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Differences in HPV-related gynaecological malignancies incidence and survival by individual and contextual variables: a population-based study

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Abbreviations:

ADC – Adenocarcinoma

ADRH – Household Income distribution Atlas

CI – Confidence Interval

CM – Community of Madrid

CR – Crude Rates

ASR – Age-standardised incidence rates

DCI – Death Certificate Initiated

DCO – Death Certificate Only

df – degrees of freedom

ECIS – European Cancer Information System

EHR – Excess of hazard Ratio

ENCR – European Network of Cancer Registries

FIGO – International Federation of Gynaecology and Obstetrics

HPV – Human Papilloma Virus

IARC – International Agency for Research of Cancer

ICD-O – International Classification of Diseases for Oncology

INE – National Institute of Statistics

JRC – European Commission's Joint Research Centre

NDI – National Death Index

NOS – Not Otherwise Specified

NS – Net Survival

PBCR-CM – Population Based Cancer Registry of the Community of Madrid

Q – Quartile

QCS – Quality Check Software

SCC – Squamous Cell Carcinoma

SD – standard distribution

SES – Socioeconomic status

TNM – tumour-node-metastasis

WHO – World Health Organisation

Abstract

Vulvar, vaginal and cervical cancers are gynaecological malignancies that share a key risk factor: infection with the human papillomavirus (HPV). As an HPV vaccine is available, many tumours are considered preventable. This study analysed the incidence and survival of vulvar, vaginal and cervical cancers in women living in the Community of Madrid (CM) from 2018-2020, by socioeconomic status and stage. Data of invasive tumours were extracted from the Population-Based Cancer Registry of Madrid (PBCR-CM). Descriptive analyses were performed for sociodemographic and tumour characteristics. Crude, age-specific and age-standardised incidence rates were calculated. Five-year observed and net survival were calculated, globally and stratified by socioeconomic status and stage. Flexible parametric models were adjusted to determine differences in the risk of death by stage. Between 2018-2020, 954 patients were diagnosed, corresponding to an age-standardised rate of 10.8 cases per 100 000 women-years. Most tumours are squamous cell carcinomas, grade II, and diagnosed at early stages. Cervical cancer patients showed greater survival results (71% vs 50% for vulvar/vaginal cancer). Survival was lowest among patients with grade-III and metastatic tumours. This study provides an overview of HPV-related gynaecological cancers in CM. To address inequalities, PBCR plays an indispensable role by ensuring high-quality epidemiological surveillance.

Keywords: female genital neoplasms; human papillomavirus viruses; population-based cancer registry; surveillance; social inequalities

1. Introduction

Gynaecological cancers are a group of tumours that affect the female genitourinary system, including the vulva, vagina, uterus, ovaries, fallopian tubes and peritoneum. Within this group of tumours, cancers of the vulva, vagina and cervix uteri share a significant risk factor: persistent infection with human papillomavirus (HPV). HPV refers to a group of viruses known to infect the anogenital area, as well as the mouth and throat. More than 200 HPV subtypes are known, and up to 12 of them have been recognised as Group 1 carcinogens by the International Agency for Research of Cancer (IARC) [1]. Infection with an oncogenic (high-risk) HPV genotype can lead to persistent infection, which increases the likelihood of developing anogenital warts or condylomas, as well as precancerous lesions and cancers of the vulva, vagina, and cervix [2]. However, only a small proportion of women infected with high-risk HPV develop precancerous lesions or cancer. Some authors estimate that up to 85% of women will acquire an HPV infection at some point in their lives, yet approximately about 1.4% will eventually develop cervical cancer [3]. The low incidence and scarcity of data for vulvar and vaginal cancers limit the ability to produce comparable estimates for these tumour types.

In Europe, in 2024, the incidence of this group of tumours as a whole was 15.5 cases per 100,000 women-year, with cervical cancer being the most common, with an estimated incidence rate of 11.4 cases per 100 000 women-year [4]. In Spain, recent estimations indicate that 2,760 women will be diagnosed of with cervical cancer by 2026, which translates into an incidence rate of 10 new cases per 100,000 women [5]. In terms of survival, the observed and net survival estimates 5 years after the diagnosis of cervical cancer were reported to be 65.3% and 67.2%, respectively, among Spanish women from 2013-2017 [6]. Additionally, 1,157 women died from vulvar, vaginal or cervical tumours in 2023 in Spain, which represents 2.6 deaths per 100,000 inhabitants (adjusted by the European Standard Population) [7].

Since human papillomavirus vaccination and screening programs are recognised strategies to eliminate these cancers, HPV-related tumors are generally regarded as preventable and/or curable. In this context, the World Health Organization (WHO) launched a global strategy for the elimination of cervical cancer, aiming to achieve and sustain an incidence rate of fewer than 4 cases per 100,000 women by 2030. To meet this goal, the strategy established the following key pillars and their corresponding targets: 90% of girls fully vaccinated against HPV by the age of 15; 70% of women screened using high-performance tests by the age

of 35 and again by the age of 45; and 90% of women with precancer treated and 90% of women with invasive cancer managed [8].

Within this framework, monitoring cancer incidence and survival indicators is needed to facilitate the development of effective cancer prevention strategies at the global, national and regional levels [9]. The aim of this study was to determine the incidence and 5-year survival estimates of HPV-related cancers, including vulvar, vaginal and cervical cancers, diagnosed in women living in the Community of Madrid (CM) in 2018-2020, by socioeconomic status and stage at diagnosis of disease.

