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ORIGINAL ARTICLE

Temporal Trends of Ovarian Cancer Between 1990 and 2019, in Asian Countries by Geographical Region and SDI, Comparison with Global Data

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Abstract

Aim Ovarian cancer is one of the health challenges all across the world, which causes significant burden and mortality in women. With the fastest-growing population, Asia has one of the largest populations in the world, and considerable variation in health statistics can be seen in this continent. So this study was conducted to investigate temporal trends of ovarian cancer in Asian countries between 1999 and 2019.

Methods and Materials We collected ovarian cancer data from the 2019 Global Burden of Disease study from 1990 to 2019 in 49 Asian countries and territories. Annual case data and age-standardized rates (ASRs) were used to investigate the incidence, prevalence, mortality, and disability-adjusted life-years (DALYs) of OC from 1990 to 2019 in 49 Asian countries and territories. Relative difference (%) between years was used to show the comparative changes in the selected indicators' age-standardized rates.

Results In Asia, with more than half of the world's population there is significant diversity in the incidence, prevalence, mortality, and burden of cancer. The number of ovarian cancer cases increased by 3.4 times during 1990–2019 and the ASR increased by 60%. With a 3.4-fold increase in mortality from 1990 to 2019, 47% of ovarian cancer deaths in 2019 occurred in Asian countries. Although during the years 1990–2019, the age-standardized DALYs rate in the world was in a stable state without significant changes, Asian countries experienced a 42% change. The highest incidence, prevalence, mortality, and burden of disease belonged to Brunei Darussalam, Brunei Darussalam, Pakistan, and Pakistan, respectively, and the lowest in all 4 categories was related to Yemen.

Conclusion While the world is experiencing a decreasing trend in the death rate caused by ovarian cancer, in Asia only High-income Asia Pacific countries are witnessing a decreasing trend, and the rate of increase in incidence and prevalence is also higher in Asia than in the world. Therefore, it seems that improving the awareness of women in the field of ovarian cancer and implementing effective strategies for early detection can reduce the epidemiological indicators of ovarian cancer in Asia.

Keywords Ovarian cancer · Asia · Incidence · Prevalence · Mortality · Burden

Introduction

Cancer is a major cause of morbidity and mortality worldwide, and its burden is increasing [1]. Ovarian cancer is one of the health challenges all across the world, which accounts for about 4% of all women's cancers. With a 5-year survival rate of 46%, this cancer is the seventh most common cancer among women [2]. Due to the lack of specific symptoms, ovarian cancer is often diagnosed in advanced and metastatic stages, and in nearly 70% of cases, its diagnosis is delayed until stage III or IV [3]. Therefore, ovarian cancer has the worst prognosis among

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gynecological cancer [4]. Although current treatment approaches promise to cure this disease, a significant number of patients experience disease relapse within a short period [5].

In 2019, 144,017 new cases of ovarian cancer were identified and 92,385 people lost their lives due to this cancer. However, Ovarian cancer has different statistics in different parts of the world for reasons such as differences in risk factors, even though these differences can be seen in different countries of the same region [6]. On the other hand, patients with different genetic backgrounds have different survival rates [7]. To design policies that control the incidence and burden of disease, we need to know the communities with the highest incidence and mortality. With the fastest-growing population, Asia has one of the largest populations in the world, and considerable variation in health statistics can be seen in this continent [8]. In addition, ovarian cancer is more common in older women [9], and Asia is one of the fastest-aging regions in the world [10–12]. Therefore, this study was conducted as the first comprehensive and up-to-date study on the time trend of the epidemiological indicators of ovarian cancer in Asian countries between 1990 and 2019 with more details including geographic region and socio-demographic index (SDI), relative changes in two time period (1990 to 2019 and 2010 to 2019) and compared with global trends.

Methods and Materials

Source Data

The annual data on incidence, prevalence, death, and the burden imposed by ovarian cancer on Asian countries (49 countries and territories included) according to the International Classification of Diseases 10 (ICD-10) code (C56.9) were obtained from the Global Burden of Disease (GBD) 2019 which were presented at the online data source Global Health Data Exchange (GHDx) query tool (http://ghdx.healthdata.org/gbd-results-tool). GBD studies are based on data extracted by the Institute for Health Metrics and Evaluation (IHME). IHME is part of the University of Washington and an independent global health research foundation responsible for maintaining and exchanging comprehensive registry data, surveys, censuses, and other health-related data to produce various disease estimates [13]. GBD estimates all available epidemiological data for the comparative assessment of health loss due to 364 diseases across 204 countries and territories from 1990 to 2019 [14]. These data include incidence, mortality, prevalence, year of life lost (YLL), years lived with disability (YLD), and disability-adjusted life years (DALY) of each disease and injury by time, location, gender, and age group [13].

In this study, data were extracted in different classifications of Asian countries based on a socio-demographic index (SDI), and five GBD categories for Asian countries from 1990 to 2019 and compared with global data. Specifically, we use data for North Africa and the Middle East, given that 15 out of 21 GBD countries in North Africa and the Middle East belong to West Asia. Also in Southeast Asia countries, 2 counties were from Africa.

The process of estimating GBD involves identifying multiple sources of data relevant to each disease or injury; censuses, household surveys, civil registration and vital statistics, disease registries, health service use, air pollution monitors, satellite imaging, disease notifications, and other sources. Each of these types of data is identified from a systematic review of published studies, searches of government and international organization websites, published reports, primary data sources such as the Demographic and Health Surveys, and contributions of datasets by GBD collaborators. 86,249 sources were used in this analysis, of which 19,354 sources reported fatalities, 31,499 reported incidence, 19,773 reported prevalence, and 26,631 reported alternative measures. Each newly identified and obtained data source receives a unique identification from a team of librarians and is included in the Global Health Data Exchange (GHDx). GHDx makes public the metadata of each source included in GBD along with the data when the data provider allows it. Readers can use the GHDx source tool to identify the sources used to estimate the outcome of a disease or injury in a particular place [15].

GBD has developed an internationally standardized form of QALY, known as the Adjusted Year of Life (DALY). DALY is defined as years of life lost as a result of premature death and years with a disability of specific severity and duration. A DALY is therefore a wasted year of healthy living. A "premature" death is defined as a death that occurred before the age at which the dying person is expected to survive if they belonged to a standardized population with a life expectancy at birth equal to the world's longest-surviving population, Japan. For the calculation of the total number of DALYs for a given condition within a population, years of life lost (YLLs) and years of disability of known severity and duration (YLDs) for this condition must be estimated and summed [1].

The SDI is a summary indicator that represents the base levels of social and economic conditions that can affect health outcomes in a given location [16], and was calculated as the geometric average of lag-distributed income per capita, average educational attainment of people aged 15 years and older, and the total fertility rate (in people aged < 25 years). According to the SDI values, countries

and territories were classified into five groups: low SDI (< 0·45), low-middle SDI (≥ 0·45 and < 0·61), middle SDI (≥ 0·61 and < 0·69), high-middle SDI (≥ 0·69 and < 0·80), and high SDI (≥ 0·80) [17, 18].

Comparisons of crude age-specific rates over time and between populations may be very misleading if the underlying age composition differs in the populations being compared [19]. Age-standardized rates (ASR) adjust for differences in the age distribution of the population by applying the observed age-specific rates for each population to a standard population. ASR is a weighted average of the age-specific rates per 100,000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population [19].

The study was approved by the Code of Ethics: IR.BUMS.REC.1400.316 in the Ethics Committee of the Birjand University of Medical Sciences in Iran. Informed consent was not required, because of using the anonymized online dataset. All methods were carried out according to applicable guidelines and regulations, and no identifying information was published.

Statistical Analysis

Incidence, prevalence, deaths, DALYs, and age-standardized rates were expressed on a per 100,000 population basis to eliminate the influence of the various composition of age groups in populations. Data were reported in values with a confidence interval (CI) of 95%. The selected epidemiological indicators were presented separately for the different classification systems.

We used relative difference (%) between years to show the comparative changes in incidences, prevalence, deaths, and DALY age-standardized rates. The relative difference is equal to the value of the absolute difference divided by the value in the original year, and then we multiplied it by 100 [20]. The definition of what has been used is available at https://www.healthdata.org/terms-defined and https://www.healthdata.org/gbd/.

Results

Morbidity

In Asia, the number of ovarian cancer incidences increased from 41,888 (95% CI 35381_56004) in 1990 to 144,017 (95% CI 117220_168876) in 2019, which is over a 3.4-fold increase. In 2019 approximately 50% (144,017 from 294,422) of ovarian cancer cases happened in Asia countries. During this period, the age-standardized incidence rate (ASIR) of ovarian cancer with 60% change, increased from 3.57 (95% CI 3.06_4.71) per 100,000 in 1990 to 5.73 (95% CI 4.66_6.7) per 100,000 in 2019, while in the same time, this rate globally increased 6%.

In 1990, the highest ASIR of OC was observed in High-income Asia Pacific countries (6.13 (95% CI 5.84_6.43)) but these countries experienced a slow increase from 1990 to 2010 and a decreasing trend from 2010 to 2019. In contrast, South Asia, East Asia, and Southeast Asia countries experienced a significant increase trend from 1990 to 2019, respectively. So in 2019, the highest ASIR of OC was allocated to Southeast Asia countries with 7.98 (95% CI 6.19_11.04) per 100,000. (Fig. 1).

Among high SDI Asian countries, Brunei Darussalam (16.12) and Qatar (11.42) have the highest ASIR of OC, and the Republic of Korea (5.51) have the lowest rate.

Among high-middle SDI Asian countries, Lebanon (11.78) and Bahrain (10.87) have the highest ASIR of OC, and Jordan (5.42) have the lowest rate.

Among middle SDI Asian countries, Philippine (9.91) and Indonesia (8.16) have the highest ASIR of OC, and Republic of the Syrian Arab Republic (3.55) has the lowest rate.

Among low-middle SDI Asian countries, Maldives (9.98) and Cambodia (8.39) have the highest ASIR of OC, and Bangladesh (4.57) have the lowest rate.

Among low SDI Asian countries, Pakistan (15.85) has the highest ASIR of OC, and Yemen (2.59) has the lowest rate.

Among Asian countries, 46 countries experienced a significant increase in the ovarian cancer morbidity rate between 1990 and 2019, but the greatest increase was detected in Saudi Arabia (increase in ASIR = 1.68, 95% CI 0.27–3.56). Only Israel, Kuwait, and Singapore had a decreasing trend in OC incidence from 1990 to 2019 (Fig. 2).

In 2019, the highest ASIR of ovarian cancer was reported in Brunei Darussalam (16.12), Pakistan (15.85), Lebanon (11.78), Qatar (11.42), and Bahrain (10.87). The lowest ASIR of ovarian cancer was reported in Yemen (2.59), the Syrian Arab Republic (3.55), Afghanistan (3.65), China (4.54), and Bangladesh (4.57). Results in detail were presented in Table 1.

Prevalence

In Asia, the number of women who lived with ovarian cancer increased from 172,322 (95% CI 117220_168876) in 1990 to 614,843 (95% CI 503410_718099) in 2019, which is over a 3.6-fold increase. In 2019 approximately 51% (614,843 of 1,206,652) of ovarian cancer cases lived in Asia countries. During this period, the age-standardized prevalence rate (ASPR) of ovarian cancer with 81% change, increased from 13.5 (95% CI 11.32_17.93) per 100,000 in 1990 to 24.48 (95% CI 20.09_28.5) per 100,000

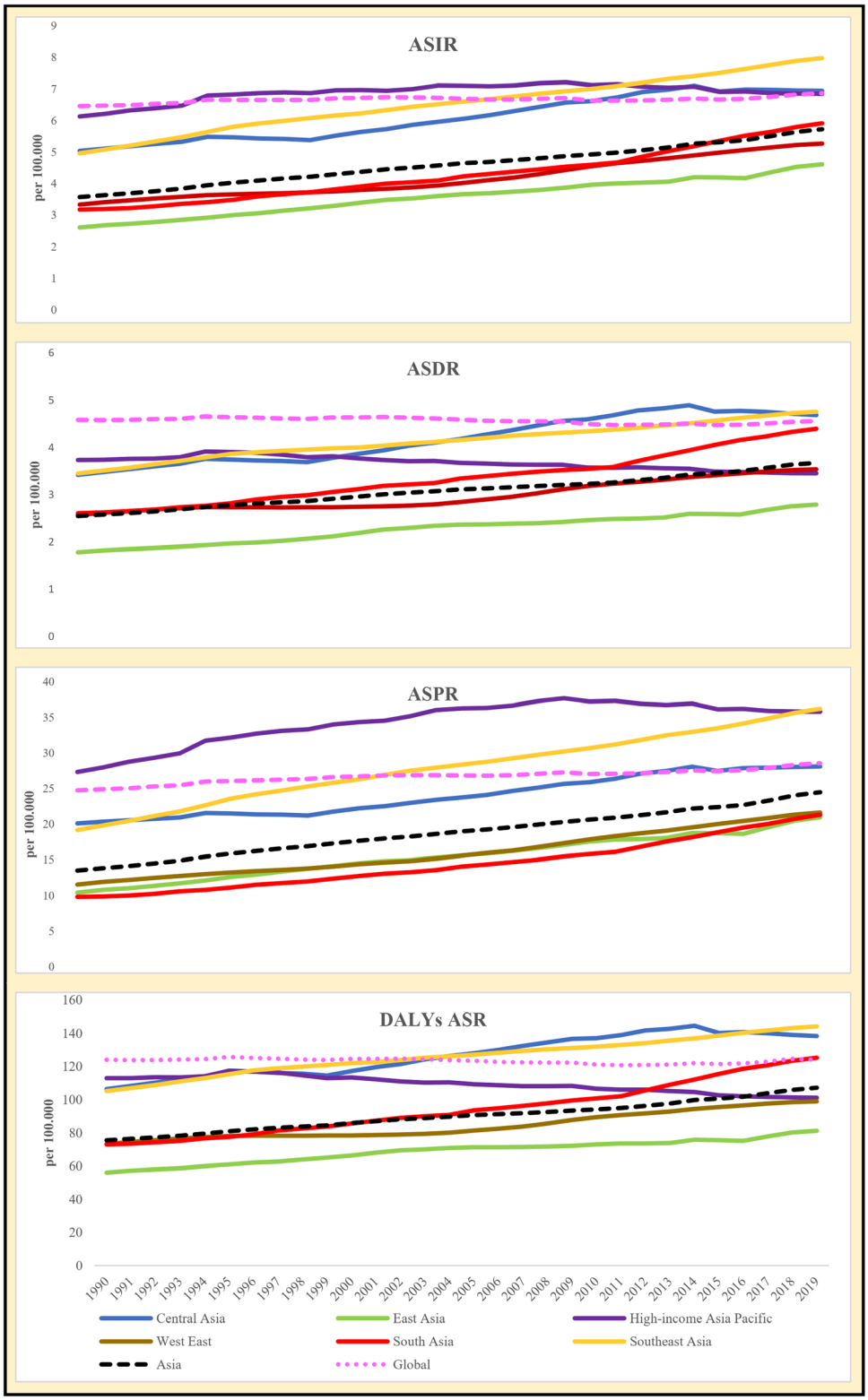

Fig. 1 Temporal trend of incidence, prevalence, death and DALYs age standard rates (per 100,000 population) of ovarian cancer in ASIA comparison with global data from 1990 to 2019

in 2019, while in the same time, this rate globally increased 15%.

