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Changing patterns of gynaecological cancer incidence and mortality in Sri Lanka, 2005–2022: a national population-based registry study

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Abstract

Background

Gynaecological cancers are an important public health concern, yet evidence on their epidemiological patterns and temporal trends in Sri Lanka remains limited. This study evaluated trends in incidence and mortality and characterised histological patterns across gynaecological cancer sites.

Methods

This population-based study used Sri Lanka cancer registry data and national mortality data for 2005–2022. Age-standardised incidence (ASIR) and mortality (ASMR) rates were calculated using the World Health Organization world standard population. Joinpoint regression was used to estimate annual and average annual percent changes (APC/AAPC) with 95% confidence intervals. Histological distribution was assessed for the major cancer sites.

Results

A total of 48,603 gynaecological cancer cases were recorded, led by cervical (n = 18,013), ovarian (n = 15,765), and uterine (n = 12,766) cancers. Overall ASIR increased from 18.62 to 29.95 per 100,000, with an AAPC of 3.25% (95% CI: 2.30–4.41; $p < 0.001$). Uterine cancer showed the steepest increase (AAPC 8.21%; 95% CI: 7.01, 10.04; $p < 0.001$), followed by ovarian cancer, whereas cervical cancer incidence remained stable ($p = 0.53$). Vulval, vaginal, and other unspecified female genital cancers also showed significant increases in age-standardised incidence. Uterine cancer accounted for the highest number of deaths (n = 4,115) with a non-significant decline (AAPC − 0.80%). Cumulative risk increased most markedly for corpus uteri cancer, with significant trends in both age groups, and for vaginal cancer among women aged 0–74 years. Histology was predominantly squamous cell carcinoma for cervical cancer (77.8%), while adenomas and adenocarcinomas predominated in uterine corpus cancer (73.1%). Cystic, mucinous, and serous neoplasms were the most common ovarian histological group (44.1%).

Conclusion

Sri Lanka's gynaecological cancer burden is shifting, with a growing contribution from uterine and ovarian cancers alongside a persistent cervical cancer burden, in the context of demographic and metabolic transitions. These findings support strengthening organised cervical cancer screening and sustained human papillomavirus vaccination while expanding diagnostic and treatment capacity for uterine and ovarian cancers.

Background

According to GLOBOCAN 2024, gynaecological cancers such as cervical, corpus uteri, ovarian, vulvar, and vaginal cancers accounted for 604,196, 434,620, 330,731, 48,894, and 18,143 new cases worldwide, with corresponding age-standardised incidence rates (ASIRs) of 12.4, 8.3, 6.5, 0.84, and 0.34 per 100,000 population, respectively. Cervical cancer caused an estimated 279,583 deaths annually with an age-standardized mortality rate (ASMR) of 5.5%, followed by ovarian cancer with 203,850 deaths (ASMR 3.8%) and corpus uteri cancer with 100,680 deaths (ASMR 1.7%). However, approximately half of the global burden of cervical (336,441; 55.7%), ovarian (181,187; 54.8%), and vaginal cancers (9,038; 49.8%) occurs in Asia. Similarly, Asia accounts for a substantial proportion of cancer-related mortality, including 141,639 (50.7%) deaths from cervical cancer, 108,742 (53.3%) from ovarian cancer, and 4,003 (53.5%) from vaginal cancer.

The burden of gynaecological cancers is particularly relevant in South Asia [1], where ageing populations, changing reproductive patterns, persistent HPV-related disease, and lifestyle changes coexist with marked inequalities in cancer prevention and care. The epidemiology of individual cancers varies across the region, reflecting differences in risk-factor profiles, population structure, and healthcare access. Their aetiology is similarly diverse, involving genetic, reproductive, hormonal, infectious, and lifestyle-related factors [2]. Genetic and reproductive or hormonal factors are important in ovarian and uterine cancers, particularly endometrial malignancies, whereas persistent high-risk HPV infection is the principal cause of cervical cancer and contributes to vaginal and vulvar cancers [3]. Modifiable factors such as tobacco and alcohol use, obesity, unhealthy diet, and physical inactivity may further influence risk [4]. Cervical cancer is largely preventable through HPV vaccination and screening, supporting the WHO call for the global elimination [5], whereas effective population-based screening is unavailable for ovarian and uterine cancers and is not considered cost-effective for rare vaginal and vulvar cancers [6]. Understanding the burden and temporal patterns of these cancers is therefore essential for informing appropriately targeted cancer-control strategies in South Asia.

Sri Lanka is undergoing a demographic and epidemiological transition, marked by population ageing and a growing burden of non-communicable diseases, with cancer becoming an increasingly important cause of morbidity and mortality among women [7]. Earlier national evidence from 1995–2010 demonstrated increasing overall cancer incidence and mortality among Sri Lankan women, with uterine cancer incidence rising steadily, cervical cancer incidence declining after 2000, and ovarian cancer incidence remaining largely stable [7]. Subsequent site-specific studies reported an increase in ovarian cancer ASIR from 3.0 to 8.5 per 100,000 between 2005 and 2019 (APC 8.4%) [8] while a study of endometrial and uterine corpus cancers reported annual incidence increases of 8.26% and 9.26%, respectively, between 2011 and 2020 [9]. In contrast, a conference abstract reported a decline in cervical cancer ASIR from 9.81 to 7.98 per 100,000 between 1992 and 2021, despite rising crude incidence rates [10]. A retrospective, non-registry-based study of 12,197 cases from state oncology units during 2013–2018 identified cervical cancer (37.6%) and ovarian cancer (31.8%) as the most common gynaecological cancers, predominantly affecting middle-aged and older women [11].

