

Incidence of cervical, endometrial, and ovarian cancer in Korea, 1999–2010

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Objective: To investigate the recent incidence of and trends in cervical, endometrial, and ovarian cancer in Korean females.

Methods: Data from the Korea Central Cancer Registry between 1999 and 2010 were analyzed. Age-standardized rates (ASRs) and annual percent changes (APCs) were calculated.

Results: The absolute incidence rates of the three major gynecologic cancers increased: 6,394 in 1999 to 7,454 in 2010. The ASR for gynecologic cancer was 23.7 per 100,000 in 1999 and decreased to 21.0 in 2010 (APC, -1.1%; 95% confidence interval [CI], -1.53 to -0.70) due to a definitive decrease in the incidence of cervical cancer (APC, -4.3%). Endometrial cancer has been definitively increasing (APC, 6.9% during 1999–2010), especially in females <30 years old (APC, 11.2%) and in females ≥80 years old (APC, 9.5%). The incidence of ovarian cancer is increasing gradually (APC, 1.5%).

Conclusion: ASRs and APC for gynecologic cancers overall are decreasing due to the decrease in the incidence of cervical cancer. However, the incidence of endometrial and ovarian cancer has been increasing.

Keywords: Cancer, Cervix uteri, Endometrium, Ovary, Korea

INTRODUCTION

The three major gynecologic cancers are cervical, endometrial, and ovarian cancer. Different issues may be related to the incidence of each gynecologic cancer. Effective screening and early detection programs using the Pap smear have proved effective against cervical cancer. Recently, human papillomavirus (HPV) vaccination was introduced as part of a program to prevent cervical cancer. Risk reducing surgery, based on genetic tests and genetic counseling for the hereditary portion of endometrial and ovarian cancer, might reduce

their incidence. In Korean females, the hereditary portion of endometrial and ovarian cancer is significant, as is the case in other ethnic populations [1,2].

The Korea Central Cancer Registry (KCCR), initiated as a nation-wide, hospital based cancer registry by the Ministry of Health and Welfare in 1980, was expanded in 1999 to cover the whole population [3]. From the KCCR, the incidence and pattern of cancer in Korea has been clearly identified.

The incidence of cervical cancer has decreased from 19.0 to 15.1 per 100,000 females between 1993 and 2002 according to the KCCR and the Gynecologic Oncology Committee of Korean Society of Obstetrics and Gynecology [4]. Using data from the same database the incidence of ovarian cancer has increased gradually from 3.79 to 4.74 per 100,000 females between 1993 and 2002 [5]. The objective of this study was to investigate the incidence pattern of cervical, endometrial, and ovarian cancer from 1999 to 2010.

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MATERIALS AND METHODS

The incidence data between 1999 and 2010 were extracted from the Korean National Cancer Incidence Database. Primary subsites were defined based on the International Classification of Diseases, 10th edition (ICD-10) [6]. We defined the three main gynecologic cancers as cervix uteri (C53), endometrium (C54.1), and ovary (C56).

Age-standardized rates (ASRs) were calculated using the World Health Organization (WHO) world standard population [7]. The trends in gynecologic cancer incidence rates were estimated by calculating the annual percent changes (APCs)

Table 1. The incidence of cervical, endometrial, and ovarian cancer cases, the Korea Central Cancer Registry, 1999–2010

Year	Overall	Cervix	Endometrium	Ovary
1999	6,394	4,443	619	1,332
2000	6,157	4,253	615	1,289
2001	6,617	4,572	724	1,321
2002	6,632	4,402	803	1,427
2003	6,749	4,359	920	1,470
2004	6,583	4,119	915	1,549
2005	6,747	3,998	1,091	1,658
2006	6,881	4,033	1,157	1,691
2007	6,914	3,731	1,279	1,904
2008	7,281	3,969	1,465	1,847
2009	7,209	3,765	1,632	1,812
2010	7,454	3,857	1,616	1,981

Data extraction was based on the definition of the International Classification of Diseases, 10th edition (ICD-10): cervix (C53), endometrium (C54.1), and ovary (C56).