In 1990, the highest ASPR of OC was observed in High-income Asia Pacific countries (27.33 (95% CI 25.98_28.59)) but these countries experienced a slow increase from 1990 to 2010 and a decreasing trend from 2010 to 2019; so the ASPR of OC in these countries had the second situation after Southeast Asia countries. In

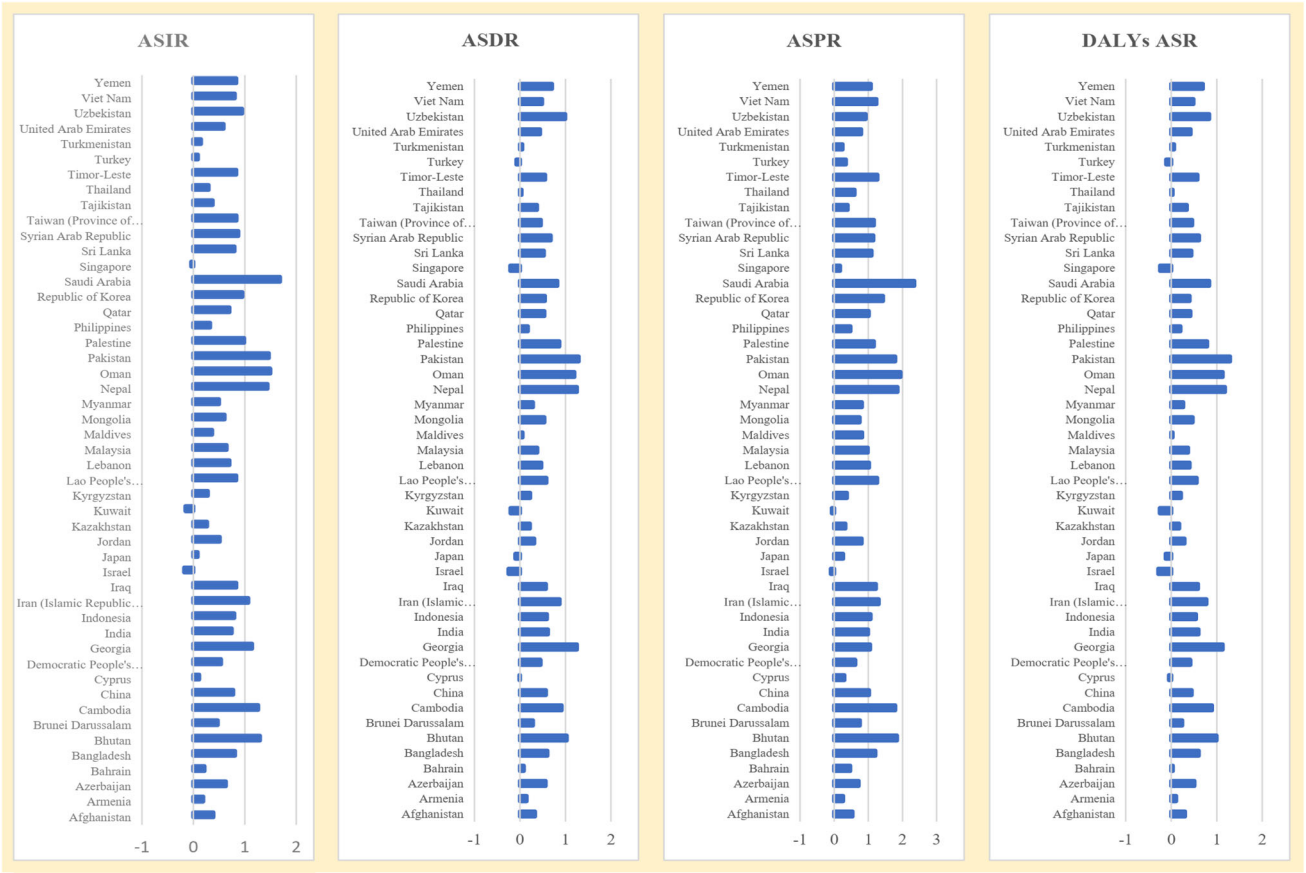

Fig. 2 The relative change (%) in age-standardized incidence rate (ASIR), age-standardized death rate (ASMR), age-standardized DALYs rate (DALYs ASR), and age-standardized prevalence rate (ASPR) of ovarian cancer in Asian countries from 1990 to 2019

contrast, South Asia countries experienced a significant increase trend (0.35 (95% CI 0.05_0.64)) in ASPR from 1990 to 2019. (Fig. 1).

Among high SDI Asian countries, Brunei Darussalam (69.64) has the highest ASPR of OC, and Kuwait (24.60) has the lowest rate.

Among high-middle SDI Asian countries, Lebanon (51.05) has the highest ASPR of OC, and Republic of Jordan (22.74) has the lowest rate.

Among middle SDI Asian countries, Philippines (45.22) has the highest ASPR of OC, and the Republic of Syrian Arab Republic (15.15) has the lowest rate.

Among low-middle SDI Asian countries, Maldives (48.32) has the highest ASPR of OC, and Bangladesh (16.64) has the lowest rate.

Among low SDI Asian countries, Pakistan (56.53) has the highest ASPR of OC, and Yemen (6.25) has the lowest rate.

Among Asian countries, 47 countries experienced a significant increase in the ovarian cancer morbidity rate between 1990 and 2019, but the greatest increase was detected in Saudi Arabia (increase in ASPR = 2.35 (95% CI 0.61_4.81)). Only Israel and Kuwait had a decreasing trend in OC prevalence from 1990 to 2019 (Fig. 2).

In 2019, the highest ASPR of ovarian cancer was reported in Brunei Darussalam (69.64), Pakistan (56.53), Lebanon (51.05), Taiwan (Province of China) (48.61), and Maldives (48.32). The lowest ASPR of ovarian cancer was reported in Yemen (9.25), Afghanistan (12.17), the Syrian Arab Republic (15.15), Bangladesh (16.64), and India (17.72). Results in detail were presented in Table 2.

Mortality

In Asia, the number of ovarian cancer death increased from 27,472 (95% CI 23711_36343) in 1990 to 92,385 (95% CI 76661_108030) in 2019, which is over a 3.4-fold increase. In 2019 approximately 47% (92,385 from 198,412) of ovarian cancer death happened in Asia countries. During this period, the age-standardized death rate (ASDR) of ovarian cancer with 44% change, increased from 2.55 (95% CI 2.2_3.34) per 100,000 in 1990 to 3.67 (95% CI 3.05_4.3) per 100,000 in 2019, while in the same period, this rate globally decreased 1%.

Table 1 The morbidity of ovarian cancer in Asian countries in 1990, 2010, and 2019 and the temporal trends between 1990 and 2019, by geographical region and SDI

Location	SDI2019	1990		2010		% change 1990–2010 (95%CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASRper 10^5(95% CI)	Number(95%CI)	ASRper 10^5(95% CI)		Number (95% CI)	ASRper 10^5(95% CI)		
Global		141,706	6.46	229,929	6.64	0.03	294,422	6.87	0.03	0.06
		(130541_160779)	(5.97_7.29)	(214203_247838)	(6.18_7.14)	(− 0.05_0.11)	(260649_329727)	(6.08_7.7)	(− 0.06_0.13)	(− 0.1_0.2)
Asia		41,888	3.57	98,225	4.93	0.38	144,017	5.73	0.16	0.60
		(35381_56004)	(3.06_4.71)	(86769_112310)	(4.38_5.61)	(0.11_0.58)	(117220_168876)	(4.66_6.7)	(0_0.31)	(0.12_0.95)
Countries by geographical location										
Central Asia		1440	5.04	2469	6.62	0.31	3187	6.94	0.05	0.38
		(1217_1591)	(4.25_5.56)	(2352_2588)	(6.3_6.92)	(0.18_0.54)	(2759_3567)	(6_7.76)	(− 0.09_0.17)	(0.17_0.65)
East Asia		13,419	2.61	33,423	3.96	0.52	47,852	4.61	0.16	0.77
		(10535_18334)	(2.05_3.6)	(28915_39677)	(3.44_4.69)	(0.08_0.95)	(35082_59600)	(3.41_5.74)	(− 0.13_0.49)	(0.09_1.47)
High-income Asia Pacific		6620	6.13	10,886	7.12	0.16	11,882	6.85	− 0.04	0.12
		(6311_6965)	(5.84_6.43)	(9841_11528)	(6.59_7.47)	(0.08_0.23)	(9655_14073)	(5.55_8.16)	(− 0.19_0.13)	(− 0.1_0.33)
West Asia		3295	3.33	8375	4.55	0.37	12,877	5.27	0.16	0.58
		(2361_6096)	(2.42_6)	(7015_9629)	(3.86_5.2)	(− 0.15_0.75)	(10395_15071)	(4.29_6.15)	(− 0.03_0.3)	(− 0.17_1.17)
South Asia		9996	3.17	26,862	4.60	0.45	45,756	5.91	0.29	0.86
		(7382_15060)	(2.42_4.63)	(22444_32080)	(3.9_5.51)	(0.07_0.87)	(34899_56554)	(4.58_7.29)	(0.01_0.56)	(0.15_1.59)
Southeast Asia		8175	4.96	19,909	7.00	0.41	28,151	7.98	0.14	0.61
		(6454_12130)	(4.02_7.19)	(16082_27292)	(5.7_9.57)	(0.05_0.65)	(21777_38998)	(6.19_11.04)	(− 0.06_0.33)	(0_1.01)
Countries by SDI 2019										
High SDI										
Brunei Darussalam	0.823	7	10.94	22	15.17	0.39	31	16.12	0.06	0.47
		(5_11)	(8.26_16.04)	(19_26)	(12.94_17.7)	(− 0.05_0.9)	(24_38)	(12.74_19.38)	(− 0.12_0.29)	(− 0.05_1.04)
Cyprus	0.841	38	8.79	73	9.93	0.13	94	9.79	− 0.01	0.11
		(29_55)	(6.79_12.72)	(59_84)	(8.02_11.4)	(− 0.3_0.51)	(68_119)	(7_12.31)	(− 0.24_0.22)	(− 0.42_0.65)
Israel	0.803	289	11.54	436	9.66	− 0.16	537	9.47	− 0.02	− 0.18
		(247_312)	(9.83_12.45)	(402_470)	(8.9_10.43)	(− 0.24_0.03)	(407_692)	(7.14_12.34)	(− 0.25_0.28)	(− 0.39_0.11)
Japan	0.87	5950	6.87	8926	7.86	0.14	9198	7.44	− 0.05	0.08
		(5627_6177)	(6.48_7.14)	(8050_9576)	(7.36_8.34)	(0.09_0.25)	(7192_11347)	(5.82_9.33)	(− 0.24_0.17)	(− 0.15_0.37)
Kuwait	0.851	23	6.72	43	5.76	− 0.14	87	5.68	− 0.01	− 0.16
		(20_31)	(5.47_9.09)	(38_59)	(5.11_7.57)	(− 0.38_0.28)	(54_134)	(3.68_8.28)	(− 0.3_0.31)	(− 0.47_0.37)
Qatar	0.83	3	6.72	19	11.83	0.76	39	11.42	− 0.03	0.70
		(2_5)	(3.79_10.5)	(14_24)	(7.42_15.07)	(0.07_1.73)	(26_55)	(7.64_15.56)	(− 0.33_0.27)	(− 0.16_1.89)
Republic of Korea	0.878	557	2.82	1706	5.08	0.80	2364	5.51	0.08	0.95
		(484_923)	(2.43_4.81)	(1238_1862)	(3.69_5.55)	(− 0.34_1.19)	(1376_2981)	(3.29_6.95)	(− 0.14_0.32)	(− 0.38_1.7)
Saudi Arabia	0.805	72	2.34	388	5.36	1.29	735	6.27	0.17	1.68
		(47_130)	(1.54_4.21)	(324_503)	(4.56_6.94)	(0.36_2.63)	(509_1047)	(4.36_9.1)	(− 0.17_0.52)	(0.27_3.56)

Table 1 (continued)