Despite these findings, evidence on gynaecological cancers in Sri Lanka remains fragmented, with previous studies largely focusing on individual cancer sites, restricted periods, or incidence trends alone. Comprehensive, contemporary population-based evidence on incidence and mortality trends across cervical, uterine corpus, ovarian, vaginal, vulval, and other or unspecified female genital cancers remains limited. Examining these cancers collectively enables comparisons of their temporal trends and changing contributions to the overall gynaecological cancer burden, which cannot be fully captured by site-specific analyses. Therefore, this study provides a comprehensive assessment of national cancer registry data, covering the latest available data up to 2022, to characterise incidence and mortality trends across these cancer sites, address an important evidence gap, and inform national cancer-control priorities in Sri Lanka.

To address these evidence gaps, this study aimed to comprehensively assess the incidence and mortality trends of gynaecological cancers in Sri Lanka from 2005 to 2022, encompassing cervical, uterine corpus, ovarian, vaginal, vulval, and other or unspecified female genital cancers. By examining age-standardised and crude incidence and mortality rates, cumulative risk, temporal trends, and the histological distribution of major gynaecological cancers, the study sought to characterise changes across cancer sites and provide contemporary population-based evidence to inform cancer surveillance, resource allocation, and national strategies for gynaecological cancer prevention and control.

Methods

Study Design and Data Source

This population-based temporal analysis utilised data from the Cancer Incidence and Mortality Database of Sri Lanka (Sri Lanka Cancer Registry), maintained by the National Cancer Control Programme (NCCP), Ministry of Health, Sri Lanka [12]. Cancer incidence data publicly available on the National Cancer Control Programme (NCCP) website cover the period from 2005 to 2022. Cancer-specific mortality data for cervical, uterine and ovarian cancers for 2005–2022 were obtained from Vital Statistics compiled by the Department of Census and Statistics, Sri Lanka [13].

Study Population and Cancer Classification

The study population comprised all women newly diagnosed with gynaecological cancers between 2005 and 2022, as recorded in the Sri Lanka Cancer Registry. Cancers included vulval (C51), vaginal (C52), cervical (C53), uterine (C54-C55), ovarian (C56), and other/unspecified female genital organ malignancies (C57) based on the International Classification of Diseases, 10th revision (ICD-10) as described elsewhere [6]. Histological classifications were based on WHO tumour classification and coded according to the International Classification of Diseases for Oncology (ICD-O). Cases were analysed by cancer site and stratified into three age groups: younger women (< 45 years), middle-aged women (45–64 years), and older women (≥ 65 years). Histological distributions were assessed for

cancer sites and for available study years; therefore, histological proportions were based only on years with available histological data.

Outcome Measures

Outcome Measures
The primary outcome was the temporal trend in incidence and mortality of gynaecological cancers. Incidence and mortality were expressed as age-standardised incidence rates (ASIRs) and age-standardised mortality rates (ASMRs) per 100,000 women using the direct standardisation method and the WHO 2000–2025 world standard population, allowing comparison across years while accounting for changes in population age structure as described previously. Secondary outcomes included crude rate, cancer-site distribution, age-specific incidence trends, cumulative lifetime risk and histological distribution.

Statistical Analysis

Temporal trends in ASIRs and ASMRs were evaluated using the Joinpoint Regression Program (version 6.0.0) as described elsewhere [14]. In brief, log-linear regression models were fitted to annual rates to identify statistically significant changes in trends and to estimate annual percentage change (APC) for each segment. Average annual percentage change (AAPC) was calculated for the entire study period as a weighted average of the segment-specific APCs. Model selection was performed using the permutation test approach, with statistical significance set at $\alpha = 0.05$.

Results

Annual counts and age-standardized incidence rates of gynecological cancers

Between 2005 and 2022, 48,603 gynaecological cancer cases (C51–C57) were recorded in Sri Lanka, with the overall age-standardised incidence rate (ASIR) increasing from 18.62 to 29.95 per 100,000 (AAPC, 3.25%). Cervical cancer made the largest contribution (n = 18,013), followed by ovarian (n = 15,765) and uterine cancers (n = 12,766), while vaginal (n = 838), vulval (n = 754), and other or unspecified female genital organ cancers (n = 557) contributed relatively smaller proportions (Fig. 1). Cervical cancer remained the most frequently reported cancer throughout most of the study period, with relatively stable annual counts and year-to-year fluctuations. In contrast, ovarian and particularly uterine cancers showed clear increases in annual case numbers, with uterine cancer demonstrating the most pronounced rise. The age-standardised incidence rates showed a similar pattern, with cervical, ovarian, and uterine cancer ASIRs of 8.9, 5.9, and 2.48 per 100,000 in 2005, increasing to 8.9, 8.4, and 9.2 per 100,000, respectively, in 2022 (Fig. 1, Supplementary Table 1). This represented a 3.7-fold increase in the ASIR of uterine cancer, compared with a 1.4-fold increase for ovarian cancer, whereas the cervical cancer

ASIR remained relatively stable. Crude incidence rates increased significantly for ovarian, cervical, vulvar, vaginal, uterine, and other female genital cancers between 2005 and 2022. The AAPC was highest for other female genital cancers (13.78%), followed by uterine cancer (10.06%), vaginal cancer (5.72%), vulvar cancer (5.70%), ovarian cancer (3.84%), and cervical cancer (1.72%) (Supplementary Fig. 1). Cervical cancer staging data were available for 2015–2022 (Supplementary Table 2). The proportion of cases without recorded stage was high, increasing from 56.0% in 2015 to 70.0% in 2022 and peaking at 86% in 2021. Among staged cases, stages II and III predominated. The proportion of stage IV disease increased from 2.1% in 2015 to 11.0% in 2021, before declining to 6.0% in 2022 (Supplementary Table 2).