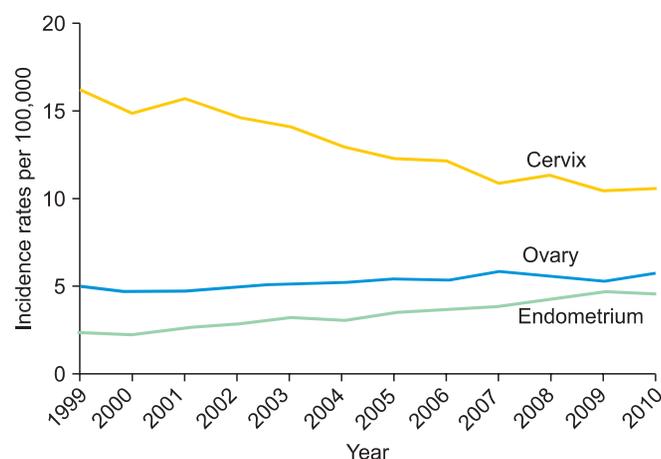


Fig. 1. Age-standardized incidence curves of cervical, endometrial, and ovarian cancer, the Korea Central Cancer Registry, 1999–2010.

using the following formula; $[\exp(\beta)-1] \times 100$, where the regression coefficient (β) was calculated by a linear regression of log-transformed age-standardized incidence rates in a calendar year [8].

RESULTS

The absolute incidence of overall cervical, ovarian, and endometrial cancer has increased continuously from 6,394 in 1999 to 7,454 in 2010 (Table 1, Fig. 1). The absolute number of cervical cancer cases has decreased (4,443 in 1999 to 3,857 in 2010), but the incidence of ovarian cancer (1,332 in 1999 to 1,981 in 2010) and endometrial cancer (619 in 1999 to 1,616 in 2010) has increased.

The ASRs and APCs overall and for each gynecologic cancer are shown in Tables 2 and 3. The ASR for gynecologic cancer was 23.7 per 100,000 in 1999 and decreased to 21.0 in 2010 (APC, -1.1%; 95% confidence interval [CI], -1.53 to -0.70). The incidence of cervical cancer has decreased: The ASR for cervical cancer was 16.3 in 1999 and 10.6 in 2010 (APC, -4.3%; 95% CI, -4.92 to -3.63). The incidence of endometrial cancer

Table 2. Age-standardized incidence rates* per 100,000 and annual percent changes (APCs) of cervical, endometrial, and ovarian cancer, the Korea Central Cancer Registry, 1999–2010

Year	Overall	Cervix	Endometrium	Ovary
1999	23.7	16.3	2.4	5.0
2000	22.1	15.0	2.3	4.8
2001	23.2	15.8	2.6	4.8
2002	22.7	14.8	2.8	5.0
2003	22.5	14.1	3.2	5.1
2004	21.3	13.0	3.1	5.1
2005	21.3	12.3	3.5	5.4
2006	21.2	12.1	3.6	5.4
2007	20.8	11.0	3.9	5.9
2008	21.3	11.4	4.3	5.5
2009	20.6	10.5	4.7	5.3
2010	21.0	10.6	4.6	5.7
APC	-1.1	-4.3	6.9	1.5
95% CI	-1.53 to -0.70	-4.92 to -3.63	6.05 to 7.66	0.82 to 2.22
p-value	<0.001	<0.001	<0.001	<0.001

Data extraction was based on the definition of the International Classification of Diseases, 10th edition (ICD-10): cervix (C53), endometrium (C54.1), and ovary (C56).

CI, confidence interval.
*Age adjusted to the World Health Organization world standard population.

Table 3. Incidence rates per 100,000* (1999, 2004 and 2010) and APCs of cervical, endometrial, and ovarian cancer according to age group, the Korea Central Cancer Registry, 1999–2010