Location	SDI2019	1990		2010		% change 1990–2010 (95%CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASRper 10^5(95% CI)	Number(95%CI)	ASRper 10^5(95% CI)		Number (95% CI)	ASRper 10^5(95% CI)		
Singapore	0.861	106 (96_116)	7.73 (7.05_8.49)	232 (213_252)	8.26 (7.58_8.94)	0.07 (− 0.04_0.2)	289 (225_368)	7.42 (5.77_9.36)	− 0.10 (− 0.3_0.13)	− 0.04 (− 0.27_0.24)
Taiwan(Province of China)	0.868	411 (384_436)	4.72 (4.43_5.01)	1283 (1041_1382)	8.45 (6.89_9.09)	0.79 (0.35_0.96)	1560 (1137_2078)	8.68 (6.29_11.57)	0.03 (− 0.22_0.35)	0.84 (0.31_1.47)
United Arab Emirates	0.88	14 (8_27)	5.33 (2.78_11.74)	77 (50_120)	8.21 (4.96_18.66)	0.54 (− 0.11_1.53)	169 (102_305)	8.46 (4.86_15.7)	0.03 (− 0.38_0.42)	0.59 (− 0.28_2.02)
High-middle SDI										
Bahrain	0.751	9 (6_13)	8.92 (6.56_12.95)	28 (21_43)	9.82 (7.99_14.04)	0.10 (− 0.32_0.86)	50 (34_81)	10.87 (7.72_16.26)	0.11 (− 0.15_0.37)	0.22 (− 0.35_1.17)
Georgia	0.702	157 (132_196)	4.52 (3.81_5.69)	246 (176_277)	8.32 (6.05_9.36)	0.84 (0.15_1.28)	282 (187_349)	9.68 (6.71_11.98)	0.16 (− 0.08_0.47)	1.14 (0.24_1.85)
Jordan	0.731	30 (21_48)	3.59 (2.42_5.73)	106 (87_124)	5.09 (4.19_6.05)	0.42 (− 0.17_1.07)	210 (148_276)	5.42 (3.87_7.01)	0.06 (− 0.18_0.35)	0.51 (− 0.25_1.37)
Kazakhstan	0.723	623 (486_716)	7.92 (6.17_9.06)	860 (803_917)	9.69 (9.06_10.32)	0.22 (0.05_0.57)	1048 (852_1254)	10.02 (8.13_12.01)	0.03 (− 0.17_0.24)	0.27 (0.02_0.59)
Lebanon	0.708	87 (61_134)	6.93 (4.91_10.68)	228 (177_290)	10.38 (8.06_13.27)	0.50 (− 0.17_1.19)	334 (228_444)	11.78 (8.03_15.71)	0.13 (− 0.12_0.42)	0.70 (− 0.2_1.68)
Malaysia	0.737	277 (213_415)	4.92 (3.84_7.23)	942 (827_1131)	8.19 (7.22_9.65)	0.66 (0.11_1.18)	1182 (874_1612)	8.10 (6.02_10.99)	− 0.01 (− 0.24_0.28)	0.65 (− 0.03_1.41)
Oman	0.783	10 (5_17)	2.74 (1.33_4.9)	38 (32_44)	6.28 (4.97_7.31)	1.29 (0.17_4.04)	67 (42_88)	6.85 (4.54_9.05)	0.09 (− 0.26_0.41)	1.50 (− 0.06_4.08)
Sri Lanka	0.69	215 (181_269)	3.24 (2.72_4.15)	577 (464_640)	5.18 (4.17_5.71)	0.60 (0.19_0.95)	790 (529_1086)	5.82 (3.93_7.99)	0.12 (− 0.19_0.51)	0.80 (0.19_1.54)
Turkey	0.748	1265 (715_2302)	6.16 (3.52_10.85)	2288 (1523_2733)	6.18 (4.12_7.38)	0.00 (− 0.44_0.45)	3137 (1946_4122)	6.69 (4.15_8.77)	0.08 (− 0.18_0.42)	0.09 (− 0.45_0.69)
Middle SD										
Armenia	0.689	103 (80_148)	6.49 (5.11_9.25)	179 (165_191)	8.64 (7.99_9.26)	0.33 (− 0.05_0.7)	168 (134_204)	7.73 (6.14_9.43)	− 0.11 (− 0.29_0.1)	0.19 (− 0.23_0.66)
Azerbaijan	0.683	108 (78_144)	3.44 (2.44_4.57)	256 (191_315)	5.41 (4.12_6.61)	0.57 (0.14_1.11)	327 (210_451)	5.61 (3.67_7.63)	0.04 (− 0.24_0.37)	0.63 (0.05_1.33)
China	0.686	12,680 (9905_17511)	2.56 (2_3.58)	31,479 (27134_37810)	3.87 (3.34_4.64)	0.51 (0.06_0.96)	45,482 (33113_57376)	4.54 (3.33_5.71)	0.17 (− 0.14_0.51)	0.77 (0.06_1.51)
Indonesia	0.66	2961 (2077_5708)	4.54 (3.3_8.54)	7441 (5010_13423)	7.03 (4.8_12.7)	0.55 (0.08_1.01)	10,543 (6547_19733)	8.16 (5.07_15.24)	0.16 (− 0.18_0.56)	0.80 (− 0.01_1.54)
Iran(Islamic Republic of)	0.67	369 (243_693)	2.30 (1.58_4.22)	1207 (915_1312)	3.80 (2.95_4.13)	0.65 (− 0.14_1.34)	1944 (1318_2216)	4.75 (3.27_5.39)	0.25 (0.06_0.4)	1.06 (− 0.03_2.06)

Table 1 (continued)

Location	SDI2019	1990		2010		% change 1990–2010 (95%CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASRper 10^5(95% CI)	Number(95%CI)	ASRper 10^5(95% CI)		Number (95% CI)	ASRper 10^5(95% CI)		
Iraq	0.671	156	3.28	515	4.83	0.47	931	6.03	0.25	0.84
		(88_273)	(1.83_5.95)	(375_684)	(3.53_6.47)	(− 0.17_1.73)	(647_1313)	(4.29_8.27)	(− 0.1_0.68)	(− 0.17_2.8)
Philippines	0.623	1517	7.49	3246	8.49	0.13	4805	9.91	0.17	0.32
		(1188_1958)	(5.77_9.68)	(2810_3881)	(7.44_10.45)	(− 0.1_0.49)	(3553_6526)	(7.35_13.34)	(− 0.13_0.55)	(− 0.1_0.95)
Syrian Arab Republic	0.619	62	1.89	200	3.11	0.64	248	3.55	0.14	0.87
		(41_100)	(1.24_3.05)	(151_253)	(2.38_3.92)	(− 0.1_1.72)	(159_373)	(2.3_5.34)	(− 0.21_0.62)	(− 0.17_2.54)
Thailand	0.687	1254	5.48	2809	6.78	0.24	3619	7.11	0.05	0.30
		(1011_1577)	(4.44_6.91)	(2335_3540)	(5.64_8.47)	(− 0.06_0.62)	(2510_5360)	(4.87_10.47)	(− 0.26_0.44)	(− 0.18_0.96)
Turkmenistan	0.67	63	4.74	110	5.26	0.11	133	5.43	0.03	0.15
		(48_71)	(3.78_5.31)	(96_120)	(4.66_5.7)	(− 0.02_0.31)	(94_173)	(3.88_7.06)	(− 0.24_0.33)	(− 0.19_0.57)
Uzbekistan	0.631	196	2.75	483	4.49	0.63	753	5.36	0.19	0.95
		(102_245)	(1.42_3.44)	(446_567)	(4.18_4.92)	(0.29_2.15)	(585_921)	(4.17_6.5)	(− 0.08_0.47)	(0.36_2.34)
Viet Nam	0.617	947	3.88	2535	5.92	0.52	3867	7.01	0.18	0.81
		(719_1251)	(2.94_5.1)	(1947_3130)	(4.57_7.37)	(0.12_1.05)	(2814_5026)	(5.13_9.07)	(− 0.07_0.46)	(0.2_1.58)
Low-middle SDI										
Bangladesh	0.483	639	2.53	1847	3.83	0.52	3166	4.57	0.19	0.81
		(377_1176)	(1.5_4.57)	(1308_3851)	(2.72_7.87)	(− 0.17_1.24)	(1980_6892)	(2.84_9.92)	(− 0.1_0.53)	(− 0.2_1.95)
Bhutan	0.455	4	2.98	13	5.54	0.86	20	6.84	0.23	1.29
		(2_9)	(1.47_6.28)	(8_27)	(3.31_11.56)	(− 0.08_2.17)	(11_46)	(3.87_15.29)	(− 0.06_0.56)	(− 0.1_3.23)
Cambodia	0.469	119	3.71	405	6.76	0.82	647	8.39	0.24	1.26
		(62_353)	(2.01_10.49)	(265_705)	(4.53_11.55)	(0.01_2.42)	(421_1091)	(5.54_14.04)	(0_0.52)	(0.11_3.36)
Democratic People's Republic of Korea	0.558	328	3.08	661	4.34	0.41	810	4.73	0.09	0.54
		(162_706)	(1.54_6.52)	(438_1160)	(2.86_7.63)	(− 0.13_1.64)	(536_1310)	(3.12_7.56)	(− 0.16_0.42)	(− 0.15_2.07)
India	0.566	7307	2.87	18,439	3.90	0.36	31,024	5.01	0.28	0.75
		(4821_11444)	(1.94_4.39)	(14938_23317)	(3.18_4.85)	(0.04_0.83)	(23462_38479)	(3.82_6.2)	(0_0.64)	(0.14_1.46)
Kyrgyzstan	0.596	100	5.48	156	6.69	0.22	205	7.03	0.05	0.28
		(88_111)	(4.82_6.13)	(143_169)	(6.06_7.23)	(0.07_0.38)	(159_247)	(5.45_8.42)	(− 0.18_0.26)	(0_0.6)
Lao People's Democratic Republic	0.49	57	4.32	149	6.75	0.56	225	7.93	0.17	0.84
		(28_179)	(2.16_12.92)	(91_272)	(4.33_11.94)	(− 0.17_1.82)	(144_363)	(5.18_12.58)	(− 0.1_0.49)	(− 0.2_2.51)
Maldives	0.562	4	7.32	11	9.36	0.28	17	9.98	0.07	0.36
		(2_13)	(4.02_23.11)	(10_13)	(8.05_11.09)	(− 0.58_1.34)	(13_23)	(7.81_12.97)	(− 0.17_0.34)	(− 0.63_1.74)
Mongolia	0.606	24	3.82	65	5.83	0.53	97	6.14	0.05	0.61
		(16_45)	(2.53_6.92)	(49_94)	(4.58_8.02)	(− 0.02_1.37)	(68_143)	(4.42_8.73)	(− 0.23_0.38)	(− 0.04_1.54)
Myanmar	0.521	783	5.41	1680	7.34	0.36	2299	8.10	0.10	0.50
		(480_1831)	(3.39_12.02)	(1122_2623)	(5.04_11.18)	(− 0.19_1.19)	(1600_3283)	(5.67_11.43)	(− 0.17_0.42)	(− 0.27_1.57)

Table 1 (continued)

Location	SDI2019	1990		2010		% change 1990–2010 (95%CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASRper 10^5(95% CI)	Number(95%CI)	ASRper 10^5(95% CI)		Number (95% CI)	ASRper 10^5(95% CI)		
Palestine	0.588	18	3.33	51	4.60	0.38	100	6.62	0.44	0.99
		(10_37)	(1.78_6.66)	(38_62)	(3.46_5.55)	(− 0.25_1.45)	(58_126)	(3.84_8.36)	(0.04_0.91)	(− 0.13_2.97)
Tajikistan	0.539	66	3.99	115	5.10	0.28	174	5.48	0.07	0.37
		(45_90)	(2.67_5.43)	(94_144)	(4.14_6.3)	(− 0.09_0.91)	(133_229)	(4.22_6.92)	(− 0.17_0.4)	(− 0.05_1.08)
Timor-Leste	0.514	6	3.04	14	3.99	0.31	26	5.57	0.40	0.83
		(3_16)	(1.5_7.81)	(7_24)	(2.15_6.63)	(− 0.31_1.21)	(15_38)	(3.28_8.07)	(0.06_0.93)	(− 0.15_2.48)
Low SDI										
Afghanistan	0.343	102	2.63	201	3.12	0.19	331	3.65	0.17	0.39
		(37_565)	(0.97_14.07)	(84_1015)	(1.32_14.79)	(− 0.12_0.78)	(162_1304)	(1.79_13.51)	(− 0.1_0.65)	(− 0.11_1.41)
Nepal	0.422	131	2.44	429	(0_0)	0.81	764	5.96	0.35	1.44
		(66_261)	(1.22_4.83)	(278_919)	(2.87_9.49)	(− 0.05_2.15)	(465_1743)	(3.65_13.51)	(0.03_0.68)	(0.06_3.44)
Pakistan	0.449	1915	6.42	6134	(0_0)	0.91	10,783	15.85	0.30	1.47
		(1481_2418)	(5.01_8.21)	(4027_8481)	(8.33_16.72)	(0.17_1.84)	(5511_17344)	(8.49_25.36)	(− 0.14_0.88)	(0.14_3.28)
Yemen	0.412	42	1.41	122	(0_0)	0.45	220	2.59	0.27	0.83
		(13_184)	(0.41_5.89)	(56_340)	(0.92_5.5)	(− 0.11_1.85)	(129_529)	(1.51_5.99)	(− 0.07_0.94)	(− 0.04_3.63)

In 1990, the highest ASDR of OC was observed in High-income Asia Pacific countries (3.73 (95% CI 3.53_3.99)) but these countries experienced a decreasing trend from 1990 to 2019. In contrast, South Asia and East Asia countries experienced a significant increase trend from 1990 to 2019, respectively. But in 2019, the highest ASDR of OC was allocated to Southeast Asia countries with 4.76 (95% CI 3.75_6.64) per 100,000. (Fig. 1).