2. Methods

2.1. Data collection:

Data were extracted from the Population-Based Cancer Registry of the Community of Madrid (PBCR-CM), Spain. This registry includes all incident primary malignant tumours diagnosed in population who reside in the CM. For this study, all primary invasive vulvar, vaginal and cervical cancers diagnosed in women aged over 20 years between January 2018 and December 2020 were included. Data collection combined active and passive case-finding. First, the PBCR-CM identified a set of reportable cases using multiple sources of information, including hospital records, primary health care data, pathology electronic records, death certificates and official health care administrative data which allows personal identification and data linkage between data sources. Second, potential incident tumours were validated by retrospectively reviewing the electronic medical charts. All tumours are coded according to international recommendations [10]. Women who had been living in the region for less than six months prior to diagnosis were excluded from the study to avoid including people from other regions seeking diagnosis or treatment in the CM. Mid-year population estimates from 2018-2020 were obtained from the Madrid Regional Institute of Statistics (https://www.madrid.org/iestadis, accessed in July 2026).

2.2. Variables:

Essential variables for population-based cancer registries were used, including place of residence, date of birth, country of birth, date of incidence, topography, morphology (histology of the primary tumour), grade of histological differentiation, behaviour and basis of diagnosis. Tumour topography, morphology, behaviour and grading were recorded according to the International Classification of Diseases for Oncology

(ICD-O 3.1) [11]. Only tumours with topographic codes "C51._", "C52._", "C53._" and invasive behaviour (code "/3") were included in this study. Tumours were grouped according to morphology as follows: squamous cell and translational carcinoma (SCC; ICD-O-3.1 codes 8051-8086, 8120-8131), basal cell carcinoma (BCC; ICD-O-3.1 codes 8090-8110), adenocarcinoma (ADC; ICD-O-3.1 codes 8140-8149, 8160-8163, 8190-8221, 8250-8552, 8570-8576, 8940-8941, 9110), melanoma (only for vulvar topography; ICD-O-3.1 code 8720), and unspecific carcinoma (NOS; ICD-O-3.1 codes 8000, 8010, 8020, 8050). Lymphomas (ICD-O 3.1 codes 9590-9993) and Kaposi's sarcomas (9140) were excluded.

Additionally, the stage at diagnosis was coded according to the International Federation of Gynaecology and Obstetrics (FIGO) 2018 classification [12–14], excluding vulvar melanoma. Vulvar melanomas were staged using the 8th Edition of the Union for International Cancer Control Classification of Malignant Tumours, which is based on the clinical or pathological tumour node metastasis (TNM) system. Stages were grouped into four categories: local stage of diseases (FIGO IA-IB, TNM (melanoma) T1-4 N0 M0), locally advanced (FIGO IIA-IIIC, TNM (melanoma) AnyT N1-3 M0), advanced (FIGO IVA-IVB, TNM (melanoma) AnyT AnyN M1) and unknown (FIGO not available, missing data).

Socioeconomic status (SES) was assessed using the Household Income Distribution Atlas (ADRH) published by the National Institute of Statistics (INE). The ADRH is an operation based entirely on the use of administrative records that provide estimates on the level and distribution of household income broken down according to basic demographic variables of the population at the census section level [15]. Specifically, the average net household income was used as a socioeconomic indicator. The average net income per capita at the census section level was divided into terciles (Q) to classify the study population into three groups according to neighbourhood socioeconomic position, where Q1 represents the most deprived areas and Q3 represents the least deprived areas.

Finally, patients were followed up for vital status until 31st December 2024 using linkage with the Spanish National Death Index (NDI) and the administrative health database of the CM. Patients who were not identified as deceased in the NDI, did not have a death record in their official health care administrative data, and showed no evidence of death upon review of their medical records were considered alive at the end of the follow-up period.

2.3. Quality indicators:

Cancer registry data quality was evaluated using the IARCcrgTools software for Cancer Registries developed by the International Association of Cancer Registries and the JRC-ENCR Cancer Registries Data Quality Check Software (QCS) developed by the European Network of Cancer Registries (ENCR) and the European Commission's Joint Research Centre (JRC) [16,17]. The following quality indicators were calculated: percentage of microscopically verified tumours, percentage of tumours for which the basis of diagnosis was unknown, percentage of death-certificate-initiated tumours (DCI), percentage of death-certificate-only tumours (DCO) and percentage of not otherwise specified tumours (NOS) (ICD-O 3.1 codes 8000). Quality indicators were calculated for all tumours combined and stratified by topography.

2.4. Data analysis:

Descriptive analyses were performed for sociodemographic and tumour characteristics for patients with vulvar, vaginal and cervix uteri tumours. Crude rates (CR) and age-specific incidence rates (by 5-year age groups) per 100,000 inhabitants were calculated using the corresponding mid-year female population. Age-standardised incidence rates (ASR) per 100,000 women-years were computed using European standard population (2013) and the user-designed Stata command "distrate" which calculates efficient confidence intervals for the purpose of comparing regions [18]. Incidence rates were calculated for each topography and stratified by socioeconomic status.

For survival analysis, due to the low number of patients with vaginal cancer, they were grouped together with patients with vulvar cancer. Net survival (NS) was calculated with the complete approach using Pohar-Perme estimator, which uses life tables stratified by sex, age, and calendar year. The "strs" package of Stata was used to estimate 5-year NS and their corresponding 95% confidence intervals (95% CI) for each topography by age, socioeconomic status, country of birth, grade of histological differentiation and stage [19]. Additionally, stage-specific 5-year NS was determined by SES.