Gynecologic cancers	Age group (yr)						
	<30	30–39	40–49	50–59	60–69	70–79	≥80
Overall							
1999	2.4	25.5	52.1	66.0	69.3	64.8	33.3
2004	2.3	20.7	46.0	59.6	60.1	63.9	52.9
2010	3.0	22.4	46.0	57.8	56.6	53.3	53.3
APC	2.4	-1.4	-1.8	-0.9	-1.6	-1.7	3.0
95% CI	1.28 to 3.54 [†]	-2.32 to -0.46 [†]	-2.52 to -1.17 [†]	-1.53 to -0.25 [†]	-2.15 to -1.02 [†]	-2.55 to -0.75 [†]	0.99 to 4.99 [†]
Cervix							
1999	0.7	19.9	38.9	43.0	49.4	43.6	18.2
2004	0.9	14.9	30.0	32.6	39.1	41.2	31.0
2010	1.1	14.6	24.0	24.9	26.8	30.3	33.4
APC	4.8	-3.4	-4.9	-5.3	-5.1	-3.8	3.2
95% CI	2.82 to 6.86 [†]	-4.58 to -2.17 [†]	-5.76 to -3.99 [†]	-6.12 to -4.43 [†]	-5.77 to -4.49 [†]	-5.19 to -2.40 [†]	0.18 to 6.26 [†]
Endometrium							
1999	0.1	1.8	5.0	9.8	6.2	4.9	1.4
2004	0.2	2.0	6.9	12.8	7.6	6.1	2.7
2010	0.4	3.3	9.7	17.9	13.9	7.0	3.7
APC	11.2	6.2	5.6	7.2	7.8	5.3	9.5
95% CI	7.19 to 15.17 [†]	4.45 to 7.94 [†]	4.78 to 6.51 [†]	5.70 to 8.67 [†]	6.10 to 9.49 [†]	2.68 to 7.93 [†]	4.00 to 15.10 [†]
Ovary							
1999	1.5	3.8	8.3	13.3	13.7	16.3	13.6
2004	1.3	3.8	9.1	14.3	13.5	16.6	19.1
2010	1.5	4.5	10.6	15.0	15.8	16.0	16.1
APC	-0.1	2.2	2.2	1.8	1.5	1.4	1.6
95% CI	-1.44 to 1.27	1.31 to 3.12 [†]	1.36 to 3.12 [†]	0.64 to 3.05 [†]	0.39 to 2.66 [†]	-0.76 to 3.63	-1.69 to 5.10

Data extraction was based on the definition of the International Classification of Diseases, 10th edition (ICD-10): cervix (C53), endometrium (C54.1), and ovary (C56).

APC, annual percent change; CI, confidence interval.

*Age adjusted to the World Health Organization world standard population, [†]p<0.001, [‡]p<0.05.

and ovarian cancer has increased. The ASR for endometrial cancer was 2.4 in 1999 and 4.6 in 2010 (APC, 6.9%; 95% CI, 6.05 to 7.66). The ASR for ovarian cancer was 5.0 in 1999 and 5.7 in 2010 (APC, 1.5%; 95% CI, 0.82 to 2.22).

Fig. 2 shows the APCs for each gynecologic cancer according to age group. The increasing APCs in gynecologic cancer were 3.0% in the eldest females (≥80 years old) and 2.4% in the youngest females (<30 years old) (**Table 3**). The highest APC was 11.2% in the youngest females with endometrial cancer (<30 years old), followed by 9.5% in eldest females with endometrial cancer (≥80 years old). In these groups, the incidences of most types of gynecologic cancers increased. The APC in cervical cancer decreased from ages 30 to 79 years from -3.4% to -5.3%. Although the incidence of endometrial and ovarian cancer increased, that of cervical cancer decreased from -0.9% to 1.8%.

DISCUSSION

The incidences of the three major gynecologic cancers decreased from 23.7 in 1999 to 21.0 in 2010 with an APC of -1.1% (**Table 2**). The major reason for this decrease is the definitive decrease in cervical cancer: ASR, 16.3 in 1999 to 10.6 in 2010. In 2013, the estimated incidence of cervical cancer is 3,240, ranked as the 13th of all cancers and 7th of female cancers [9]. Based on the decreased incidence from 4,443 in 1999 and 3,857 in 2010, a significantly decreasing pattern is also expected by statistical modeling. One reason for the decrease in the incidence of cervical cancer is the Korean national cancer screening program [10]. HPV vaccination was introduced into clinical practice in Korea in 2007; thus the decreasing trend in the incidence of cervical cancer will likely be accelerated.