Among high SDI Asian countries, Brunei Darussalam (10.08) has the highest ASDR of OC, and Republic of Korea (2.91) has the lowest rate.

Among high-middle SDI Asian countries, Bahrain (7.79) and Lebanon (7.50) have the highest ASDR of OC, and Sri Lanka (3.21) has the lowest rate.

Among middle SDI Asian countries, Philippines (5.82) has the highest ASDR of OC, and the Republic of Syrian Arab Republic (2.59) has the lowest rate.

Among low-middle SDI Asian countries, Cambodia (5.26) has the highest ASDR of OC, and Democratic People's Republic of Korea (2.67) has the lowest rate.

Among **low SDI Asian countries**, Pakistan (11.84) has the highest ASDR of OC, and Yemen (1.94) has the lowest rate.

Among Asian countries, 43 countries experienced a significant increase in the ovarian cancer morbidity rate between 1990 and 2019, but the greatest increase was detected in Pakistan, Nepal, and Georgia. Israel, Singapore, and Kuwait experienced the highest decreasing trend in OC death rates from 1990 to 2019 (Fig. 2).

In 2019, the highest ASDR of ovarian cancer was reported in Pakistan (11.84), Brunei Darussalam (10.08), Qatar (8.19), Bahrain (7.79), and Lebanon (7.5). The lowest ASDR of ovarian cancer was reported in Yemen (1.94), Syrian Arab Republic (2.29), Democratic People's Republic of Korea (2.67), China (2.77), and Afghanistan (2.83).

Results in detail were presented in Table 3.

Burden

In Asia, the number of ovarian cancer DALYs increased from 899,014 (95% CI 757552_1221171) in 1990 to 2,730,014 (95% CI 2239232_3219963) in 2019, which is over a threefold increase. In 2019 approximately 51% (2,730,014 from 5,359,737) of ovarian cancer burden was allocated to Asian countries. During this period, the age-standardized DALYs rate of ovarian cancer with 42% change, increased from 75.45 (95% CI 64.57_100.96) per 100,000 in 1990 to 107.2 (95% CI 88.04_126.71) per 100,000 in 2019, while in the same period, this rate globally was stable without no changes. (Fig. 1).

In 1990, the highest DALYs ASR of OC was observed in High-income Asia Pacific countries (112.95 (95% CI 108.81_119.08)) but these countries experienced a decreasing trend from 1990 to 2019. In contrast, South Asia (0.72 (95% CI 0.05_1.4)) countries experienced a significant increase trend from 1990 to 2019. But in 2019, the highest DALYs ASR of OC was allocated to Southeast Asia countries with 144.22 (95% CI 112.72_201.78) per 100,000.

Among high SDI Asian countries, Brunei Darussalam (281.99) has the highest DALYs ASR of OC, and Republic of Korea (81.44) has the lowest rate.

Among high-middle SDI Asian countries, Lebanon (201.49) has the highest DALYs ASR of OC, and Sri Lanka (92.55) has the lowest rate.

Among middle SDI Asian countries, Philippines (183.67) has the highest DALYs ASR of OC, and Republic of Syrian Arab Republic (66.46) has the lowest rate.

Among low-middle SDI Asian countries, Cambodia (161.44) has the highest DALYs ASR of OC, and Democratic People's Republic of Korea (84.13) has the lowest rate.

Among low SDI Asian countries, Pakistan (348.37) has the highest DALYs ASR of OC, and Yemen (56.53) has the lowest rate.

Among Asian countries, 43 countries experienced a significant increase in the ovarian cancer DALYs rate between 1990 and 2019; the greatest increase was detected in Pakistan, Nepal, Oman, and Georgia. The highest decreasing trend in OC DALYs was detected in Israel, Kuwait, and Singapore from 1990 to 2019 (Fig. 2).

In 2019, the highest DALYs ASR of ovarian cancer was reported in Pakistan (348.37), Brunei Darussalam (281.99), Lebanon (201.49), Qatar (195.62), and Kazakhstan (194.88). The lowest DALYs ASR of ovarian cancer was reported in Yemen (56.53), Syrian Arab Republic (66.46), China (80.52), Republic of Korea (81.44), and Democratic People's Republic of Korea (84.13).

Results in detail were presented in Table 4.

Discussion

In Asia, with more than half of the world's population [21], there is significant diversity in the incidence, mortality, and burden of cancer [22], and to design effective measures, there is a need to understand this diversity. Although the increase in the incidence of ovarian cancer is seen in most Asian countries, the difference between countries is significant [23]. The age-standardized incidence rates (ASIR) of ovarian cancer vary from 2.59 in Yemen to 16.12 in Brunei Darussalam. The reason for differences in incidence rate is probably multifactorial and is still unknown. But part of these differences can be due to differences in lifestyle, risk factors, fertility behaviors, and socio-economic

Table 2 The prevalence of ovarian cancer in Asian countries in 1990, 2010 and 2019 and the temporal trends between 1990 and 2019, by geographical region and SDI

Location	SDI 2019	1990		2010		% change 1990 − 2010 (95% CI)	2019		% change 2010 − 2019 (95% CI)	% change 1990 − 2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Global		561,475	24.75	950,867	27.05	0.09	1,206,652	28.56	0.06	0.15
		(514350_641525)	(22.77_28.1)	(888453_1023111)	(25.29_29.08)	(0_0.2)	(1064857_1353763)	(25.15_32.12)	(− 0.05_0.16)	(− 0.03_0.32)
Asia		172,322	13.50	427,874	20.62	0.53	614,843	24.48	0.19	0.81
		(141493_232321)	(11.32_17.93)	(376394_487268)	(18.18_23.44)	(0.22_0.76)	(503410_718099)	(20.09_28.5)	(0.01_0.35)	(0.26_1.2)
Countries by geographical location										
Central Asia		5883	20.09	10,329	25.88	0.29	13,508	28.11	0.09	0.40
		(4960_6546)	(16.97_22.32)	(9845_10861)	(24.63_27.17)	(0.15_0.51)	(11658_15243)	(24.29_31.67)	(− 0.06_0.22)	(0.18_0.68)
East Asia		57,780	10.40	151,030	17.57	0.69	208,240	20.95	0.19	1.01
		(45523_77861)	(8.2_14.01)	(130338_178646)	(15.16_20.77)	(0.23_1.2)	(155766_261728)	(15.82_26.4)	(− 0.11_0.53)	(0.26_1.79)
High-income Asia Pacific		28,848	27.33	51,113	37.24	0.36	53,593	35.82	− 0.04	0.31
		(27369_30162)	(25.98_28.59)	(46813_54033)	(34.62_39.22)	(0.26_0.46)	(43017_64233)	(29.11_42.93)	(− 0.19_0.14)	(0.06_0.57)
West Asia		12,813	11.53	36,642	17.87	0.55	57,721	21.63	0.21	0.88
		(8887_24230)	(8.19_21.32)	(29842_41844)	(14.74_20.23)	(− 0.06_0.98)	(45489_68083)	(17.21_25.45)	(0.01_0.37)	(− 0.06_1.6)
South Asia		35,728	9.81	101,762	15.81	0.61	175,641	21.31	0.35	1.17
		(25653_54951)	(7.23_14.72)	(83739_121096)	(13.03_18.8)	(0.18_1.13)	(132791_220581)	(16.07_26.63)	(0.05_0.64)	(0.3_2.09)
Southeast Asia		35,127	19.16	92,944	30.68	0.60	131,373	36.20	0.18	0.89
		(26908_52879)	(15.08_28.26)	(74387_126908)	(24.6_41.68)	(0.17_0.89)	(100910_180358)	(27.78_49.68)	(− 0.03_0.39)	(0.13_1.4)
Countries by SDI 2019										
High SDI										
Brunei Darussalam	0.82	32	39.70	107	64.02	0.61	147	69.64	0.09	0.75
		(23_47)	(29.24_58.71)	(90_127)	(54.53_74.95)	(0.07_1.25)	(114_186)	(54.22_86)	(− 0.12_0.35)	(0.14_1.51)
Cyprus	0.84	141	33.19	309	43.50	0.31	395	43.10	− 0.01	0.30
		(111_204)	(26.09_47.6)	(252_357)	(35.4_50.24)	(− 0.18_0.75)	(279_503)	(30.29_54.89)	(− 0.24_0.24)	(− 0.29_0.92)
Israel	0.80	1096	45.11	1762	41.11	− 0.09	2156	40.87	− 0.01	− 0.09
		(938_1193)	(38.51_49.09)	(1607_1917)	(37.45_44.79)	(− 0.19_0.13)	(1616_2834)	(30.74_54.13)	(− 0.25_0.31)	(− 0.33_0.25)
Japan	0.87	25,922	31.31	41,545	41.85	0.34	40,892	39.50	− 0.06	0.26
		(24309_27222)	(28.97_32.77)	(38278_44761)	(39.36_44.65)	(0.25_0.5)	(31831_50843)	(30.75_49.44)	(− 0.25_0.18)	(− 0.01_0.63)
Kuwait	0.85	118	26.48	218	23.49	− 0.11	458	24.60	0.05	− 0.07
		(97_153)	(21.73_35)	(191_298)	(20.78_31.26)	(− 0.34_0.32)	(284_707)	(15.72_37.76)	(− 0.28_0.4)	(− 0.41_0.53)
Qatar	0.83	14	21.71	93	42.34	0.95	203	43.72	0.03	1.01
		(9_24)	(13.08_35.59)	(69_126)	(29.9_53.6)	(0.15_2.01)	(132_300)	(29.23_59.85)	(− 0.28_0.36)	(− 0.1_2.46)
Republic of Korea	0.88	2433	11.43	8317	25.30	1.21	11,155	27.80	0.10	1.43
		(2133_3825)	(9.97_18.43)	(6024_9173)	(18.34_27.88)	(− 0.14_1.67)	(6565_14239)	(16.81_35.11)	(− 0.14_0.35)	(− 0.18_2.31)

Table 2 (continued)

Location	SDI 2019	1990		2010		% change 1990 − 2010 (95% CI)	2019		% change 2010 − 2019 (95% CI)	% change 1990 − 2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Saudi Arabia	0.81	303 (195_540)	8.27 (5.46_14.72)	1938 (1605_2484)	21.81 (18.26_28.07)	1.64 (0.53_3.19)	3911 (2694_5507)	27.68 (19.19_39.29)	0.27 (− 0.12_0.67)	2.35 (0.61_4.81)
Singapore	0.86	462 (414_511)	31.39 (28.26_34.65)	1144 (1045_1252)	39.73 (36.32_43.34)	0.27 (0.12_0.44)	1398 (1069_1780)	36.68 (28.04_46.73)	− 0.08 (− 0.29_0.17)	0.17 (− 0.13_0.53)
Taiwan (Province of China)	0.87	2096 (1939_2257)	22.52 (20.97_24.14)	7023 (5731_7626)	46.72 (38.22_50.65)	1.08 (0.6_1.3)	8233 (5941_11009)	48.61 (35.1_65.15)	0.04 (− 0.22_0.38)	1.16 (0.52_1.89)
United Arab Emirates	0.88	66 (36_123)	19.12 (10.24_40.42)	413 (256_613)	29.99 (18.89_59.37)	0.57 (− 0.13_1.57)	880 (526_1565)	34.28 (20.42_61.88)	0.14 (− 0.23_0.52)	0.79 (− 0.19_2.44)
High-middle SDI										
Bahrain	0.75	35 (26_51)	28.62 (21.6_41.85)	132 (102_212)	36.03 (28.44_55.17)	0.26 (− 0.25_1.16)	239 (160_393)	42.12 (28.92_67.93)	0.17 (− 0.11_0.46)	0.47 (− 0.25_1.67)
Georgia	0.70	631 (525_793)	19.16 (16.02_24.24)	923 (672_1050)	34.15 (25.26_38.62)	0.78 (0.15_1.26)	1022 (705_1265)	39.28 (27.78_48.52)	0.15 (− 0.1_0.46)	1.05 (0.23_1.79)
Jordan	0.73	126 (85_201)	12.58 (8.53_20.03)	497 (402_590)	20.29 (16.6_23.96)	0.61 (− 0.08_1.38)	1004 (691_1324)	22.74 (15.86_29.85)	0.12 (− 0.14_0.42)	0.81 (− 0.14_1.86)
Kazakhstan	0.72	2552 (1964_2949)	32.19 (24.73_37.16)	3533 (3266_3817)	39.00 (36.12_42.05)	0.21 (0.03_0.58)	4460 (3555_5358)	42.73 (34.1_51.35)	0.10 (− 0.12_0.33)	0.33 (0.06_0.69)
Lebanon	0.71	336 (234_543)	25.31 (17.7_40.66)	947 (742_1196)	43.11 (33.78_54.36)	0.70 (− 0.07_1.52)	1444 (1001_1936)	51.05 (35.38_68.42)	0.18 (− 0.08_0.49)	1.02 (− 0.05_2.22)
Malaysia	0.74	1184 (892_1834)	18.83 (14.35_28.4)	4541 (3951_5657)	36.34 (31.8_44.42)	0.93 (0.26_1.58)	5675 (4145_7947)	37.28 (27.3_51.75)	0.03 (− 0.23_0.35)	0.98 (0.12_1.91)
Oman	0.78	39 (19_71)	9.54 (4.6_17.43)	183 (155_216)	24.85 (20.14_28.95)	1.60 (0.32_4.62)	329 (199_443)	28.08 (17.92_37.61)	0.13 (− 0.26_0.47)	1.94 (0.09_5.07)
Sri Lanka	0.69	995 (837_1215)	13.56 (11.39_16.8)	2731 (2215_3056)	23.93 (19.4_26.7)	0.76 (0.34_1.14)	3750 (2493_5208)	28.38 (18.9_39.59)	0.19 (− 0.17_0.62)	1.09 (0.39_1.97)
Turkey	0.75	4645 (2579_8698)	20.95 (11.72_38.46)	9522 (6191_11513)	25.06 (16.28_30.2)	0.20 (− 0.35_0.75)	13,189 (8052_17531)	28.10 (17.18_37.34)	0.12 (− 0.16_0.49)	0.34 (− 0.36_1.11)
Middle SDI										
Armenia	0.69	406 (316_593)	25.00 (19.55_36.29)	687 (631_745)	34.40 (31.65_37.6)	0.38 (− 0.04_0.78)	637 (504_794)	31.44 (24.84_39.2)	− 0.09 (− 0.29_0.14)	0.26 (− 0.23_0.79)
Azerbaijan	0.68	463 (336_609)	14.11 (10.18_18.61)	1138 (829_1425)	22.53 (16.65_27.9)	0.60 (0.13_1.14)	1445 (900_2000)	24.18 (15.17_33.27)	0.07 (− 0.23_0.43)	0.71 (0.03_1.48)