Finally, flexible parametric models were adjusted to determine differences in the instantaneous risk of death (excess of hazard ratio, EHR) due to studied tumours by stage at diagnosis. Firstly, unadjusted models were used to estimate crude hazard ratios (Model 1). Secondly, models were adjusted for group of age, socioeconomic status and country of birth (Model 2). In addition, Model 3 was further adjusted for tumour characteristics (grade of histological differentiation). The models were fitted on known stage cases. The

"stpm2" [20] Stata package was used to model the hazard using 3 degrees of freedom(df) for the spline's variables. Statistical analyses were performed using Stata software (STATA/BE version 18.0).

2.5. Ethics declarations

Ethical approval for this study was granted by the Regional Ethics Committee of Madrid (approval code: PI21_01288). This study complies with data protection regulations established by the Spanish Law 41/2002, of November 14, concerning patient autonomy, rights, and obligations regarding information and clinical documentation. Article 16.3 of this law stipulates that informed consent is not required for accessing patients' identifying data for epidemiological or public health reasons, provided anonymity is maintained. In this manuscript, we present aggregate anonymized data to prevent the identification of individuals. We confirm that all methods were carried out in accordance with relevant guidelines and regulations.

3. Results

In total, 954 cases of gynaecological HPV-related tumours among 952 women with gynaecological HPV-related tumours, over 8,5 million women, were registered by the Population-Based Cancer Registry of the Community of Madrid between 2018 and 2020. During that period, 227 vulvar, 38 vaginal and 689 cervix uteri cancers were diagnosed in the area covered by the cancer registry.

3.1. Quality indicators

Globally, 96.4% (N=920) of the tumours were microscopically verified, and only 2.1% (N=20) of the basis of diagnosis was missing. Only 3.4% (N=32) of the cancer cases were first identified by a death certificate, and only 1.3% (N=12) of the registered tumours had no information other than a cancer code in the death certificate. Non-specified malignant neoplasms (8000/3) accounted for 3.8% (N_{vulva}=13; N_{vagina}=3; N_{cervix}=20) of all studied tumours. **Table S1** shows the quality indicators for data recorded in the PBCR-CM globally and stratified by cancer type.

3.2. Gynaecological HPV-related cancer characteristics

Among 954 incident gynaecological HPV-related cancers diagnosed among the 952 patients included in this study, 72.2% (N=689) were diagnosed with cervical cancer, 23.8% (N=227) with vulvar cancer, and 4.0% (N=38) with vaginal cancer.

Table 1 presents female patients and their tumour characteristics by cancer site. The mean age at diagnosis was 59.8 years (SD: 18.1). Women diagnosed with vulvar and vaginal cancer were notably older than those

diagnosed with cervical cancer were (75 and 72 versus 54 years, respectively). While 76% of vulvar cancers and 74% of vaginal cancers occurred in women older than 64 years, 74% of cervical cancers were diagnosed in women aged 20-64 years. Regarding country of birth, 25% of patients were born in a foreign country, although this percentage was lower for vulvar and vaginal cancer and higher for cervical cancer. Of 954 women, 43% lived in the most deprived neighbourhoods (Q1).

With respect to tumour characteristics, squamous carcinomas and adenocarcinomas were the most frequent histological types across all sites. Additionally, 7% of vulvar tumours were melanomas. Among women with vulvar cancer, 26% of tumours were moderately differentiated compared with more than 30% in both vaginal and cervical tumours. Furthermore, 48% of patients with vulvar cancer were diagnosed at early stages (FIGO I), whereas 40% of patients with vaginal tumours and 41% of cervical cancers were diagnosed at locally advanced stages (FIGO II-III). Advanced stage (FIGO IVA-IVB) disease, was identified in 10% of vulvar, 24% of vaginal and 15% of cervical tumours. Descriptive analyses of stage at diagnosis according to socioeconomic status revealed differences among patients with vulvar and cervical cancer, with a greater proportion of locally advanced and advanced disease observed among women from lower socioeconomic strata, however, these differences did not reach statistical significance. For vaginal cancer, the apparently higher proportion of advanced-stage cases among the least deprived women should be interpreted cautiously given the small number of cases in this subgroup (n=3/7) (**Figure 1**).

3.3. Gynaecological HPV-related cancer incidence

In terms of incidence rates, the European standardised incidence rate of gynaecological HPV-related cancers in women was 10.8 cases (95% CI 10.4-11.3) per 100,000 women-years. Cervical tumours showed the highest incidence rates [ASR: 8.0 (95% CI: 7.5-8.4)], followed by vulvar and vaginal tumours [ASR vulva: 2.5 (95% CI: 2.2-2.7); ASR vagina: 0.4 (95% CI: 0.3-0.5)].

Regarding socioeconomic status, women living in the most deprived areas had the highest crude and adjusted incidence rates, regardless of the tumour site. This difference was higher in cervical cancer patients, with age-standardised incidence rates ranging from 6.1 cases per 100,000 in less deprived women (Q3) to 10.4 cases per 100,000 women-year in most deprived women (Q1) (**Table 2**).

Age-specific incidence rates by tumour site showed different pattern with age. Vulvar tumours showed exponential increasing incidence rates, attaining rates of 53.2 cases per 100,000 women in +85 years old women, while vaginal tumours remained moderately low across age groups. Cervical tumours, however,

exhibited a steep increase in the incidence rate among young women, rising from 1.2 cases per 100,000 in the youngest age group (20-24 years) to 27.2 cases per 100,000 women in the 30-34 age group, remaining relatively stable across older women (**Figure S1**).