Trends in age-standardized incidence rates of gynecological cancers

The Joinpoint analysis showed a significant overall increase in the incidence of gynecological cancers from 2005 to 2022 (APC 3.25%, 95% CI: 2.30–4.41). Among individual cancer sites, cervical cancer remained the most frequently diagnosed malignancy, but its ASIR remained largely stable (APC 0.28%, 95% CI: -0.62, 1.31) (Fig. 2A). In contrast, uterine cancer showed the steepest and most sustained increase (APC 8.21%, 95% CI: 7.01, 10.04), followed by ovarian cancer (APC 2.69%, 95% CI: 1.51, 4.13), which showed a comparatively modest increase (Fig. 2A). Vaginal cancer (APC 4.15%, 95% CI: 2.36, 6.40) and vulval cancer (APC 3.99%, 95% CI: 1.52, 7.37) also showed significant increases (Fig. 2B). Other and unspecified female genital organ cancers showed the most rapid relative increase, with ASIR rising more than seven-fold from 0.05 to 0.38 per 100,000 (APC 12.94%, 95% CI: 8.80, 21.89). Other reproductive organ cancers increased markedly during 2005–2018 (APC 21.90%, 95% CI: 17.29, 39.66) but showed a non-significant decline thereafter (2018–2022 APC − 11.87%, 95% CI: -38.48, 3.42) (Fig. 2B).

Trends in age-standardized incidence rates by age groups

For age-specific analyses, women were categorized into three age groups: younger women (< 45 years), middle-aged women (45–64 years), and older women (≥ 65 years). In the 0–44-year age group, ovarian cancer had the highest ASIR throughout the study period and showed a significant increasing trend from 2005 to 2022 (APC 2.44%, 95% CI: 0.49, 4.68) (Fig. 3A). Uterine cancer also demonstrated a marked and significant increase (APC 8.61%, 95% CI:7.07, 10.96), although its ASIR remained substantially lower than that of ovarian cancer. Cervical cancer showed a significant decrease from 2005 to 2007 (APC − 15.68%, 95% CI: -23.50, -0.50) and then with a significant increase in 2007 to 2022 (APC 1.53%, 95% CI: 0.50, 5.05) resulting in a modest, non-significant decrease in ASIR (APC − 0.66%, 95% CI: -1.69, 1.06), while vaginal cancer remained relatively stable despite a small positive trend (APC 0.19%, 95% CI: -5.31, 6.20) (Fig. 3A). Overall, ovarian and uterine cancers demonstrated the most notable increasing trends in ASIR in this age group, with uterine cancer showing the steepest increase.

A different pattern was observed among middle-aged women (45–64 years), with significant increases in uterine, ovarian, and other reproductive cancers between 2005 and 2022 (Fig. 3B). Other reproductive

cancers showed the greatest increase (AAPC 10.18%, 95% CI: 5.24, 19.64), followed by uterine cancer (AAPC 5.83%, 95% CI: 4.34, 7.93) and ovarian cancer (AAPC 1.51%, 95% CI: 0.34, 2.89). Incidence of vaginal (AAPC 2.67%, 95% CI: -1.63, 8.71) and vulval cancers (AAPC 2.93%, 95% CI: -0.50, 7.85) increased non-significantly, whereas cervical cancer showed a non-significant decline (AAPC – 0.74%, 95% CI: -1.78, 0.42; p = 0.21) (Fig. 3B).

The oldest age group showed a more pronounced upward trend, with significant increases in uterine, ovarian, vulval, vaginal and cervical cancers among women aged 65 years and above throughout 2005–2022 (Fig. 3C). Uterine cancer showed the steepest sustained increase, with an APC of 11.83% (95% CI: 10.55, 13.97), followed by ovarian cancer (APC 5.15%, 95% CI: 3.99, 6.72), vulval cancer (APC 4.58%, 95% CI: 2.06, 8.20), and cervical cancer (APC 1.87%, 95% CI: 0.78, 3.19). Vaginal cancer demonstrated marked temporal fluctuations, with a significant decline during 2005–2009 (APC – 7.30%, 95% CI: -32.81, 12.06), followed by a sharp increase during 2009–2022 (APC 7.84%, 95% CI: -11.15, 26.99) with a final AAPC of 4.07 (95% CI: 1.47, 8.67). Age-specific trends for other reproductive cancers (C57) could not be assessed because of the small number of cases.

Trends in age-standardised mortality rates

Between 2005 and 2022, ASMR showed a non-significant increase for cervical cancer (AAPC 1.67%, 95% CI: -0.54, 4.16) and modest but a significant increase in ovarian cancer (AAPC 2.25%, 95% CI: 0.48, 4.27), while uterine cancer showed a non-significant decline (AAPC – 0.80%, 95% CI: -1.94, 0.35) (Fig. 4).

Figure 4. Trends in age-standardized mortality rates (ASMRs) for cervical, ovarian, and uterine cancers in Sri Lanka, 2005–2022, with corresponding annual percentage changes (APCs) from Joinpoint regression analysis.

Lifetime Risk of gynaecological cancers (0–64 and 0–74 years)

Between 2012 and 2022, cumulative risks increased for most female genital cancers in both age groups (0–64 and 0–74 years). Corpus uteri cancer showed the most pronounced increase, from 0.29% to 0.45% and from 0.50% to 0.98%, respectively (Supplementary Table 3). Both trends were statistically significant (AAPC = 2.63%, p = 0.041; and AAPC = 5.24%, p = 0.003). Vaginal cancer also showed a significant increasing trend among women aged 0–74 years (AAPC = 4.15%, p = 0.038). Although cumulative risks for cervical and ovarian cancers increased in both age groups, these trends were not statistically significant. No significant trends were observed for other female genital organ cancers or vulvar cancer. Overall, the findings indicate a marked increase in corpus uteri cancer risk, particularly among women aged up to 74 years.