Table 2 (continued)

Location	SDI 2019	1990		2010		% change 1990 − 2010 (95% CI)	2019		% change 2010 − 2019 (95% CI)	% change 1990 − 2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
China	0.69	54,169 (42352_72737)	10.11 (7.89_13.71)	140,988 (121049_169062)	16.99 (14.64_20.38)	0.68 (0.2_1.21)	196,349 (145038_250678)	20.44 (15.14_26.18)	0.20 (− 0.12_0.56)	1.02 (0.24_1.85)
Indonesia	0.66	12,646 (8432_24943)	17.22 (11.96_33.34)	34,323 (22415_60847)	29.75 (19.79_53.1)	0.73 (0.17_1.31)	48,631 (29609_88312)	35.59 (21.84_64.75)	0.20 (− 0.17_0.64)	1.07 (0.07_2.02)
Iran (Islamic Republic of)	0.67	1649 (1004_3154)	8.93 (5.76_16.88)	5626 (4087_6206)	15.95 (11.92_17.51)	0.79 (− 0.07_1.55)	8971 (5834_10327)	20.57 (13.65_23.58)	0.29 (0.08_0.45)	1.30 (0.05_2.43)
Iraq	0.67	639 (363_1124)	11.97 (6.73_20.8)	2428 (1688_3270)	19.95 (14.35_26.82)	0.67 (− 0.08_2.12)	4600 (2993_6684)	26.60 (18.41_37.55)	0.33 (− 0.06_0.84)	1.22 (− 0.03_3.61)
Philippines	0.62	7079 (5509_9088)	30.65 (24.07_39.38)	15,776 (13215_18325)	37.87 (32.49_44.37)	0.24 (− 0.04_0.61)	23,244 (16931_31315)	45.22 (33.11_60.79)	0.19 (− 0.12_0.6)	0.48 (− 0.02_1.21)
Syrian Arab Republic	0.62	266 (168_455)	7.07 (4.59_11.49)	982 (711_1255)	13.01 (9.82_16.51)	0.84 (− 0.04_2.08)	1129 (706_1699)	15.15 (9.47_22.98)	0.16 (− 0.2_0.7)	1.14 (− 0.11_3.15)
Thailand	0.69	5617 (4481_7143)	22.34 (17.98_28.09)	13,817 (11433_17221)	32.94 (27.21_40.99)	0.47 (0.1_0.97)	17,248 (11576_26007)	35.58 (23.9_53.42)	0.08 (− 0.25_0.51)	0.59 (− 0.02_1.44)
Turkmenistan	0.67	293 (197_334)	20.12 (14.65_22.82)	528 (428_585)	23.67 (19.99_26.09)	0.18 (0.02_0.4)	628 (436_827)	25.05 (17.44_32.97)	0.06 (− 0.23_0.37)	0.24 (− 0.13_0.73)
Uzbekistan	0.63	827 (453_1025)	10.93 (5.93_13.6)	2122 (1929_2604)	16.96 (15.53_20.01)	0.55 (0.24_1.83)	3326 (2557_4106)	20.98 (16.28_25.72)	0.24 (− 0.05_0.55)	0.92 (0.36_2.14)
Viet Nam	0.62	3622 (2717_4864)	14.16 (10.69_19.01)	11,483 (8906_14403)	25.58 (19.9_32.03)	0.81 (0.29_1.49)	17,803 (12993_23267)	31.62 (23.13_40.9)	0.24 (− 0.04_0.55)	1.23 (0.45_2.2)
Low-middle SDI										
Bangladesh	0.48	2281 (1332_4322)	7.55 (4.46_13.9)	7308 (5114_15385)	13.15 (9.27_27.6)	0.74 (− 0.1_1.62)	12,464 (7708_27414)	16.64 (10.39_36.4)	0.27 (− 0.06_0.62)	1.21 (− 0.09_2.75)
Bhutan	0.46	15 (7_32)	8.75 (4.18_18.77)	50 (29_105)	19.09 (11.15_39.39)	1.18 (− 0.02_2.95)	80 (43_187)	24.82 (13.56_57.31)	0.30 (− 0.05_0.68)	1.84 (0_4.55)
Cambodia	0.47	476 (231_1461)	13.02 (6.62_38.6)	1800 (1112_3200)	27.60 (17.57_48.37)	1.12 (0.15_2.93)	2931 (1851_4986)	36.25 (23.14_61.46)	0.31 (0.02_0.65)	1.78 (0.32_4.25)
Democratic People's Republic of Korea	0.56	1514 (740_3358)	13.87 (6.81_30.74)	3019 (1958_5313)	20.21 (12.94_35.57)	0.46 (− 0.12_1.75)	3658 (2342_5986)	22.40 (14.25_36.35)	0.11 (− 0.16_0.47)	0.61 (− 0.13_2.3)
India	0.57	26,216 (16785_41928)	8.90 (5.85_13.87)	68,627 (54869_87270)	13.32 (10.74_16.84)	0.50 (0.15_1.05)	115,557 (87177_143623)	17.72 (13.39_21.96)	0.33 (0.02_0.7)	0.99 (0.28_1.86)

Table 2 (continued)

Location	SDI 2019	1990		2010		% change 1990 − 2010 (95% CI)	2019		% change 2010 − 2019 (95% CI)	% change 1990 − 2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Kyrgyzstan	0.60	382 (337_429)	20.74 (18.27_23.31)	667 (607_730)	26.43 (24.17_28.79)	0.27 (0.12_0.45)	877 (677_1064)	28.48 (22.13_34.52)	0.08 (− 0.16_0.3)	0.37 (0.05_0.73)
Lao People's Democratic Republic	0.49	213 (101_719)	14.62 (6.98_47.45)	663 (382_1252)	26.66 (16.15_49.27)	0.82 (− 0.07_2.32)	1036 (627_1699)	32.99 (20.6_53.36)	0.24 (− 0.09_0.6)	1.26 (− 0.07_3.42)
Maldives	0.56	16 (8_57)	26.54 (14.03_88.98)	59 (50_73)	43.62 (37.16_53.12)	0.64 (− 0.5_2.15)	90 (69_125)	48.32 (37.37_65.42)	0.11 (− 0.15_0.4)	0.82 (− 0.56_2.79)
Mongolia	0.61	92 (60_179)	13.44 (8.85_25.14)	274 (202_417)	21.39 (16.19_31.25)	0.59 (0.07_1.45)	408 (280_621)	23.47 (16.2_35.25)	0.10 (− 0.22_0.46)	0.75 (0.05_1.76)
Myanmar	0.52	3085 (1792_7785)	19.22 (11.48_46.54)	7216 (4654_11861)	29.37 (19.23_47.41)	0.53 (− 0.11_1.47)	10,234 (6931_14958)	34.79 (23.59_50.73)	0.18 (− 0.15_0.59)	0.81 (− 0.19_2.15)
Palestine	0.59	75 (38_157)	12.13 (6.35_24.71)	223 (162_272)	17.21 (12.76_20.93)	0.42 (− 0.25_1.54)	460 (258_587)	26.20 (15.04_32.87)	0.52 (0.09_1.03)	1.16 (− 0.07_3.34)
Tajikistan	0.54	238 (172_348)	13.70 (9.8_19.59)	457 (362_641)	17.26 (14.21_21.54)	0.26 (− 0.11_0.81)	705 (522_993)	19.06 (14.53_25.17)	0.10 (− 0.16_0.45)	0.39 (− 0.08_1.07)
Timor-Leste	0.51	24 (11_66)	10.28 (4.95_27.35)	60 (27_100)	15.49 (7.38_25.68)	0.51 (− 0.34_1.69)	118 (57_174)	23.33 (12.04_33.82)	0.51 (0.13_1.15)	1.27 (− 0.1_3.54)
Low SDI										
Afghanistan	0.34	330 (116_1933)	7.93 (2.8_45.26)	763 (316_4010)	9.97 (4.13_49.78)	0.26 (− 0.08_0.89)	1333 (647_5222)	12.17 (5.86_47.35)	0.22 (− 0.07_0.73)	0.53 (− 0.01_1.76)
Nepal	0.42	452 (224_902)	7.24 (3.6_14.48)	1586 (1008_3410)	14.61 (9.37_31.3)	1.02 (0_2.5)	2886 (1712_6612)	20.67 (12.48_47.71)	0.41 (0.06_0.8)	1.86 (0.12_4.23)
Pakistan	0.45	6765 (5051_8495)	20.30 (15.41_25.47)	24,190 (15309_34326)	41.43 (26.71_58.07)	1.04 (0.24_2.07)	44,653 (22015_72564)	56.53 (28.62_91.62)	0.36 (− 0.12_1.02)	1.78 (0.25_3.89)
Yemen	0.41	150 (47_691)	4.47 (1.36_19.81)	495 (227_1400)	7.15 (3.23_19.94)	0.60 (− 0.03_2.17)	911 (514_2237)	9.25 (5.4_22.38)	0.29 (− 0.07_1.04)	1.07 (0.06_4.25)

Table 3 The mortality of ovarian cancer in Asian countries in 1990, 2010, and 2019 and the temporal trends between 1990 and 2019, by geographical region and SDI

Location	SDI 2019	1990		2010		% change 1990–2010 (95% CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Global		97,363	4.59	153,456	4.49	− 0.02	198,412	4.56	0.01	− 0.01
		(89703_109761)	(4.24_5.16)	(141768_164591)	(4.15_4.82)	(− 0.09_0.04)	(175357_217665)	(4.03_5)	(− 0.07_0.09)	(− 0.14_0.1)
Asia		27,472	2.55	61,558	3.23	0.27	92,385	3.67	0.14	0.44
		(23711_36343)	(2.2_3.34)	(54176_70375)	(2.84_3.68)	(0.02_0.45)	(76661_108030)	(3.05_4.3)	(− 0.02_0.29)	(0.04_0.76)
Countries by geographical location										
Central Asia		953	3.42	1601	4.59	0.34	2044	4.68	0.02	0.37
		(803_1056)	(2.88_3.78)	(1520_1679)	(4.33_4.82)	(0.2_0.58)	(1768_2287)	(4.04_5.22)	(− 0.1_0.13)	(0.16_0.63)
East Asia		8433	1.78	20,280	2.46	0.38	30,350	2.79	0.13	0.57
		(6502_12138)	(1.38_2.59)	(17275_23727)	(2.1_2.88)	(− 0.04_0.8)	(22124_38066)	(2.05_3.49)	(− 0.14_0.45)	(− 0.07_1.25)
High-income Asia Pacific		4133	3.73	6383	3.57	− 0.04	7341	3.45	− 0.03	− 0.07
		(3913_4418)	(3.53_3.99)	(5579_6820)	(3.25_3.76)	(− 0.12_0.01)	(6205_8064)	(3.03_3.72)	(− 0.1_0.01)	(− 0.2_− 0.01)
West Asia		2291	2.56	5214	3.18	0.24	7825	3.54	0.11	0.38
		(1661_4127)	(1.86_4.47)	(4444_6072)	(2.75_3.68)	(− 0.22_0.59)	(6488_9137)	(2.93_4.17)	(− 0.06_0.25)	(− 0.25_0.89)
South Asia		7328	2.60	19,000	3.54	0.36	32,105	4.40	0.24	0.69
		(5505_10799)	(2.01_3.76)	(16066_22804)	(3_4.27)	(0.01_0.72)	(24894_39896)	(3.39_5.48)	(− 0.02_0.48)	(0.05_1.33)
Southeast Asia		5094	3.45	11,388	4.34	0.26	16,187	4.76	0.10	0.38
		(4105_7253)	(2.83_4.83)	(9477_15742)	(3.61_5.96)	(− 0.04_0.48)	(12722_22681)	(3.75_6.64)	(− 0.08_0.27)	(− 0.1_0.72)
Countries by SDI 2019										
High SDI										
Brunei Darussalam	0.823	4	7.86	12	9.75	0.24	17	10.08	0.03	0.28
		(3_7)	(6.03_11.52)	(10_14)	(8.21_11.38)	(− 0.16_0.66)	(13_20)	(8.03_11.89)	(− 0.11_0.22)	(− 0.18_0.77)
Cyprus	0.841	28	6.46	48	6.36	− 0.01	65	6.39	0.00	− 0.01
		(21_40)	(4.95_9.49)	(38_55)	(5.1_7.22)	(− 0.4_0.35)	(46_80)	(4.62_7.93)	(− 0.2_0.2)	(− 0.49_0.48)
Israel	0.803	209	8.18	305	6.40	− 0.22	376	6.13	− 0.04	− 0.25
		(177_225)	(6.94_8.79)	(280_325)	(5.92_6.81)	(− 0.28_− 0.04)	(328_423)	(5.4_6.88)	(− 0.14_0.07)	(− 0.34_− 0.09)
Japan	0.87	3723	4.08	5301	3.84	− 0.06	5791	3.68	− 0.04	− 0.10
		(3525_3850)	(3.86_4.22)	(4603_5729)	(3.49_4.07)	(− 0.11_0)	(4858_6400)	(3.27_3.97)	(− 0.11_0)	(− 0.19_ − 0.03)
Kuwait	0.851	12	4.67	23	3.95	− 0.15	43	3.69	− 0.07	− 0.21
		(10_16)	(3.8_6.47)	(20_30)	(3.49_5.01)	(− 0.4_0.26)	(27_63)	(2.48_5.29)	(− 0.34_0.23)	(− 0.5_0.27)
Qatar	0.83	2	5.33	10	8.88	0.67	20	8.19	− 0.08	0.54
		(1_3)	(2.93_8.17)	(7_12)	(4.97_11.4)	(0.03_1.71)	(12_27)	(5.07_11.28)	(− 0.36_0.21)	(− 0.21_1.58)
Republic of Korea	0.878	341	1.88	942	2.72	0.45	1370	2.91	0.07	0.55
		(291_600)	(1.58_3.38)	(681_1027)	(1.98_2.97)	(− 0.49_0.8)	(823_1608)	(1.76_3.39)	(− 0.08_0.21)	(− 0.55_1.04)