3.4. Gynaecological HPV-related cancer survival

Of the 954 patients, 12 were diagnosed through the death certificate only and 2 were over 100 years of age, leaving 940 individuals included in the survival analysis. Due to the low number of patients with vaginal cancer, they have been grouped together with patients with vulvar cancer. By 31st of December 2024, 351 patients had died within 5 years of diagnosis (143 patients with vulvar and vaginal cancer, and 208 with cervical cancer).

The overall 5-year net survival estimates were 50.2% (95% CI 41.4-58.3) and 71.1% (95% CI: 67.2-74.5) for patients with vulvar-vaginal and cervical cancer, respectively. **Figure 2** shows the 5-year net survival with 95% CI for women diagnosed with vulvar-vaginal and cervical cancer between 2018-2020 across sociodemographic and tumour characteristics.

In terms of age at diagnosis, a decrease in survival was observed in the oldest group, both among patients with vulvar/vaginal cancers and those with cervical cancer (p-value<0.001). No significant differences in survival were observed across socioeconomic statuses patients either with vulvar/vaginal or cervical cancer. Differences in survival were found related to the country of birth in patients with cervical cancer, showing greater survival among patients born in foreign countries (78.83% vs 67.44%, p-value=0.013). Regarding tumour characteristics, poorly differentiated tumours (grade III) and advanced stage (FIGO IVA-IVB) showed the lowest survival, independent of the topographic site (**Figure 2**).

Table 3 shows the 5-year net survival of patients with vulvar/vaginal and cervical cancer by stage at diagnosis and socioeconomic status. In patients with vulvar/vaginal tumours this analysis revealed the worst results in those patients with advanced tumours, independently of their socioeconomic status [$NS_{Advanced\text{-}Q1}$: 17.1 (95% CI: 3.6-39.1) vs. $NS_{Advanced\text{-}Q3}$: 15.3 (95% CI: 3.4-35.3)]. On the other hand, most deprived (Q1) women with cervical cancer showed lower survival estimates in every stage category, with 89.3% (95% CI: 81.0-94.1) for local tumours [vs 98.1% (95% CI: 79.3-99.8) in Q3], 68.0% (95% CI: 58.4-75.8) for locally-advanced tumours [vs 75.0% (95% CI: 60.3-84.9) in Q3] and 23.4% (95% CI: 12.8-35.9) for advanced disease [vs. 32.4% (95% CI: 14.7-51.6) in Q3]. However, those differences were not statistically significant.

Finally, flexible parametric models were adjusted to estimate the excess hazard of death by stage at diagnosis (**Table 4**). Different models have been developed, including sociodemographic and tumour variables. Adjusting by sociodemographic factors (group of age, socioeconomic status and country of birth) and tumour characteristics (grade of histological differentiation), patients with advanced vulvar/vaginal and advanced cervical tumours had 22.6 (EHR; 95% CI: 10.7-47.6) and 15.2 (EHR; 95% CI: 8.6-26.8) times higher risk of instantaneous death compared to patients with local tumours at diagnosis, respectively.

4. Discussion

This population-based study offers a thorough overview of the characteristics and demographic profile of the population living in the Community of Madrid (CM) affected by gynaecological HPV-related tumours during the period 2018-2020. It also presents incidence data and 5-year survival estimates following the diagnosis of these tumours. Our findings deeply highlight the influence of age and socioeconomic status on cancer incidence and reinforce the role of tumour characteristics and stage at diagnosis as key determinants of prognosis.

A total of 954 patients were included in this study. The age-standardised rates were 2.5, 0.4, 8.0 cases per 100,000 women for vulvar, vaginal and cervical cancers, respectively. These figures are slightly lower than the estimates reported by the European Cancer Information System (ECIS) for Spain (4.0, 0.8 and 9.2 cases per 100,000 inhabitants, respectively), and are aligned with those reported by other international cancer registries [4,21–24]. Congruent with previous reports [4,24], vulvar and vaginal cancers in the CM were predominantly diagnosed in women older than 65 years, whereas 74% of the cervical cancer cases occurred in women younger than 65 years. In terms of histopathological characteristics, squamous cell carcinoma was the most prevalent morphology across all three tumours (65.0%), moderately differentiation (GII) was the most frequent grade (31.0%), and most tumours were diagnosed in early stage (39.1%). These tumour patterns are consistent with those reported in other studies and with established evidence [12–14,22–24].

To achieve the targets established by the WHO within the Global Strategy for the Elimination of Cervical Cancer, HPV vaccination and population-based screening programs represent essential and highly effective public health interventions that must be accessible across all population groups. In the CM, prevention through HPV vaccination began in 2008 with the inclusion of the vaccine for 14-year-old girls. Coverage was subsequently expanded to include girls and boys aged 13 to 18 years [25]. Consequently, all HPV-cancer sites combined showed a declining incidence rate, which may be attributable to the high vaccine

coverage achieved in cohorts born after 1994 [26,27]. A recent report from the Ministry of Health of the Community of Madrid indicated that more than 90% of cohorts born after 2006 had received at least one dose of the vaccine by November 2025 [28]. Regarding screening, cervical cancer meets the criteria for the implementation of population-based cancer screening programmes. In Spain, since 2019, a cervical cancer screening programme has been included in the national portfolio of public health services, although opportunistic screening has been carried out for decades. In the CM, the population-based Cervical Cancer Screening Programme has been progressively implemented in the region's healthcare areas since 2019.