Histology types

Histological subtyping was available for most of the study period; however, data were not recorded across all three sites during 2012–2014, and histological data for uterine corpus cancer were

unavailable before 2011 (Supplementary Table 4). Accordingly, the reported proportions reflect years with available histological data rather than the full cohort. Cervical cancers (n = 14,275) were predominantly squamous cell neoplasms (77.8%), with adenomas and adenocarcinomas accounting for a further 7.0%. Among ovarian cancers (n = 12,606 with histological data), cystic, mucinous, and serous neoplasms were the most common (44.1%), followed by adenomas and adenocarcinomas (23.08%). Among uterine corpus cancers (n = 8,155; 2011 onward), adenomas and adenocarcinomas predominated (73.05%), consistent with the predominance of endometrioid-type histology.

Discussion

This national registry-based study demonstrates a substantial and evolving burden of gynaecological cancers in Sri Lanka between 2005 and 2022. Among 48,603 recorded cases, cervical cancer remained the most frequently diagnosed malignancy, followed by ovarian and uterine cancers. However, the overall ASIR increased significantly by 3.25% annually, with the increase driven predominantly by a more than three-fold rise in uterine cancer ASIR and significant increases in ovarian, vaginal, and vulval cancers. In contrast, cervical cancer incidence remained broadly stable after age standardisation. The increasing burden extended beyond older women, with significant increases in ovarian and uterine cancers among women aged 0–44 years and in uterine, ovarian, and other reproductive cancers among those aged 45–64 years. Among women aged ≥ 65 years, uterine cancer showed the steepest sustained increase, accompanied by significant increases in ovarian, cervical, and vulval cancers. Mortality trends were relatively stable, although ovarian cancer showed a modest but significant increase in ASMR, while cervical cancer showed a non-significant increase and uterine cancer a non-significant decline. Collectively, these findings indicate a shift from a predominantly cervical-cancer burden towards a broader gynaecological cancer profile increasingly characterised by uterine and ovarian malignancies.

The observed epidemiological transition is consistent with broader changes in gynaecological cancer patterns across Asia, where population ageing, demographic and socioeconomic transformation, declining fertility, changing reproductive patterns, and increasing metabolic risk factors are reshaping cancer burden [15,16]. In several Asian populations, cervical cancer is declining or stabilizing while uterine and ovarian cancers are becoming increasingly prominent, particularly with population ageing and increasing exposure to obesity, high BMI, diabetes, and other metabolic factors associated with economic development and westernized lifestyles [17,18]. The particularly pronounced increase in uterine cancer observed in Sri Lanka is consistent with recent findings reporting an annual increase of approximately 8.26% [9], and parallels the rising burden reported in South Korea, where endometrial cancer has overtaken cervical cancer and increased by approximately 4.7% annually [19]. Similar increases have been reported in Taiwan, where cohort effects have been associated with declining fertility and delayed childbirth [20]. Although differences in study periods, population structure, registry methodology, and cancer classification preclude direct comparisons between countries, these findings suggest that the rising uterine cancer burden in Sri Lanka forms part of a wider regional epidemiological transition rather than an isolated national phenomenon.

The rise in uterine cancer across women aged 0–44, 45–64, and ≥ 65 years is consistent with evidence that the increasing endometrial cancer burden extends beyond older women to younger and premenopausal populations. Although registry data cannot establish causality, this age-spanning increase is compatible with increasing exposure to obesity, diabetes, and metabolic syndrome, which are established risk factors for endometrial cancer [21,22]. Higher body mass index and waist-to-hip ratio are strongly associated with endometrial cancer risk, while diabetes has been associated with increased risk in both younger and older women [23,24]. In East Asian populations, metabolic syndrome and its components have similarly been associated with increased endometrial cancer risk, particularly among women with obesity [23]. These metabolic trends are relevant to Sri Lanka, where diabetes crude prevalence among women has increased substantially, reaching 25.5% overall and approximately 43% among those aged 60–69 years [25], while abdominal obesity has been reported in more than half of urban adult women [26]. Reproductive factors may provide an additional pathway, with lower parity consistently associated with increased endometrial cancer risk and evidence of a dose-response relationship whereby risk decreases with increasing number of births [27,28]. The predominance of adenocarcinomas in our uterine corpus cancers is also consistent with the established predominance of epithelial endometrial malignancies, particularly endometrioid adenocarcinoma, although the registry classification does not permit detailed assessment of histological or molecular subtypes [29].

Ovarian cancer was the second most common gynaecological malignancy and showed a significant increase in ASIR over the study period. The increase was evident among women aged 0–44, 45–64, and ≥ 65 years, indicating that the rising burden is not solely attributable to population ageing and is consistent with broader Asian evidence of increasing ovarian cancer incidence associated with demographic and epidemiological change [30–32]. Previous Sri Lankan registry analyses have similarly reported an annual increase of approximately 8.4% during 2005–2019 [8]. Comparable increases have been documented in South Korea and China, at approximately 2.3% and 0.9%, [6,19], while recent regional analyses indicate increasing incidence in several Asian countries, including China, Japan, and South Korea, despite declining trends in Europe and North America [33,34]. The increasing incidence is of particular concern because no population-based screening strategy has been proven to substantially reduce ovarian cancer mortality among average-risk women [35,36]. Although multimodal screening may facilitate earlier detection or stage shift, this has not translated into a definitive mortality benefit [36], underscoring the importance of timely clinical diagnosis and adequate diagnostic and specialist gynaecological oncology services, including access to surgery and systemic treatment. Histologically, cystic, mucinous, and serous neoplasms constituted the largest groups in the registry data. However, direct comparison with contemporary classifications is limited because ovarian carcinomas comprise biologically and molecularly distinct histotypes, including high-grade and low-grade serous, mucinous, endometrioid, and clear cell carcinomas [37]. Serous neoplasms remain the predominant epithelial group, whereas mucinous tumours represent a smaller but diagnostically challenging category, with classification systems evolving over time and limiting comparison between historical registry categories and current WHO-based classifications [34,38].

