of Ukraine,  
 9 Dorohozhytska St., 04112 Kyiv, Ukraine  
 e-mail: mozsago@gmail.com

**A** – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article

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