Regarding socioeconomic status, the studied tumours were more frequently diagnosed among women with lower socioeconomic status, which is a pattern consistent with previous reports on the epidemiological profile of HPV-related tumours [29,30]. These differences are largely attributed to a higher prevalence of persistent HPV infection among women with lower socioeconomic status, a trend also observed in younger women [30–32]. This association is crucial, given that an estimated 25% of vulvar cancers, 78% of vaginal cancers, and nearly 100% of cervical cancers are linked to this infection [33]. Additional cofactors—including multiparity, tobacco use, and the prevalence of other sexually transmitted infections—also correlate with deprivation level, and may contribute to the observed variation in incidence across socioeconomic strata [34]. Moreover, substantial inequalities in secondary prevention practices among women of different socioeconomic status have been reported. Women residing in more deprived areas exhibit lower HPV vaccination coverage and lower participation in screening programs, thereby increasing their risk of invasive cancer [35–38].

Survival analysis revealed that patients with cervical cancer had demonstrated better outcomes (5-year NS = 71.1%) than those diagnosed with vulvar and/or vaginal cancer (5-year NS = 50.2%). These estimates differ from those reported in the EUROCARE-6 study, which described a 57% 5-year relative survival for vulvar/vaginal cancer patients and 62% for women with cervical cancer (62%) [39]. As expected, substantial differences in net survival were observed across tumour grade and stage at diagnosis, with stage representing the strongest determinant of prognosis. Among patients diagnosed with advanced disease, the 5-year net survival was 11.3% for vulvar/vaginal cancer (vs. 74.2% in localised disease) and 26.6% for cervical cancer (vs. 92.5% in localised disease), consistent with previously published estimates [40–42]. When assessing socioeconomic factors, stage-specific analyses showed differences in survival across deprivation strata, with minor differences in survival outcomes among women living in most deprived areas in vulvar/vaginal cancer patients (up to a 3% difference in local and advanced tumours). In cervical cancer,

lower survival estimates were observed among women with higher deprivation levels compared with those with lower deprivation (up to a 9% difference among localised tumours).

Taken together, these findings indicate that disparities across SES may arise from multiple factors, including behavioural factors, preventive attitudes and tumour characteristics, as reported in the literature [42–44]. Consistent with this, the review by Afshar et al. concluded that disease stage and treatment were reported as the main factors contributing to survival across socioeconomic groups for several tumours (ovarian, cervical and prostate tumours) [45]. In addition, Ibfelt et al reported in 2013 that cancer stage was the most important factor affecting socioeconomic differences in cervical cancer survival [46]. Our data are aligned with this observation, revealing a higher proportion of advanced-stage diagnosis among women with greater level of deprivation, which could also reflect poor access to care, later care-seeking, or lower screening uptake, as has been described in previous studies [45–47]. However, the Spanish National Health System provides universal healthcare coverage, which should guarantee access to diagnosis and treatment independently of socioeconomic status. Aligned with Europe's Beating Cancer Plan, further research is needed to examine in greater depth the relationship between socioeconomic factors and cancer, including gaps in participation in preventive measures, as well as attitudes and behaviours towards screening and vaccination programmes, in order to achieve equitable health outcomes for all women.

Finally, our results revealed better survival estimates from cervical cancer patients among women born outside Spain. Given that migrant women were more likely to present with locally-advanced tumours at diagnosis and were more frequently represented in lower socioeconomic groups, this finding was unexpected. One possible explanation is the return of migrants to their country of origin at the end of life. [48–50]. Although recent studies are have addressed cancer outcomes among migrant population [50], these phenomena known as salmon bias should be deeply studied in population-based cancer studies [49].

This study has several noteworthy strengths. The PBCR-CM adheres to international quality standards, ensuring high internal validity and completeness through the systematic use of multiple data sources, including public and private hospital discharge records, primary care, pathology laboratories, death certificates and administrative health databases. All potential incident tumours undergo individual review to validate key variables – such as incidence date, morphology, topography and stage at diagnosis – minimizing the risk of misclassification and guaranteeing that only women with official residence in the CM were included. Data timeliness and active follow-up, supported by complementary sources such as the

National Death Index, regional mortality registry and clinical records contributes to the robustness and reliability of the registry's findings. Despite these strengths, some limitations must be acknowledged. The primary limitation is the lack of access to the clinical history for patients diagnosed or treated exclusively in private hospitals, contributing to a higher proportion of missing data for some variables among these tumours. Also, deaths occurring outside Spain may not be fully captured in mortality records, leading to a possible overestimation of survival estimates among migrant populations, a phenomenon known as the salmon bias. These limitations have been reported in other population-based cancer studies [48].

Socioeconomic indicators also present methodological considerations. Socioeconomic status was estimated using mean net income per person from the Household Income Distribution Atlas (ADRH), an ecological measure derived from administrative registers and calculated by dividing the net household income by the number of members of said household. While this approach provides a reasonable approximation of individual socioeconomic status, it may not fully capture within-household or individual variability. To complement this measure, we also used other area-based indicator such as the 2011 Spanish Deprivation Index; however, no meaningful differences were observed between results using both indices (data not shown). Nonetheless, the use of ecological indicators may underestimate the true effect of socioeconomic status on cancer outcomes.