Table 3 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010 (95% CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Saudi Arabia	0.805	58 (37_106)	2.15 (1.37_4.02)	205 (174_265)	3.63 (3.08_4.83)	0.69 (− 0.06_1.74)	351 (243_497)	3.91 (2.71_5.82)	0.08 (− 0.24_0.39)	0.82 (− 0.15_2.24)
Singapore	0.861	65 (60_71)	5.14 (4.69_5.59)	128 (118_138)	4.72 (4.3_5.08)	− 0.08 (− 0.17_0.02)	163 (140_185)	4.06 (3.5_4.6)	− 0.14 (− 0.24_ − 0.05)	− 0.21 (− 0.32_ − 0.09)
Taiwan (Province of China)	0.868	208 (196_220)	2.63 (2.47_2.79)	594 (475_640)	3.82 (3.06_4.1)	0.45 (0.07_0.59)	774 (567_1022)	3.84 (2.81_5.07)	0.01 (− 0.23_0.31)	0.46 (0.04_0.94)
United Arab Emirates	0.88	7 (4_16)	3.94 (2_9.03)	35 (22_61)	6.04 (3.47_15.28)	0.53 (− 0.1_1.6)	82 (49_155)	5.67 (3.05_10.64)	− 0.06 (− 0.47_0.34)	0.44 (− 0.36_1.75)
High-middle SDI										
Bahrain	0.751	6 (4_8)	7.20 (4.99_10.49)	15 (12_23)	7.36 (6.08_9.82)	0.02 (− 0.35_0.69)	29 (20_44)	7.79 (5.71_10.87)	0.06 (− 0.18_0.31)	0.08 (− 0.41_0.87)
Georgia	0.702	105 (89_132)	2.90 (2.46_3.61)	179 (127_201)	5.55 (3.98_6.27)	0.91 (0.21_1.38)	210 (135_259)	6.52 (4.27_8.02)	0.17 (− 0.09_0.47)	1.25 (0.25_1.98)
Jordan	0.731	105 (13_31)	2.72 (1.82_4.2)	61 (50_73)	3.50 (2.87_4.18)	0.29 (− 0.26_0.85)	118 (85_154)	3.57 (2.59_4.62)	0.02 (− 0.21_0.3)	0.32 (− 0.34_1.09)
Kazakhstan	0.723	105 (328_474)	5.27 (4.22_6.06)	566 (531_603)	6.52 (6.1_6.94)	0.24 (0.06_0.56)	668 (552_799)	6.40 (5.27_7.64)	− 0.02 (− 0.2_0.16)	0.22 (− 0.01_0.52)
Lebanon	0.708	105 (43_91)	5.10 (3.64_7.69)	152 (117_195)	6.95 (5.34_8.92)	0.36 (− 0.26_1.02)	214 (145_285)	7.50 (5.1_10.02)	0.08 (− 0.15_0.33)	0.47 (− 0.31_1.31)
Malaysia	0.737	105 (136_252)	3.45 (2.71_4.92)	520 (454_599)	5.03 (4.37_5.75)	0.46 (0_0.89)	656 (493_880)	4.77 (3.58_6.3)	− 0.05 (− 0.27_0.21)	0.38 (− 0.17_1.02)
Oman	0.783	105 (3_12)	2.09 (0.98_3.73)	21 (17_25)	4.34 (3.3_5.18)	1.08 (0.08_3.69)	36 (23_47)	4.59 (3.06_6.02)	0.06 (− 0.26_0.35)	1.20 (− 0.14_3.51)
Sri Lanka	0.69	105 (103_161)	2.11 (1.74_2.77)	329 (260_364)	3.05 (2.4_3.36)	0.45 (0.05_0.78)	451 (306_618)	3.21 (2.19_4.38)	0.05 (− 0.24_0.39)	0.52 (− 0.01_1.15)
Turkey	0.748	105 (532_1629)	4.79 (2.78_8.35)	1519 (1020_1811)	4.21 (2.84_5.03)	− 0.12 (− 0.48_0.27)	2067 (1280_2693)	4.42 (2.74_5.74)	0.05 (− 0.2_0.34)	− 0.08 (− 0.53_0.43)
Middle SDI										
Armenia	0.689	71 (55_98)	4.57 (3.6_6.24)	127 (116_136)	5.96 (5.48_6.38)	0.30 (− 0.04_0.67)	121 (98_147)	5.25 (4.22_6.35)	− 0.12 (− 0.29_0.08)	0.15 (− 0.24_0.58)
Azerbaijan	0.683	69 (47_93)	2.27 (1.56_3.05)	155 (119_191)	3.53 (2.77_4.34)	0.55 (0.16_1.14)	201 (131_274)	3.55 (2.33_4.79)	0.01 (− 0.25_0.32)	0.56 (0.05_1.28)

Table 3 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010 (95% CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
China	0.686	8035 (6182_11673)	1.76 (1.36_2.59)	19,298 (16514_22773)	2.43 (2.07_2.87)	0.38 (− 0.05_0.82)	29,092 (20956_36860)	2.77 (2.01_3.5)	0.14 (− 0.14_0.47)	0.57 (− 0.1_1.28)
Indonesia	0.66	1841 (1371_3407)	3.19 (2.42_5.72)	4289 (2964_7869)	4.49 (3.15_8.27)	0.41 (0.02_0.78)	6115 (3870_11649)	5.08 (3.23_9.66)	0.13 (− 0.16_0.46)	0.59 (− 0.1_1.22)
Iran (Islamic Republic of)	0.67	223 (152_412)	1.62 (1.11_2.96)	699 (559_762)	2.49 (2.04_2.77)	0.54 (− 0.19_1.18)	1148 (818_1302)	3.03 (2.18_3.42)	0.21 (0.02_0.35)	0.87 (− 0.1_1.77)
Iraq	0.671	102 (56_189)	2.38 (1.29_4.6)	290 (210_388)	3.19 (2.3_4.52)	0.34 (− 0.24_1.44)	498 (357_683)	3.75 (2.7_5.28)	0.18 (− 0.12_0.56)	0.57 (− 0.24_2.24)
Philippines	0.623	862 (665_1122)	4.97 (3.83_6.59)	1745 (1511_2242)	5.12 (4.43_6.76)	0.03 (− 0.18_0.35)	2604 (1926_3594)	5.82 (4.3_8.1)	0.14 (− 0.15_0.49)	0.17 (− 0.18_0.77)
Syrian Arab Republic	0.619	38 (25_61)	1.37 (0.87_2.18)	107 (82_136)	2.04 (1.57_2.6)	0.49 (− 0.16_1.51)	147 (95_222)	2.29 (1.5_3.43)	0.12 (− 0.22_0.55)	0.68 (− 0.22_2.22)
Thailand	0.687	751 (609_949)	3.65 (2.97_4.6)	1523 (1266_1929)	3.73 (3.1_4.71)	0.02 (− 0.22_0.34)	2068 (1463_2977)	3.77 (2.66_5.43)	0.01 (− 0.28_0.37)	0.03 (− 0.32_0.53)
Turkmenistan	0.67	36 (30_41)	3.00 (2.49_3.35)	60 (53_65)	3.14 (2.81_3.4)	0.05 (− 0.07_0.26)	74 (53_97)	3.15 (2.25_4.05)	0.00 (− 0.25_0.28)	0.05 (− 0.25_0.41)
Uzbekistan	0.631	125 (62_158)	1.87 (0.92_2.37)	296 (275_330)	3.21 (3_3.45)	0.71 (0.33_2.46)	459 (356_560)	3.73 (2.88_4.49)	0.16 (− 0.1_0.43)	0.99 (0.37_2.55)
Viet Nam	0.617	669 (506_864)	2.86 (2.16_3.71)	1532 (1172_1900)	3.77 (2.86_4.7)	0.32 (− 0.02_0.77)	2291 (1630_2982)	4.26 (3.04_5.54)	0.13 (− 0.1_0.38)	0.49 (0.01_1.06)
Low-middle SDI										
Bangladesh	0.483	471 (280_850)	2.12 (1.25_3.87)	1264 (896_2599)	2.97 (2.1_6.03)	0.40 (− 0.2_1.08)	2193 (1360_4702)	3.40 (2.12_7.2)	0.14 (− 0.14_0.46)	0.61 (− 0.26_1.59)
Bhutan	0.455	3 (2_7)	2.53 (1.23_5.21)	9 (6_20)	4.31 (2.61_9.11)	0.70 (− 0.12_1.8)	14 (8_32)	5.13 (2.97_11.68)	0.19 (− 0.08_0.49)	1.03 (− 0.17_2.67)
Cambodia	0.469	78 (43_221)	2.74 (1.56_7.24)	243 (167_416)	4.46 (3.12_7.47)	0.62 (− 0.06_2.1)	382 (257_644)	5.26 (3.58_8.78)	0.18 (− 0.04_0.43)	0.92 (− 0.03_2.85)
Democratic People's Republic of Korea	0.558	190 (95_392)	1.84 (0.92_3.73)	388 (262_681)	2.50 (1.69_4.36)	0.36 (− 0.14_1.55)	484 (329_762)	2.67 (1.81_4.23)	0.07 (− 0.16_0.36)	0.45 (− 0.18_1.92)
India	0.566	5335 (3587_8281)	2.35 (1.62_3.58)	13,267 (10784_16608)	3.02 (2.47_3.74)	0.29 (0_0.7)	22,350 (16820_28024)	3.78 (2.87_4.71)	0.25 (− 0.03_0.54)	0.61 (0.07_1.29)

Table 3 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010 (95% CI)	2019		% change 2010–2019 (95% CI)	% change 1990–2019 (95% CI)
		Number (95% CI)	ASR per 10^5 (95% CI)	Number (95% CI)	ASR per 10^5 (95% CI)		Number (95% CI)	ASR per 10^5 (95% CI)		
Kyrgyzstan	0.596	70	3.88	99	4.61	0.19	131	4.74	0.03	0.22
		(61_78)	(3.36_4.35)	(90_107)	(4.14_4.97)	(0.04_0.36)	(102_157)	(3.67_5.69)	(− 0.18_0.24)	(− 0.04_0.54)
Lao People's Democratic Republic	0.49	39	3.26	89	4.58	0.40	130	5.15	0.12	0.58
		(20_117)	(1.66_9.43)	(58_155)	(3.08_7.78)	(− 0.24_1.54)	(86_206)	(3.5_8.11)	(− 0.12_0.4)	(− 0.27_1.96)
Maldives	0.562	2	5.29	5	5.49	0.04	8	5.60	0.02	0.06
		(1_7)	(2.94_15.65)	(5_6)	(4.64_6.44)	(− 0.63_0.84)	(6_11)	(4.43_7.08)	(− 0.2_0.27)	(− 0.68_1.04)
Mongolia	0.606	17	2.84	41	4.27	0.51	63	4.37	0.02	0.54
		(11_30)	(1.89_4.99)	(32_57)	(3.43_5.59)	(− 0.08_1.35)	(45_88)	(3.16_5.92)	(− 0.25_0.33)	(− 0.11_1.48)
Myanmar	0.521	527	4.00	1050	4.95	0.24	1392	5.13	0.04	0.28
		(334_1181)	(2.51_8.69)	(720_1549)	(3.45_7.15)	(− 0.24_1.01)	(994_1935)	(3.66_7.08)	(− 0.2_0.29)	(− 0.37_1.14)
Palestine	0.588	12	2.45	32	3.32	0.35	59	4.57	0.38	0.86
		(7_24)	(1.32_4.77)	(24_38)	(2.53_4.05)	(− 0.26_1.4)	(34_74)	(2.68_5.84)	(0_0.84)	(− 0.16_2.75)
Tajikistan	0.539	48	3.08	78	4.00	0.30	117	4.22	0.06	0.37
		(30_66)	(1.91_4.24)	(64_96)	(2.93_5.01)	(− 0.08_1.1)	(90_148)	(3.06_5.37)	(− 0.18_0.37)	(− 0.05_1.13)
Timor-Leste	0.514	4	2.33	9	2.77	0.19	15	3.61	0.30	0.55
		(2_10)	(1.17_5.78)	(5_15)	(1.61_4.51)	(− 0.32_0.95)	(10_22)	(2.33_5.2)	(− 0.01_0.8)	(− 0.21_1.89)
Low SDI										
Afghanistan	0.343	79	2.13	139	2.48	0.16	218	2.83	0.15	0.33
		(29_416)	(0.81_10.84)	(58_672)	(1.05_11.05)	(− 0.15_0.72)	(105_849)	(1.39_10.11)	(− 0.12_0.6)	(− 0.14_1.28)
Nepal	0.422	99	2.04	311	3.51	0.72	546	4.60	0.31	1.25
		(50_196)	(1.01_4)	(202_667)	(2.31_7.57)	(− 0.06_1.98)	(333_1227)	(2.83_10.29)	(0.02_0.64)	(0.02_3.14)
Pakistan	0.449	1420	5.17	4148	9.44	0.82	7002	11.84	0.25	1.29
		(1104_1762)	(3.99_6.63)	(2757_5713)	(6.41_13.01)	(0.1_1.73)	(3672_11477)	(6.25_19.32)	(− 0.16_0.74)	(0.08_3.09)
Yemen	0.412	31	1.14	81	1.56	0.37	144	1.94	0.25	0.71
		(9_128)	(0.31_4.51)	(37_219)	(0.68_4)	(− 0.14_1.63)	(85_336)	(1.14_4.29)	(− 0.08_0.9)	(− 0.08_3.28)