Cervical cancer remained the leading gynaecological malignancy by number of cases, accounting for 17,132 cases during the study period, but its ASIR remained stable, consistent with Sri Lankan and regional analyses showing that crude rates may increase while age-standardised rates remain stable or decline [10,39,40]. The increase in crude rate from 8.84 to 10.71 per 100,000 therefore appears to reflect, at least in part, demographic change rather than a substantial increase in age-adjusted disease risk, consistent with age-period-cohort evidence from Sri Lanka demonstrating strong age effects and increasing population ageing [10]. This pattern contrasts with South Korea, where cervical cancer incidence declined substantially, with APCs of − 4.56% during 1999–2007 and − 2.82% during 2007–2017, with declines observed across most age groups following implementation of an organised national screening programme [41]. Taiwan provides a further contrast, where nationwide Pap smear screening was followed by substantial reductions in invasive cervical cancer incidence and mortality [42,43]. In Sri Lanka, although screening has been available through Well Woman Clinics since 1996, participation remains incomplete and uneven, with reported barriers including limited knowledge, fear of the procedure, and rural access constraints [44–46]. Cytology-based screening also requires adequate laboratory capacity and trained personnel, which may constrain programme performance [45]. The persistence of late presentation, with nearly half of cases reported as stage II/III, further highlights the challenges of achieving timely detection [39,45–46]. Evidence from organised screening programmes indicates greater reductions in cervical cancer mortality than those achieved through opportunistic approaches, supporting the potential importance of improving population coverage, follow-up, and programme organisation [47]. The age-specific pattern in the present study, with no significant increase among younger women but a significant increase among women aged ≥ 65 years, is consistent with evidence that cervical cancer burden remains concentrated among older women in Sri Lanka [10]. Histologically, the predominance of squamous neoplasms (77.8%) and the smaller proportion of adenomas/adenocarcinomas (7.0%) are broadly consistent with the global predominance of squamous cell carcinoma, although glandular lesions may be less readily detected by cytology-based screening [48]. The absence of an observable population-level decline following HPV vaccine introduction in Sri Lanka should not be interpreted as evidence of vaccine ineffectiveness, as vaccination was introduced only in 2017 and the long natural history from HPV infection to invasive cancer means that measurable reductions in invasive disease require prolonged follow-up [39,49].

The smaller gynaecological cancer categories also merit attention, as although vulval and vaginal cancers are rare, their incidence has increased in several populations [50,51]. In the present study, both vaginal and vulval cancers showed significant overall increases in age-standardised incidence, although age-specific patterns were less consistent. Vaginal cancer among women aged ≥ 65 years showed pronounced temporal fluctuations, which should be interpreted cautiously given the small number of cases, considerable annual variation in rates, and potential differences in ascertainment and classification. Such instability is consistent with the rarity of vaginal cancer, which accounted for approximately 2% of gynaecological neoplasms globally in 2020 [51]. Registry-based comparisons may also be affected by historical grouping within broader categories and potential mutual misclassification of vulval and vaginal cancers [52]. Vulval cancer increased significantly overall and particularly among

older women, consistent with evidence that both cancers occur predominantly at older ages; in China, incidence peaks at approximately 80–84 years for vulval cancer and around 70–80 years for vaginal cancer [53]. Increasing trends for both sites have also been reported in China, although substantial fluctuations and low absolute numbers warrant cautious interpretation [6,53]. Similar patterns have been observed elsewhere, with Korean data showing a significant increase in vulval cancer across age groups but no significant overall change in vaginal cancer incidence [19]. A substantial proportion of vaginal and vulval cancers is attributable to HPV, although the attributable fraction is considerably higher for vaginal than vulval cancer [51,54]. Multicentre data from China reported HPV detection in 76.1% of vaginal and 33.8% of vulval cancers, while global estimates suggest that approximately 8,500 vulval and 12,000 vaginal cancers annually are attributable to HPV [55]. These findings support maintaining high HPV vaccination coverage as part of broader prevention of HPV-associated anogenital malignancies, with vaccination estimated to have the potential to prevent approximately 22.8% of vulval and 60.7% of vaginal cancers globally [54]. Surveillance of these HPV-associated cancers remains important for evaluating the longer-term population impact [55]. The substantial increase in other and unspecified female genital organ cancers should be interpreted cautiously, as low baseline incidence, small numbers, changes in diagnostic specificity, and variation in registry completeness may contribute to apparent temporal changes [50,52].

The mortality findings provide a more nuanced picture of the changing burden. Despite substantial increases in incidence ASMR did not rise in parallel, with several population-based analyses reporting stable or declining ASMRs despite increasing case numbers or incidence [56]. In the present study, only ovarian cancers showed modest but a statistically significant overall change in ASMR whereas uterine cancer showed a non-significant decline (AAPC-0.80%). This incidence–mortality divergence is particularly evident for uterine cancer and is consistent with findings from other populations in which increasing incidence has occurred alongside stable or declining mortality, potentially reflecting improvements in diagnosis and management [19,56]. Similar patterns have been reported across East Asia and globally, where absolute numbers of cancer deaths may continue to increase despite stable or declining ASMR, reflecting population growth and ageing [31,56]. Thus, the substantial mortality burden in Sri Lanka remains important, with 4,115 uterine, 3,109 ovarian, and 1,937 cervical cancer deaths recorded during the study period, even in the absence of significant increases in ASMR.

Several strengths should be considered when interpreting these findings. The study used long-term national cancer registry data covering 18 years, allowing assessment of both overall temporal trends and differences across major anatomical sites and age groups. Joinpoint regression provided a systematic assessment of changes in incidence rather than relying solely on comparisons between the first and last years. The simultaneous assessment of ASIR, CR and ASMR allowed demographic effects and mortality patterns to be considered alongside incidence trends. In addition, the histological analysis provides useful information on the distribution of major tumour categories within the registry.