This study offers a comprehensive overview of HPV-related gynaecological cancers outcomes among women in the Community of Madrid. Given the substantial heterogeneity within this group of cancers, characterising different tumours and determining the stage at diagnosis are crucial for generating clinically relevant insights. Incidence and survival estimates serve as key parameters for guiding preventive strategies and health care planning. In addition, examining social inequalities in cancer incidence and survival is aligned with Europe's Beating Cancer Plan, which promote the identification of disparities and inequalities at EU, national and regional level. To address inequalities, population-based cancer registries play an indispensable role by ensuring high-quality epidemiological surveillance through rigorous and standardised data collection procedures. In addition, they facilitate meaningful comparisons with findings from other settings.

Data availability statement

The data included in the study were analyzed in the protected environment of the Directorate General of Public Health. Due to data protection and security regulations, the sensitive patient data cannot be made

publicly available. However, anonymized data generated for the study may be accessible from the corresponding author on reasonable request.

Reference list

1. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Biological agents. *IARC Monogr. Eval. Carcinog. Risks Hum.* **100**, 1–441 (2012).

2. Bruni, L. *et al. Human Papillomavirus and Related Diseases in the World. Summary Report*. (2023).

3. Zheng, R. *et al.* Global, regional, and national lifetime probabilities of developing cancer in 2020. *Sci. Bull.* **68**, 2620–2628 (2023).

4. ECIS - European Cancer Information System | ECIS - European Cancer Information System. https://ecis.jrc.ec.europa.eu/.

5. Red Española de Registros de Cáncer (REDECAN). *Estimaciones de La Incidencia Del Cáncer En España, 2026.* (2026).

6. Guevara, M. *et al.* Supervivencia de Cáncer en España, 2003-2017. *2025* (2025).

7. Centro Nacional de Epidemiología - Instituto de Salud Carlos III. Mortalidad de cáncer en España. *Mortalidad de cáncer en España - Tablas de datos* https://cne.isciii.es/servicios/enfermedades-cronicas/mortalidad-cancer (2023).

8. Cervical Cancer Elimination Initiative. https://www.who.int/initiatives/cervical-cancer-elimination-initiative.

9. Allemani, C. *et al.* Global variation in patterns of care and time to initial treatment for breast, cervical, and ovarian cancer from 2015 to 2018 (VENUSCANCER): a secondary analysis of individual records for 275 792 women from 103 population-based cancer registries in 39 countries and territories. *The Lancet* **406**, 2325–2348 (2025).

10. European Network of Cancer Registries. ENCR Recommendations | European Network of Cancer Registries. https://www.encr.eu/ENCR-Recommendations.

11. *World Health Organization. International Classification of Diseases for Oncology (ICD-O)*. https://apps.who.int/iris/handle/10665/96612 (2013).

12. Rogers, L. J. & Cuello, M. A. Cancer of the vulva. *Int. J. Gynecol. Obstet.* **143**, 4–13 (2018).

13. Adams, T. S. & Cuello, M. A. Cancer of the vagina. *Int. J. Gynecol. Obstet.* **143**, 14–21 (2018).

14. Bhatla, N., Aoki, D., Sharma, D. N. & Sankaranarayanan, R. Cancer of the cervix uteri. *Int. J. Gynecol. Obstet.* **143**, 22–36 (2018).

15. INEbase / Standard of living and living conditions (CPI) /Living conditions /Household income distribution map / Latest data. *INE* https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736177088&menu=ultiDatos&idp=1254735976608.

16. Ferlay, J., Burkhard, C., Whelan, S. & Parkin, D. M. Check and Conversion Programs for Cancer Registries.

17. Martos, C., Giusti, F., Van Eycken, E. & Visser, O. Data quality checks for validation of the ECIS database. ECIS Technical report. (2025).

18. Consonni, D., Coviello, E., Buzzoni, C. & Mensi, C. A Command to Calculate Age-Standardized Rates with Efficient Interval Estimation. *Stata J. Promot. Commun. Stat. Stata* **12**, 688–701 (2012).

19. Dickman, P. W. & Coviello, E. Estimating and Modeling Relative Survival. *Stata J. Promot. Commun. Stat. Stata* **15**, 186–215 (2015).

20. Royston, P. & Lambert, P. C. *Flexible Parametric Survival Analysis Using Stata: Beyond the Cox Model*. (StataCorp LP, College Station, Texas, 2011).

21. Ferlay, J. *et al.* Cancer incidence and mortality patterns in Europe: Estimates for 40 countries in 2012. *Eur. J. Cancer* **49**, 1374–1403 (2013).

22. The National Cancer Registry Ireland. *HPV-Associated Cancers - Cancer Trends Report*. (2024).

23. Trent Cancer Registry, National Cancer Intelligence Network, & NHS Cancer Screening Programmes. *Profile of Cervical Cancer in England. Incidence, Mortality and Survival*. (2012).

24. Belgian Cancer Registry (BCR). Cancer Fact Sheet Cervical cancer, 2023 | Belgian Cancer Registry. https://kankerregister.org/en/publicaties/cancer-fact-sheet-cervical-cancer-2023.

25. BOCM. Boletín Oficial de la Comunidad de Madrid. Orden 369/2015, de 10 de abril, del Consejero de Sanidad, por la que se da publicidad al Acuerdo adoptado por el Consejo Interterritorial del Sistema Nacional de Salud, en su reunión de 14 de enero de 2015, sobre el Calendario de Vacunación Infantil del Sistema Nacional de Salud, y se actualiza el Calendario Vacunal Infantil de la Comunidad de Madrid. https://gestiona.comunidad.madrid/wleg_pub/secure/normativas/contenidoNormativa.jsf?opcion=VerHtml&nmnorma=8921&eli=true#no-back-button.