Table 4 The DALY of ovarian cancer in Asian countries in 1990, 2010, and 2019 and the temporal trends between 1990 and 2019, by geographical region and SDI

Location	SDI 2019	1990		2010		% change 1990–2010(95% CI)	2019		% change 2010–2019(95% CI)	% change 1990–2019(95% CI)
		Number(95% CI)	ASR per 10^5(95% CI)	Number(95% CI)	ASR per 10^5(95% CI)		Number(95% CI)	ASR per 10^5(95% CI)		
Global		2,732,666 (2493732_3165170)	124.09 (113.68_142.97)	4,204,876 (3884973_4545902)	121.20 (112.1_130.93)	− 0.02 (− 0.11_0.06)	5,359,737 (4692949_5954993)	124.68 (109.13_138.67)	0.03 (− 0.06_0.11)	0.00 (− 0.15_0.13)
Asia		899,014 (757552_1221171)	75.45 (64.57_100.96)	1,896,381 (1659596_2165495)	94.12 (82.55_107.42)	0.25 (− 0.01_0.44)	2,730,014 (2239232_3219963)	107.20 (88.04_126.71)	0.14 (− 0.03_0.29)	0.42 (0_0.74)
Countries by geographical location										
Central Asia		30,232 (25688_33516)	106.38 (90.39_117.89)	51,437 (49176_53859)	137.08 (130.78_143.56)	0.29 (0.16_0.51)	64,750 (56175_72871)	138.41 (119.88_155.6)	0.01 (− 0.12_0.13)	0.30 (0.1_0.56)
East Asia		288,347 (222940_393416)	56.07 (43.42_77.85)	625,405 (534488_729798)	73.03 (62.49_85.18)	0.30 (− 0.07_0.69)	871,645 (645106_1098317)	81.21 (60.66_102.31)	0.11 (− 0.16_0.42)	0.45 (− 0.11_1.06)
High-income Asia Pacific		122,455 (117885_129485)	112.95 (108.81_119.08)	158,742 (146007_166359)	106.56 (99.17_110.83)	− 0.06 (− 0.13_ − 0.01)	167,714 (147322_181069)	101.18 (89.47_107.95)	− 0.05 (− 0.11_0)	− 0.10 (− 0.22_ − 0.04)
West Asia		73,601 (52486_138533)	73.08 (52.72_134.44)	164,656 (136613_195335)	89.41 (75.5_104.44)	0.22 (− 0.24_0.57)	243,815 (198307_284283)	98.96 (80.8_115.45)	0.11 (− 0.06_0.25)	0.35 (− 0.28_0.88)
South Asia		240,840 (175112_367236)	72.96 (54.54_107.75)	600,648 (495098_712102)	100.73 (83.96_120.24)	0.38 (0.01_0.78)	982,473 (748576_1238008)	125.29 (95.91_157.33)	0.24 (− 0.03_0.5)	0.72 (0.05_1.4)
Southeast Asia		174,387 (136906_257864)	105.20 (84.05_152.22)	377,549 (308892_529499)	131.96 (108.83_184.4)	0.25 (− 0.07_0.48)	517,385 (404021_726116)	144.22 (112.72_201.78)	0.09 (− 0.09_0.28)	0.37 (− 0.15_0.73)
Countries by SDI 2019										
High SDI										
Brunei Darussalam	0.82	154 (112_239)	227.10 (169.45_342.41)	402 (343_478)	271.20 (231.6_319.53)	0.19 (− 0.2_0.63)	562 (440_689)	281.99 (224.57_338.62)	0.04 (− 0.12_0.25)	0.24 (− 0.23_0.74)
Cyprus	0.84	707 (546_1036)	163.91 (127.29_238.45)	1158 (944_1326)	157.03 (128.71_179.78)	− 0.04 (− 0.41_0.28)	1508 (1105_1853)	155.73 (113.86_191.91)	− 0.01 (− 0.2_0.19)	− 0.05 (− 0.49_0.38)
Israel	0.80	5308 (4457_5694)	214.56 (179.83_230.16)	7222 (6723_7766)	161.54 (150.09_173.55)	− 0.25 (− 0.31_ − 0.05)	8646 (7645_9714)	153.74 (135.53_172.55)	− 0.05 (− 0.15_0.06)	− 0.28 (− 0.37_ − 0.1)
Japan	0.87	108,566 (103437_112022)	124.93 (118.96_128.84)	128,009 (117747_136681)	116.84 (110.32_122.79)	− 0.06 (− 0.1_0.02)	127,087 (112556_137754)	109.88 (99.4_118.26)	− 0.06 (− 0.13_ − 0.01)	− 0.12 (− 0.21_ − 0.03)
Kuwait	0.85	429 (354_566)	127.16 (103.45_173.51)	734 (651_986)	101.44 (90.09_130.92)	− 0.20 (− 0.42_0.19)	1430 (897_2178)	95.13 (61.67_138.78)	− 0.06 (− 0.35_0.25)	− 0.25 (− 0.53_0.22)
Qatar	0.83	70 (45_118)	137.77 (78.74_219.12)	331 (246_422)	209.26 (131.14_266.29)	0.52 (− 0.08_1.38)	673 (430_936)	195.62 (129.16_269.17)	− 0.07 (− 0.35_0.24)	0.42 (− 0.32_1.41)
Republic of Korea	0.88	11,651 (10139_19198)	57.93 (50.13_98.12)	26,611 (19119_28921)	77.69 (55.83_84.47)	0.34 (− 0.52_0.62)	35,587 (20988_41442)	81.44 (49.33_94.55)	0.05 (− 0.1_0.19)	0.41 (− 0.57_0.82)
Saudi Arabia	0.81	1952 (1257_3484)	61.79 (39.64_112.76)	7331 (6146_9452)	102.82 (87.68_134.11)	0.66 (− 0.1_1.68)	13,042 (9054_18662)	113.26 (78.26_163.22)	0.10 (− 0.23_0.43)	0.83 (− 0.15_2.23)
Singapore	0.86	2084 (1908_2270)	149.75 (136.93_162.8)	3720 (3452_4019)	130.11 (120.48_140.08)	− 0.13 (− 0.22_ − 0.03)	4478 (3858_5086)	113.09 (97.19_127.97)	− 0.13 (− 0.24_ − 0.03)	− 0.24 (− 0.36_ − 0.12)

Table 4 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010(95% CI)	2019		% change 2010–2019(95% CI)	% change 1990–2019(95% CI)
		Number(95% CI)	ASR per 10^5(95% CI)	Number(95% CI)	ASR per 10^5(95% CI)		Number(95% CI)	ASR per 10^5(95% CI)		
Taiwan (Province of China)	0.87	6885 (6475_7290)	79.90 (75.33_84.65)	17,970 (14490_19311)	115.27 (93.15_123.54)	0.44 (0.08_0.58)	21,942 (15920_29388)	116.53 (84.79_155.66)	0.01 (− 0.24_0.33)	0.46 (0.04_0.96)
United Arab Emirates	0.88	296 (162_584)	114.33 (59.8_252.87)	1469 (961_2358)	162.82 (97.99_366.18)	0.42 (− 0.19_1.35)	3304 (1982_6091)	163.13 (92.88_307.94)	0.00 (− 0.38_0.39)	0.43 (− 0.34_1.69)
High-middle SDI										
Bahrain	0.75	182 (137_265)	180.73 (134.39_266.07)	508 (397_787)	175.27 (140.78_259.22)	− 0.03 (− 0.41_0.66)	920 (624_1467)	187.13 (130.97_284.03)	0.07 (− 0.19_0.33)	0.04 (− 0.46_0.86)
Georgia	0.70	3191 (2678_4035)	91.28 (76.91_115.17)	5004 (3571_5658)	170.17 (121.86_192.45)	0.86 (0.19_1.33)	5668 (3732_7032)	194.48 (133.14_240.54)	0.14 (− 0.11_0.44)	1.13 (0.22_1.84)
Jordan	0.73	647 (443_1026)	76.11 (51.8_121.85)	1986 (1632_2376)	96.34 (79.65_115.47)	0.27 (− 0.27_0.85)	3808 (2685_4991)	98.27 (70.51_127.12)	0.02 (− 0.22_0.31)	0.29 (− 0.35_1.08)
Kazakhstan	0.72	13,047 (10168_15048)	165.83 (128.73_191.19)	17,845 (16687_19044)	199.69 (186.87_213.19)	0.20 (0.04_0.56)	20,673 (16793_24821)	194.88 (157.77_233.18)	− 0.02 (− 0.21_0.17)	0.18 (− 0.05_0.47)
Lebanon	0.71	1829 (1283_2827)	143.66 (101.05_219.93)	4078 (3153_5158)	185.82 (143.53_235.05)	0.29 (− 0.29_0.9)	5709 (3866_7641)	201.49 (136.54_269.47)	0.08 (− 0.16_0.37)	0.40 (− 0.34_1.23)
Malaysia	0.74	5641 (4330_8508)	99.85 (77.5_148.28)	16,694 (14676_19689)	144.32 (127.17_167.61)	0.45 (− 0.04_0.91)	20,093 (14850_27396)	136.79 (101.72_185.2)	− 0.05 (− 0.28_0.23)	0.37 (− 0.22_1.04)
Oman	0.78	205 (99_368)	57.27 (27.22_102.76)	692 (567_808)	117.02 (91.01_137.2)	1.04 (0.05_3.52)	1159 (724_1548)	122.10 (79.79_162.94)	0.04 (− 0.3_0.35)	1.13 (− 0.2_3.37)
Sri Lanka	0.69	4245 (3581_5364)	64.06 (53.44_82.35)	10,001 (8020_11067)	87.96 (70.13_97.21)	0.37 (0.03_0.68)	12,888 (8556_17753)	92.55 (61.7_127.18)	0.05 (− 0.25_0.41)	0.44 (− 0.04_1.06)
Turkey	0.75	28,082 (15827_50877)	134.53 (76.11_242.47)	42,937 (28684_51293)	115.77 (77.4_138.16)	− 0.14 (− 0.52_0.23)	56,538 (35034_74620)	119.59 (74.11_157.64)	0.03 (− 0.22_0.35)	− 0.11 (− 0.56_0.4)
Middle SDI										
Armenia	0.69	2142 (1675_3042)	133.29 (104.58_189.73)	3517 (3252_3767)	169.06 (156.64_181.14)	0.27 (− 0.08_0.63)	3228 (2560_3951)	147.39 (116.49_181.62)	− 0.13 (− 0.31_0.08)	0.11 (− 0.3_0.55)
Azerbaijan	0.68	2342 (1680_3102)	74.61 (53.18_98.62)	5412 (4010_6679)	113.25 (85.98_139.27)	0.52 (0.1_1.04)	6779 (4315_9260)	112.73 (73.44_153.43)	0.00 (− 0.27_0.32)	0.51 (− 0.03_1.16)
China	0.69	275,060 (212261_377972)	55.57 (42.86_77.8)	595,315 (510408_700352)	72.14 (61.91_84.82)	0.30 (− 0.09_0.71)	835,056 (612557_1063247)	80.52 (59.44_102.57)	0.12 (− 0.16_0.44)	0.45 (− 0.12_1.08)
Indonesia	0.66	65,692 (47198_124857)	99.47 (73.46_186.27)	147,218 (99950_267417)	137.73 (94.96_252.1)	0.38 (− 0.04_0.78)	202,839 (127003_381129)	153.67 (96.98_289.01)	0.12 (− 0.19_0.49)	0.54 (− 0.18_1.19)
Iran (Islamic Republic of)	0.67	7744 (5050_14528)	48.10 (32.43_89.74)	22,564 (17142_24444)	71.82 (55.76_77.78)	0.49 (− 0.22_1.1)	35,213 (24068_40121)	85.35 (59.48_96.96)	0.19 (0_0.31)	0.77 (− 0.16_1.61)
Iraq	0.67	3454 (1956_6028)	72.79 (40.48_129.19)	10,331 (7491_13855)	98.33 (71.19_131.62)	0.35 (− 0.24_1.54)	17,602 (12223_24826)	115.76 (82.3_160.09)	0.18 (− 0.14_0.59)	0.59 (− 0.28_2.35)
Philippines	0.62	30,877 (24260_39020)	153.01 (118.28_197.59)	61,353 (53211_75399)	161.43 (140.85_202.13)	0.06 (− 0.17_0.39)	88,930 (65579_119141)	183.67 (135.69_247.3)	0.14 (− 0.16_0.51)	0.20 (− 0.18_0.8)
Syrian Arab Republic	0.62	1348 (878_2201)	41.26 (26.72_66.85)	3743 (2825_4744)	59.05 (45.37_75.49)	0.43 (− 0.23_1.35)	4760 (3039_7205)	66.46 (42.73_100.2)	0.13 (− 0.22_0.6)	0.61 (− 0.3_2.09)