The study also has limitations. As an ecological, registry-based analysis, it cannot establish causal relationships between observed cancer trends and individual-level risk factors such as obesity, diabetes,

parity, age at first childbirth, HPV infection, tobacco exposure or socioeconomic status. The registry data also do not provide consistent information on tumour stage, treatment, recurrence, comorbidities or individual survival, limiting interpretation of changes in mortality. For cervical cancer, the high proportion of cases without recorded stage further limited the assessment of stage distribution and changes in disease severity at diagnosis over time, highlighting the need to improve the completeness of staging documentation. Histological information was unavailable for all years and sites, particularly during 2012–2014, while uterine corpus histology was unavailable before 2011; consequently, histological proportions should not be interpreted as representative of the entire study period. Changes in diagnostic practices, registration completeness and classification may also have contributed to some of the observed increases, particularly for rare or unspecified cancer categories. Finally, the use of uterine corpus cancer as a proxy for predominantly endometrial malignancy facilitates epidemiological comparison but does not completely distinguish endometrial carcinoma from other uterine corpus tumours.

These findings have important implications for cancer control in Sri Lanka. Cervical cancer prevention should continue to emphasize HPV vaccination and strengthening screening and colposcopy services, with consideration of more organised population-based approaches and improved linkage between screening, diagnosis, and treatment. At the same time, the rapid increase in uterine and ovarian cancers highlights the need for a broader gynaecological cancer strategy rather than a predominantly cervical-cancer-focused approach. Prevention and control of obesity, diabetes, and other modifiable metabolic risk factors may help reduce the future burden of uterine cancer, although their effectiveness for cancer prevention in Sri Lanka requires further evaluation. As case numbers increase, strengthening gynaecological oncology services will also be important, including capacity for diagnostic hysteroscopy and endometrial sampling, pathology, MRI/CT-based staging, minimally invasive surgery, specialist gynaecological oncology, and radiotherapy, together with progressive introduction of molecular testing and Lynch syndrome assessment pathways. For ovarian cancer, risk-stratified approaches to early detection and improved diagnostic pathways are particularly warranted given the absence of an effective population-based screening test. Earlier referral, enhanced ultrasound expertise, appropriate use of CT imaging and CA-125 assessment, expanded capacity for gynaecological oncology cytoreductive surgery and chemotherapy, and access to genetic testing, including BRCA assessment, could further strengthen ovarian cancer diagnosis and management in Sri Lanka. Future research should integrate cancer registry data with individual-level information on stage, treatment, reproductive characteristics, metabolic risk factors, and HPV status to clarify the determinants of these changing trends. Continued age-specific surveillance will be essential to determine whether the observed transition persists and to evaluate the eventual population-level impact of HPV vaccination.

Conclusion

This national registry-based study demonstrates a changing gynaecological cancer profile in Sri Lanka from 2005 to 2022. Although cervical cancer remained the most frequently diagnosed malignancy, its age-standardised incidence remained stable, while uterine and ovarian cancers increased substantially

across multiple age groups. Despite rising incidence, mortality trends for the major cancers remained relatively stable. These findings highlight the need to sustain cervical cancer prevention while strengthening strategies for the prevention, early detection and management of the growing uterine and ovarian cancer burden in Sri Lanka.

Abbreviations

AAPC
Average annual percentage change
APC
Annual percentage change
ASIR
Age–standardised incidence rate
ASMR
Age–standardised mortality rate
CI
Confidence interval
ICD
10–International Classification of Diseases, Tenth Revision
NCCP
National Cancer Control Programme
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

The study used aggregated/de-identified data freely available in NCCP website and did not involve direct contact with human participants.

Consent for publication

Not applicable

Competing Interest

The authors declare no competing interests.

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Author Contribution

RMBS: Data extraction, visualization, original draft. CNRA: Supervision, editing and reviewing. SL: Methodology, Visualization, Formal analysis, Data curation. YMTY: Review & Editing. Supervision. NS: Study concept, writing and reviewing, Figure modification, Validation. All authors reviewed the manuscript.

Data Availability

Cancer incidence data publicly available on the National Cancer Control Programme (NCCP) website (https://www.nccp.health.gov.lk/en/incedenceData). All data supporting the findings of this study are available within the paper and its Supplementary Information.