26. Hernandez-Aguado, J. J. *et al.* Quadrivalent Human Papillomavirus Vaccine Effectiveness after 12 Years in Madrid (Spain). *Vaccines* **10**, 387 (2022).

27. Kjaer, S. K., Dehlendorff, C., Belmonte, F. & Baandrup, L. Real-World Effectiveness of Human Papillomavirus Vaccination Against Cervical Cancer. *JNCI J. Natl. Cancer Inst.* **113**, 1329–1335 (2021).

28. Subdirección General de Prevención y Promoción de la Salud. Dirección General de Salud Pública. Consejería de Sanidad. *Informe de Resultados de Programas de Vacunación. Coberturas de Vacunación. Comunidad de Madrid, Año 2024*.

29. Bønløkke, S., Blaakær, J., Steiniche, T. & Iachina, M. Social factors and age play a significant role in cervical cancer and advanced-stage disease among Danish women. *BMC Cancer* **24**, 259 (2024).

30. Ou, Y. *et al.* Age and socioeconomic disparities in cervical cancer incidence and mortality: a SEER-based analysis. *Front. Public Health* **13**, 1591883 (2025).

31. Sand, F. Læ. *et al.* Cervical human papillomavirus prevalence according to socioeconomic and demographic characteristics in a large Danish screening population. *Scand. J. Public Health* **52**, 502–510 (2024).

32. Zhao, Y. *et al.* Association between family income to poverty ratio and HPV infection status among U.S. women aged 20 years and older: a study from NHANES 2003-2016. *Front. Oncol.* **13**, 1265356 (2023).

33. Osmani, V. *et al.* Worldwide burden of cervical human papillomavirus (HPV) in women over 50 years with abnormal cytology: a systematic review and meta-analysis. *BMJ Glob. Health* **10**, e017309 (2025).

34. Malagón, T., Franco, E. L., Tejada, R. & Vaccarella, S. Epidemiology of HPV-associated cancers past, present and future: towards prevention and elimination. *Nat. Rev. Clin. Oncol.* **21**, 522–538 (2024).

35. Oka, E. *et al.* Area Socioeconomic Status, Vaccination Access, and Female Human Papillomavirus Vaccination. *JAMA Netw. Open* **8**, e250747 (2025).

36. Kurani, S. *et al.* Socioeconomic disadvantage and human papillomavirus (HPV) vaccination uptake. *Vaccine* **40**, 471–476 (2022).

37. Ricardo-Rodrigues, I. *et al.* Social disparities in access to breast and cervical cancer screening by women living in Spain. *Public Health* **129**, 881–888 (2015).

38. Quintal, C. & Antunes, M. Mirror, mirror on the wall, when are inequalities higher, after all? Analysis of breast and cervical cancer screening in 30 European countries. *Soc. Sci. Med.* **312**, 115371 (2022).

39. Sant, M. *et al.* Survival of women with cancers of breast and genital organs in Europe 1999–2007: Results of the EUROCARE-5 study. *Eur. J. Cancer* **51**, 2191–2205 (2015).

40. Shelton, E., Patel, J., Taylor, M. A., Kwapnoski, Z. & Xu, Y. G. Impact of disease stage, treatment timing, and demographic disparities on survival in vulvar squamous cell carcinoma: Insights from a Surveillance, Epidemiology, and End Results-based analysis. *J. Am. Acad. Dermatol.* **94**, 503–508 (2026).

41. Bielska-Lasota, M. *et al.* Reasons for low cervical cancer survival in new accession European Union countries: a EUROCARE-5 study. *Arch. Gynecol. Obstet.* **301**, 591–602 (2020).

42. Compaoré, Z. C. *et al.* To what extent do age, stage and treatment influence survival after invasive cervical cancer: a French population-based study. *Cancer Causes Control* **33**, 403–415 (2022).

43. Ruzindana, K. & Anorlu, R. I. Global disparities in gynecologic cancer outcomes: A call for action. *Int. J. Gynecol. Obstet.* **171**, 210–220 (2025).

44. Luvián-Morales, J., Gutiérrez-Enríquez, S. O., Granados-García, V. & Torres-Poveda, K. Risk factors for the development of cervical cancer: analysis of the evidence. *Front. Oncol.* **14**, (2024).

45. Afshar, N., English, D. R. & Milne, R. L. Factors Explaining Socio-Economic Inequalities in Cancer Survival: A Systematic Review. *Cancer Control J. Moffitt Cancer Cent.* **28**, 10732748211011956 (2021).

46. Ibfelt, E. H. *et al.* 'Socioeconomic position and survival after cervical cancer: influence of cancer stage, comorbidity and smoking among Danish women diagnosed between 2005 and 2010. *Br. J. Cancer* **109**, 2489–2495 (2013).

47. *Reducing Social Inequalities in Cancer: Evidence and Priorities for Research*. (International Agency for Research on Cancer, Lyon, France, 2019).

48. Arnold, M., Aarts, M. J., Van Der Aa, M., Visser, O. & Coebergh, J. W. Investigating cervical, oesophageal and colon cancer risk and survival among migrants in The Netherlands. *Eur. J. Public Health* **23**, 867–873 (2013).

49. Di Napoli, A. *et al.* Salmon bias effect as hypothesis of the lower mortality rates among immigrants in Italy. *Sci. Rep.* **11**, 8033 (2021).