Table 4 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010(95% CI)	2019		% change 2010–2019(95% CI)	% change 1990–2019(95% CI)
		Number(95% CI)	ASR per 10^5(95% CI)	Number(95% CI)	ASR per 10^5(95% CI)		Number(95% CI)	ASR per 10^5(95% CI)		
Thailand	0.69	25,173 (20454_31774)	109.55 (88.87_138.24)	47,563 (39234_59981)	112.35 (93.32_141.38)	0.03 (− 0.23_0.36)	59,805 (41070_88579)	113.06 (77.72_167.53)	0.01 (− 0.29_0.39)	0.03 (− 0.35_0.56)
Turkmenistan	0.67	1338 (1023_1503)	102.39 (81.97_114.59)	2299 (2011_2495)	110.26 (98.04_119.12)	0.08 (− 0.05_0.29)	2691 (1898_3497)	108.64 (76.44_140.91)	− 0.01 (− 0.26_0.27)	0.06 (− 0.25_0.46)
Uzbekistan	0.63	4083 (2143_5168)	58.26 (30.5_73.48)	10,137 (9352_11939)	92.15 (85.7_103.16)	0.58 (0.25_1.98)	15,532 (11987_19026)	106.86 (82.85_130.01)	0.16 (− 0.11_0.43)	0.83 (0.28_2.07)
Viet Nam	0.62	19,644 (14865_26289)	81.24 (60.86_107.94)	46,400 (35344_58117)	108.60 (82.71_136.71)	0.34 (− 0.04_0.81)	67,812 (48461_89349)	120.98 (87.95_158.83)	0.11 (− 0.13_0.39)	0.49 (− 0.02_1.16)
Low-middle SDI										
Bangladesh	0.48	15,508 (9140_28619)	58.84 (34.8_107.42)	41,009 (29096_84820)	82.99 (58.8_169.86)	0.41 (− 0.23_1.11)	66,485 (41904_145576)	94.54 (59.81_204.47)	0.14 (− 0.16_0.47)	0.61 (− 0.32_1.69)
Bhutan	0.46	105 (50_225)	69.55 (34.39_147.95)	281 (166_584)	117.15 (69.24_243.69)	0.68 (− 0.19_1.95)	419 (234_946)	138.97 (78.91_310.78)	0.19 (− 0.11_0.49)	1.00 (− 0.23_2.8)
Cambodia	0.47	2774 (1438_8309)	85.14 (45.75_243.69)	8257 (5446_14476)	137.17 (92.46_239.6)	0.61 (− 0.11_2.03)	12,508 (8109_21122)	161.44 (105.12_271.4)	0.18 (− 0.06_0.46)	0.90 (− 0.09_2.67)
Democratic People's Republic of Korea	0.56	6402 (3115_13618)	59.11 (29.11_125.76)	12,120 (8057_21551)	79.11 (52.11_140.83)	0.34 (− 0.18_1.54)	14,647 (9589_23982)	84.13 (54.97_137.26)	0.06 (− 0.18_0.38)	0.42 (− 0.22_1.9)
India	0.57	175,429 (115375_277756)	65.61 (43.99_102.19)	406,932 (328465_523898)	84.36 (68.32_107.45)	0.29 (− 0.01_0.72)	657,740 (492035_826775)	104.79 (78.66_131.55)	0.24 (− 0.05_0.54)	0.60 (0.06_1.28)
Kyrgyzstan	0.60	2127 (1869_2382)	118.23 (103.51_132.13)	3285 (2983_3567)	141.44 (127.67_153.42)	0.20 (0.05_0.36)	4228 (3268_5081)	143.34 (111.3_171.99)	0.01 (− 0.2_0.23)	0.21 (− 0.05_0.53)
Lao People's Democratic Republic	0.49	1368 (668_4368)	102.34 (50.23_311.35)	3151 (1948_5685)	142.97 (91.27_253.14)	0.40 (− 0.27_1.55)	4551 (2887_7336)	159.72 (104_255.47)	0.12 (− 0.15_0.43)	0.56 (− 0.32_2.04)
Maldives	0.56	80 (42_266)	152.30 (82.39_482.03)	179 (153_218)	154.80 (132.79_186.66)	0.02 (− 0.67_0.88)	262 (202_353)	156.83 (121.84_206.3)	0.01 (− 0.21_0.27)	0.03 (− 0.73_1.08)
Mongolia	0.61	558 (368_1043)	88.58 (58.93_162.3)	1441 (1093_2074)	126.90 (98.46_176.45)	0.43 (− 0.08_1.23)	2138 (1501_3097)	130.10 (92.62_185.66)	0.03 (− 0.26_0.35)	0.47 (− 0.12_1.34)
Myanmar	0.52	18,024 (10903_42917)	122.90 (76.46_281.54)	34,674 (23184_52984)	149.94 (101.19_225.32)	0.22 (− 0.26_0.95)	44,905 (31561_63587)	155.71 (109.55_219.58)	0.04 (− 0.22_0.35)	0.27 (− 0.42_1.12)
Palestine	0.59	388 (204_794)	70.21 (37.18_140.47)	998 (743_1209)	91.61 (68.63_111.37)	0.30 (− 0.3_1.33)	1874 (1085_2347)	125.77 (72.88_158.51)	0.37 (− 0.01_0.83)	0.79 (− 0.23_2.62)
Tajikistan	0.54	1403 (973_1962)	86.19 (58.81_118.98)	2497 (2053_3202)	109.31 (89.61_134.74)	0.27 (− 0.1_0.87)	3814 (2896_5076)	115.77 (89.68_145.66)	0.06 (− 0.18_0.38)	0.34 (− 0.09_1.03)
Timor-Leste	0.51	142 (68_380)	70.00 (34.29_180.73)	295 (153_496)	81.85 (43.56_135.71)	0.17 (− 0.42_0.99)	510 (290_740)	110.34 (65.56_160.1)	0.35 (0.01_0.87)	0.58 (− 0.27_2.03)
Low SDI										
Afghanistan	0.34	2613 (942_14789)	65.33 (23.67_363.61)	4933 (2051_25360)	75.10 (30.92_366.92)	0.15 (− 0.16_0.75)	7970 (3863_32130)	85.31 (41.23_327.36)	0.14 (− 0.13_0.62)	0.31 (− 0.16_1.32)

Table 4 (continued)

Location	SDI 2019	1990		2010		% change 1990–2010(95% CI)	2019		% change 2010–2019(95% CI)	% change 1990–2019(95% CI)
		Number(95% CI)	ASR per 10^5(95% CI)	Number(95% CI)	ASR per 10^5(95% CI)		Number(95% CI)	ASR per 10^5(95% CI)		
Nepal	0.42	3260	57.71	9594	96.58	0.67	16,425	126.00	0.30	1.18
		(1665_6554)	(29.25_114.93)	(6240_20489)	(62.1_206.16)	(− 0.14_1.85)	(9944_37176)	(76.28_283.86)	(− 0.02_0.64)	(− 0.06_2.93)
Pakistan	0.45	46,538	152.04	142,832	278.17	0.83	241,404	348.37	0.25	1.29
		(35377_57205)	(117.63_188.06)	(93099_197498)	(185.46_383.98)	(0.09_1.76)	(122744_390862)	(182.72_562.44)	(− 0.17_0.77)	(0.07_3.1)
Yemen	0.41	1014	33.33	2730	45.26	0.36	4862	56.53	0.25	0.70
		(302_4516)	(9.77_140.5)	(1252_7638)	(20.42_123.98)	(− 0.16_1.7)	(2837_11815)	(33.39_132.86)	(− 0.09_0.92)	(− 0.12_3.32)

status that can affect the incidence of this disease [24]. Changes in nutritional patterns, low fertility rates, and reduced use of oral contraceptives are responsible for the increase in the incidence of this cancer in East Asia [25]. Overall, the evidence suggests that reproductive hormone exposure plays an important role in the pathogenesis of ovarian cancer [26]. Unfortunately, there is limited information on the trends in major known risk factors for ovarian cancer other than the fertility rate in Asian countries [27].

Geographical differences in mortality rate are also due to the biology of cancer, access to treatment, and especially, surgery and co-morbidities [28]. Tracking the risk factors of ovarian cancer can lead researchers to a better understanding of differences in the occurrence of this cancer.

The survival rate in type I epithelial ovarian tumors is higher than other types and in Asian countries, epithelial tumors are more prevalent than other types, therefore, the higher survival rate of ovarian cancer in Asia my related to the common type of ovarian cancer [29]. Ovarian cancer is predominantly the disease of elderly women [9, 30]. More than half of all OC occur in women older than 65 years; peaking during the 7th decade of life, and remaining elevated until the age of 80 years [30]. Therefore it is expected that the changes in the composition of the population in the countries would affect the epidemiology of this disease [9]. According to the statistics of the World Health Organization in 2012, the increase in the aging population increases the incidence of cancer by 2025 [23]. As a result of increasing life expectancy, cancer incidence in the older population is on the rise [30].

The strongest risk factor for ovarian cancer is a family history of ovarian or breast cancer. Genetic mutations can be seen in a quarter of people with ovarian cancer [31]. In people who are genetically susceptible to this disease, ovarian cancer is detected 10 years earlier than the average age of the population. Also, racial differences can play a role in this cancer along with the changes in menopause age [32, 33]. On the other hand, since menopause symptoms, lifestyle, and behavior during and after menopause transition are not the same in different races and ethnicities, it can be expected to play a role in the occurrence of this disease [33]. Also, there is heterogeneity in the relationship between reproductive, hormonal, and lifestyle factors, and ovarian cancer in different races. For example, parity exerts greater protection against ovarian cancer in Asian women [34].

Hormone replacement therapy (HRT) after menopause is one of the risk factors for ovarian cancer, but racial differences play a role in its use and impact [35]. The

experience of menopause symptoms also plays a role in the use of hormone therapy. Some Asian women pay little attention to menopause symptoms, which can justify the lower use of hormone therapy in the countries where these women live. By announcing the statistics of 6.7% for HRT use, China confirms this finding and refers to the lack of awareness and poor understanding of the symptoms as the reasons for low HRT use in China [36].

Researchers believe that nutrition and changes in eating habits, a decrease in physical activity and obesity, delay in pregnancy, as well as a decrease in breastfeeding, explain the high incidence of age-standardized rate in Pakistan. Delay in diagnosis is also the cause of most ovarian cancer-related deaths in Pakistan [37]. China, which is experiencing an upward trend of ovarian cancer, refers to the low age of menarche, the higher age of menopause, and the small number of pregnancies due to the one-child policy as some of the reasons for this increase [38]. On the other hand, family planning policies in this country have caused delays in marriage and also childbearing at an older age, which partly justifies this increase [36]. The meat-centered diet in some regions of China and the increase in calorie intake has contributed to the changes in disease statistics in China [38].

According to the results of ASR studies, this rate has a direct relationship with the human development index. Brunei Darussalam is classified as a very high-development country with an HDI of 0.838, thus it had the highest ASR in 2019 [39]. Asia is very heterogeneous, and although high-income countries such as Israel, Kuwait, Qatar, the Republic of Korea, Singapore and the United Arab Emirates have well-developed health services, the vast majority of the population living in many low- and middle-income Asian countries (LMICs) have extremely limited services and the cancer burden is substantial in these countries. Despite the growing burden of cancer, it remains a low priority in healthcare planning and expenditure in most Asian LMICs [40].

Furthermore, the burden of cancer in countries with lower socioeconomic status may be underestimated because these countries frequently lack reliable cancer registries and reporting systems [41].

Despite the advances in surgery and chemotherapy and also the increase in treatment options, the mortality rate of ovarian cancer is still high [42]. The increasing trend of ovarian cancer mortality from 1990 to 2019 can be seen in South and East Asian countries. There are about 16 cases of ovarian cancer per 100,000 women in Northern Europe, 11 cases per 100,000 women in the UK, and 2–3 cases per 100,000 women in Japan [43]. Referral in the final stages of this disease reduces its 5-year survival rate from 92 to 29% [44]. Advances in cancer management in recent decades have increased the survival rate of this cancer [45].

A decrease in the incidence of epithelial ovarian cancer during recent decades is due to the protective effect of oral contraceptive pills (OCPs) [46]. Meanwhile, the ethnic-racial differences are not well clarified. The absence of ovulation, which occurs as a result of pregnancy or the use of oral contraceptive pills, reduces the risk of ovarian cancer [47]. OCP reduces all types of epithelial ovarian cancer, except for mucinous. In countries where ovarian cancer is declining, increased use of oral contraceptive pills had reduced the risk of this cancer by 30–40%. Although oral contraceptives are the most common method of contraception in European countries, their use is lower in East Asia [48]. In general, the use of OCP and other modern methods of family planning in South, Central, and Southeast Asia is lower than the global average [49].

Part of the high mortality rates of ovarian cancer is due to the lack of effective screening options (to detect cancer in the early stages] and the absence of warning signs [50]. Although increasing awareness about the signs and symptoms of this cancer has played a role in help-seeking behaviors, it still has not significantly increased its survival rate [51]. The delay in the referral of ovarian cancer is significant and shows that there is still a need for raising the awareness of high-risk people. Most patients are diagnosed at advanced stages of cancer, and it is unclear how effective screening strategies are in low-risk populations.

Conclusion

While the world is experiencing a decreasing trend in the death rate caused by ovarian cancer, in Asia only High-income Asia Pacific countries are witnessing a decreasing trend, and the rate of increase in incidence and prevalence is also higher in Asia than in the world. Therefore, it seems that improving the awareness of women in the field of ovarian cancer and risk factors related to it, as well as using methods for early diagnosis can reduce the epidemiological indicators of ovarian cancer such as mortality and DALYs in Asia.

Limitation

Because online data are used in this study, the possibility of errors in recorded data is a major limitation of the study. Challenges of quantification of all sources, delays in accessing data, changes in coding practices over time, gaps in reliable cancer reporting, and registration systems in low

SDI countries are some of the most significant limitations of an online database.

Declarations

Conflict of interest The authors declare no conflict of interest.

Supplementary Information

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