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Figures

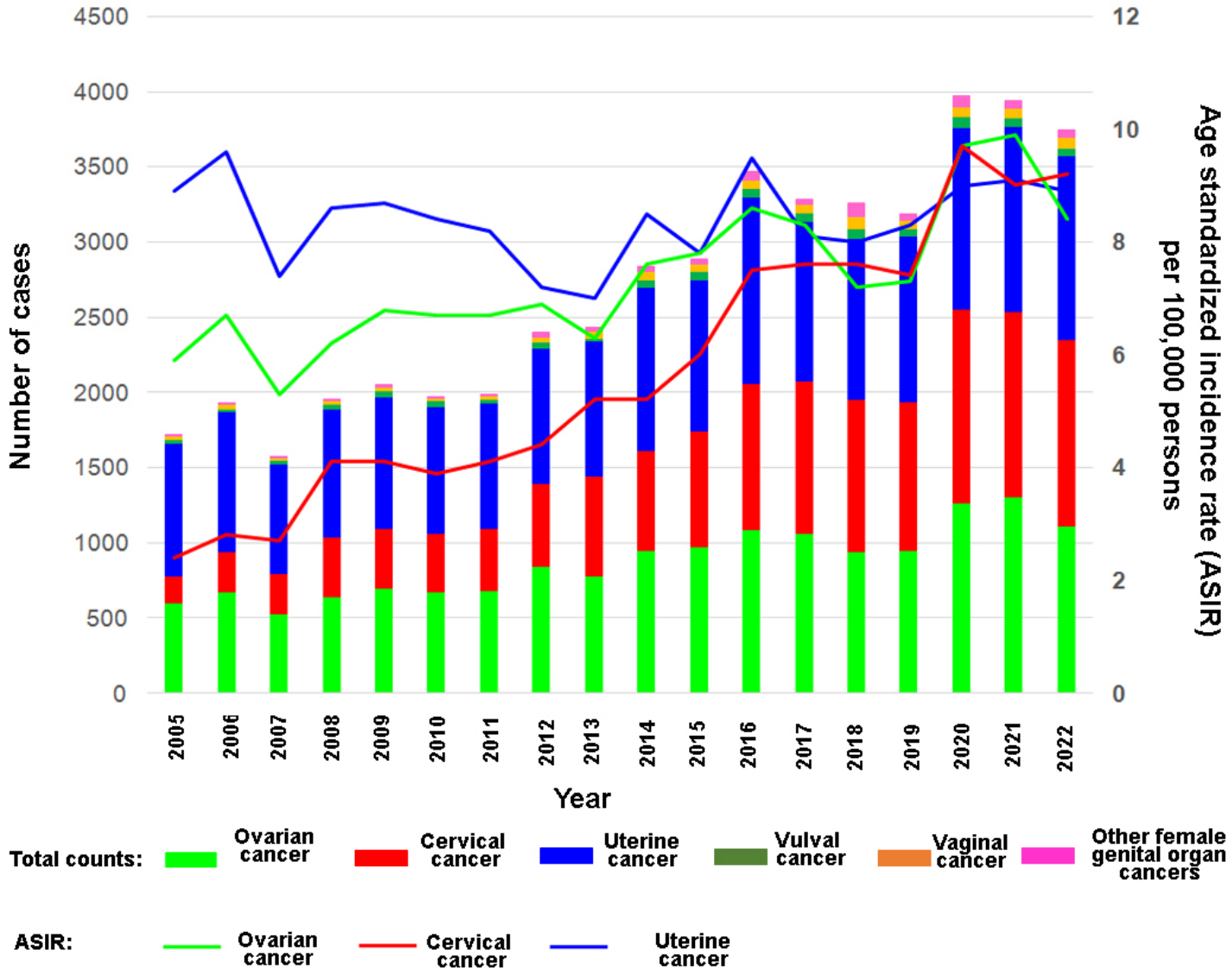


Figure 1

Trends in gynecological cancer case counts and age-standardized incidence rates in Sri Lanka, 2005–2022.

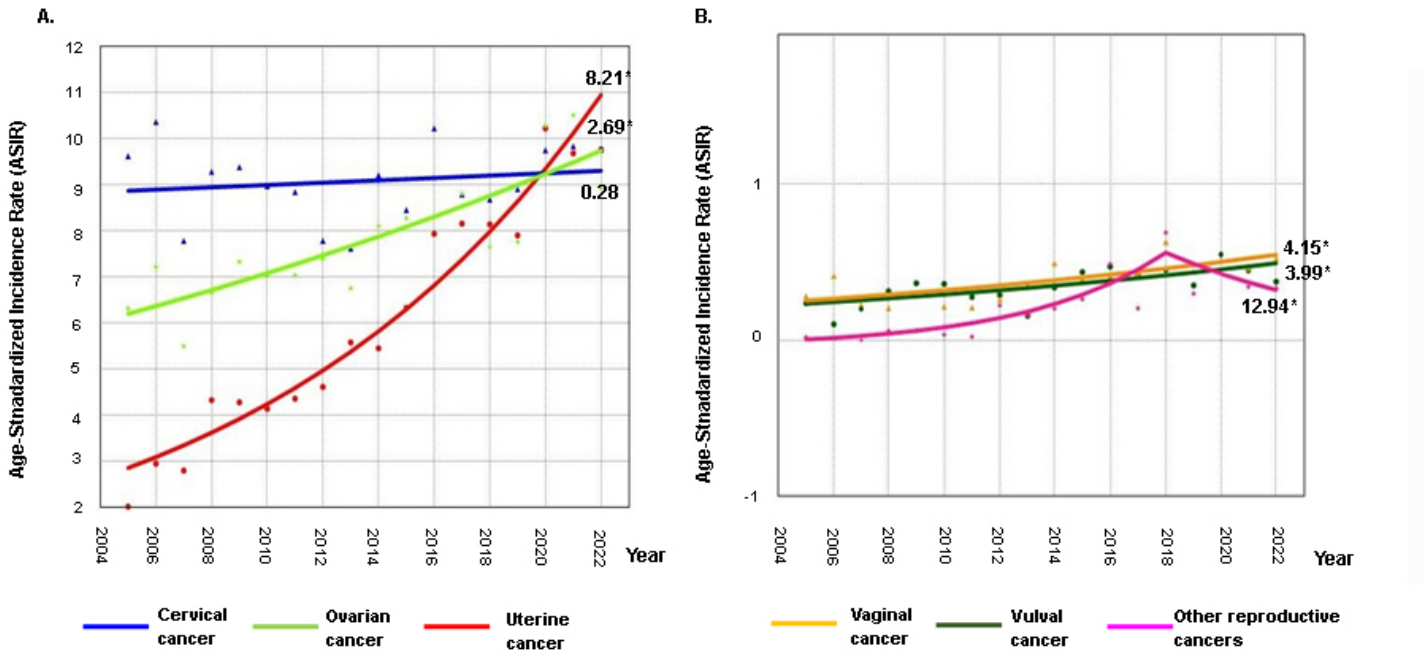


Figure 2

Joinpoint regression analysis of incidence trends in gynecological cancers in Sri Lanka, 2005–2022. (A) Annual percentage changes (APCs) in the incidence of cervical, ovarian, and uterine cancers. (B) APCs in the incidence of vaginal, vulval, and other reproductive cancers.