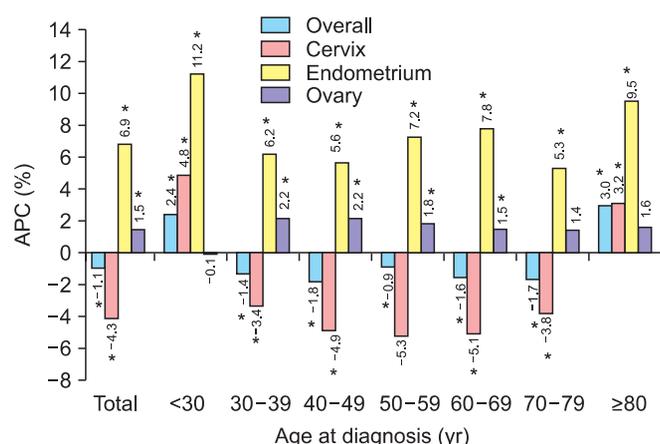


Fig. 2. Annual percent changes (APCs) in the incidences of cervical, endometrial, and ovarian cancer according to age group, 1999–2010. Data extraction was based on the definition of the International Classification of Diseases, 10th edition (ICD-10): cervix (C53), endometrium (C54.1), and ovary (C56). * $P < 0.05$.

The increasing trend in the incidence of endometrial cancer (APC, 6.9% during 1999–2010) is similar to that of colon cancer (APC, 6.6% during 1999–2000) [11]. This is interesting in terms of the shared etiology and genetic background of hereditary nonpolyposis colorectal cancer syndrome or Lynch syndrome [1]. Considering the recent APC in endometrial and colon cancer, preventive and early detective strategies should be established in Korea. Fortunately, definitive genetic screening tests are well established. It is a well-timed national policy project that incorporates genetic testing into the Korean national cancer screening program or hospital based screening program.

There is an increasing trend in the incidences of endometrial and cervical cancer in younger (<30 years old) and older (≥80 years old) females. The APC of endometrial cancer is up to 10% in both of these subgroups (APC, 11.2% in females <30 years old and 9.5% in females ≥80 years old). Although the incidence of cervical cancer in all females is decreasing (APC, -4.3%), the incidence is increasing in these two subgroups (APC, 4.8% in females <30 years old and 3.2% in females ≥80 years old). This steady increase in cervical cancer has also been identified in England and is thought to be due to increased exposure to HPV rather than cervical cancer screening [12]. Clinico-pathological variables in these two groups should be characterized to identify the cause of the increasing incidence of endometrial cancer and decreasing incidence of cervical cancer. Also, public support, including education, of vulnerable social groups is required to maintain maternal healthcare.

The incidence of ovarian cancer is increasing gradually (APC, 1.5%), and the predicted incidence in 2013 is estimated at 2,199 (1.8%), and is ranked as the 10th most common of a total of

124,122 female cancers [9]. Of the estimated 27,569 deaths in females in 2013, the proportion caused by ovarian cancer is estimated at 3.6%, ranking it as the 8th most common cancer-related cause of death; moreover, it is the gynecologic cancer with the highest mortality rate [9]. Although the increasing trend of the incidence is not steep compared to that of endometrial or colon cancer, ovarian cancer is challenging as there is no screening program or acceptable early detection strategy; this results in diagnosis at an advanced stage and a high recurrence rate (up to 80% in advanced stage) [11], suggesting a high financial burden. Fortunately, the incidence of ovarian cancer in young females <30 years old does not seem to be changing. Considering the age distribution in the increasing incidence group, the incidence of epithelial ovarian cancer seems to be increasing. The genetic background of epithelial ovarian cancer in Korean females is well established [2]. Because ovarian cancer has the highest hereditary portion of all adult solid tumors and an effective risk-reduction strategy has been established, clinical introduction of preventive and risk reducing strategy using hereditary background of ovarian cancer might reduce the incidence and mortality of ovarian cancer. The Korean health insurance review and assessment service approved the use of a risk-reduction surgery and/or preventive surgery based on genetic testing (risk, *BRCA1* or *BRCA2* mutant carrier) on December 1, 2012.

In conclusion, the incidences of cervical, endometrial, and ovarian cancers are changing. The incidence of the current top-ranked gynecologic cancer, cervical cancer, is decreasing (APC, -4.3%). The incidence of endometrial cancer has increased rapidly (APC, 6.9%), and shows a predominantly increasing pattern in younger and older females. The incidence of ovarian cancer is also increasing gradually (APC, 1.5%). Strategies to address these changing incidence patterns of gynecologic cancer should be developed and introduced to routine clinical practice.

CONFLICT OF INTEREST

Myong Cheol Lim, Sokbom Kang, and Jae-Weon Kim serve as Editors of the JGO but have no role in the decision to publish this article. No other conflict of interest relevant to this article was reported.

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