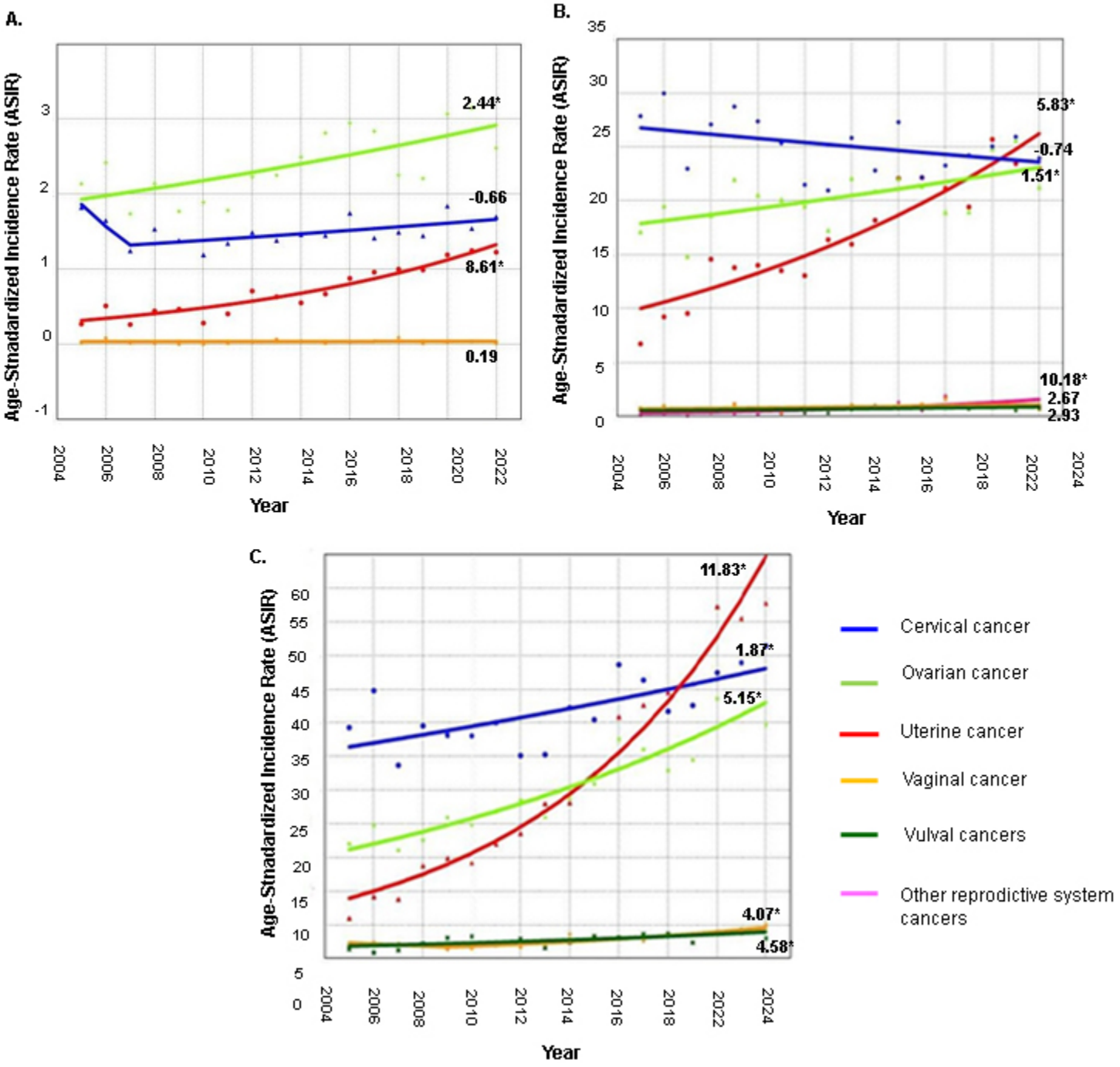


Figure 3

Joinpoint regression analysis of incidence trends in gynecological cancers in Sri Lanka by age group, 2005–2022. Annual percentage changes (APCs) for individual gynecological cancer types are presented for women aged (A) <45 years, (B) 45–64 years, and (C) ≥65 years.

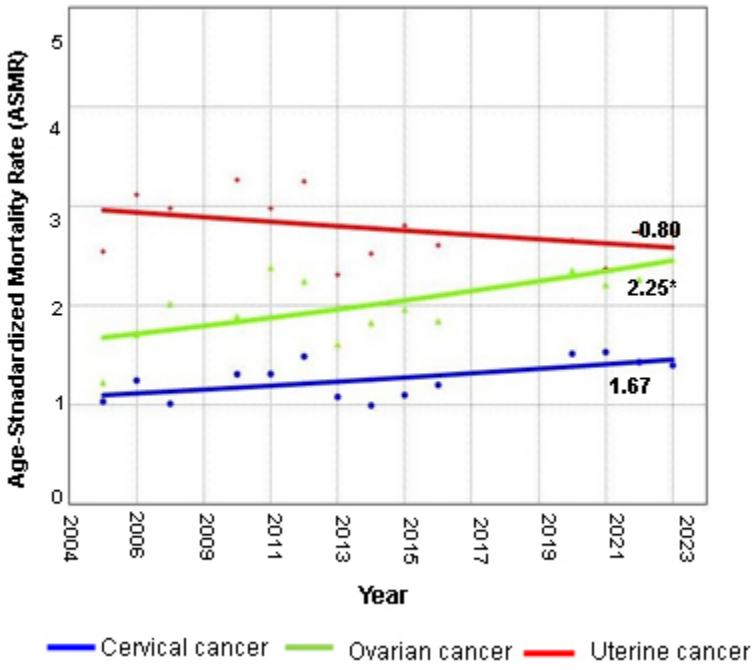


Figure 4

Trends in age-standardized mortality rates (ASMRs) for cervical, ovarian, and uterine cancers in Sri Lanka, 2005–2022, with corresponding annual percentage changes (APCs) from Joinpoint regression analysis.

Supplementary Files

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- SupplementaryFigure1.jpg
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