50. Alberts, C. J. *et al.* A European collaborative initiative to systematically map cancer risk by migration background: the Cancer RADAR project. *Int. J. Equity Health* https://doi.org/10.1186/s12939-026-02899-8 (2026) doi:10.1186/s12939-026-02899-8.

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Author Contributions

Candela Pino-Rosón: Conceptualization; formal analysis; investigation; visualization; writing – original draft. **Ana María Ruíz Tornero**: Validation; writing – review and editing; data curation. **María J. Soto Zabalgogeazcoa**: Conceptualization; writing – review and editing. **María Felicitas Domínguez-Berjón**: Writing – review and editing; supervision; **Nuria Aragonés**: Conceptualization; writing – review and editing; supervision; funding acquisition; project administration; resources.

Additional information

Competing Interests

Authors declare no conflict of interest.

Supplementary information

Supplementary data associated with this article can be found in the online version:

Tables

Table 1. Sociodemographic and tumour characteristics for vulvar, vaginal and cervical cancers. Community of Madrid, 2018-2020 (N=954).

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Table 3. Five-year net survival by stage at diagnosis and socioeconomic status. Women diagnosed with vulvar/vaginal and cervical cancer in the Community of Madrid. 2018-2020.

Table 4: Excess hazard of death (EHR) estimates from flexible parametric models: crude (Model 1), adjusted by sociodemographic variables (Model 2) and adjusted by sociodemographic and tumour variables (Model 3).

Table 1. Sociodemographic and tumour characteristics for vulvar, vaginal and cervical cancers. Community of Madrid, 2018-2020 (N=954)

	Topography			
	Vulvar cancer	**Vaginal cancer**	**Cervical cancer**	**Total**
N	227 (23.8%)	38 (4.0%)	689 (72.2%)	954 (100.0%)
Age at diagnosis (mean, years)	75.4 (13.9)	71.8 (15.2)	54.0 (16.0)	59.8 (18.1)
Age groups				
20-34 years	0 (0.0%)	0 (0.0%)	79 (11.5%)	79 (8.3%)
35-49 years	12 (5.3%)	5 (13.2%)	221 (32.1%)	238 (24.9%)
50-64 years	42 (18.5%)	5 (13.2%)	210 (30.5%)	257 (26.9%)
65-79 years	66 (29.1%)	13 (34.2%)	125 (18.1%)	204 (21.4%)
+80 years	107 (47.1%)	15 (39.5%)	54 (7.8%)	176 (18.4%)
Country of birth				
Spain	213 (93.8%)	30 (78.9%)	472 (68.5%)	715 (74.9%)
Foreign country	14 (6.2%)	8 (21.1%)	217 (31.5%)	239 (25.1%)
Quartiles – Socioeconomic Status (SES)				
Q1- most deprived level	93 (41.0%)	15 (39.5%)	299 (43.4%)	407 (42.7%)
Q2	68 (30.0%)	14 (36.8%)	212 (30.8%)	294 (30.8%)
Q3-least deprived level	66 (29.1%)	9 (23.7%)	178 (25.8%)	253 (26.5%)
Morphology (codes ICD-O-3.1)				
Squamous carcinomas	156 (68.7%)	28 (73.7%)	436 (63.3%)	620 (65.0%)
Basal cell carcinomas	20 (8.8%)	0 (0.0%)	1 (0.1%)	21 (2.2%)
Adenocarcinomas	21 (9.3%)	4 (10.5%)	190 (27.6%)	215 (22.5%)
Other specific carcinomas	0 (0.0%)	0 (0.0%)	15 (2.2%)	15 (1.6%)
Melanomas	16 (7.0%)	0 (0.0%)	0 (0.0%)	16 (1.7%)
Sarcomas and other soft tissues	1 (0.4%)	2 (5.3%)	10 (1.5%)	13 (1.4%)
Unspecified neoplasm (8000/3)	13 (5.7%)	4 (10.5%)	37 (5.4%)	54 (5.7%)
Grade of histological differentiation				
Grade I, well differentiated	52 (22.9%)	4 (10.5%)	92 (13.4%)	148 (15.5%)
Grade II, moderately differentiated	58 (25.6%)	12 (31.6%)	226 (32.8%)	296 (31.0%)
Grade III, poorly differentiated	18 (7.9%)	4 (10.5%)	152 (22.1%)	174 (18.2%)
Grade IV, undifferentiated	0 (0.0%)	1 (2.6%)	4 (0.6%)	5 (0.5%)
Unknown	99 (43.6%)	17 (44.7%)	215 (31.2%)	331 (34.7%)
Stage (FIGO)				
Local (FIGO I)	108 (47.6%)	10 (26.3%)	255 (37.0%)	373 (39.1%)
Local-advanced (FIGO II-III)	56 (24.7%)	15 (39.5%)	279 (40.5%)	350 (36.7%)
Advanced (FIGO IV)	22 (9.7%)	9 (23.7%)	100 (14.5%)	131 (13.7%)
Unknown	41 (18.1%)	4 (10.5%)	55 (8.0%)	100 (10.5%)

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Table 2. Crude and age-standardised vulvar, vaginal and cervical cancer incidence rates by socioeconomic status. Community of Madrid, 2018-2020.

	Vulvar cancer				Vaginal cancer				Cervical cancer			
	CR	Age-standardised incidence rate			CR	Age-standardised incidence rate			CR	Age-standardised incidence rate		
		ASR	95%CI			ASR	95%CI			ASR	95%CI	
Q1 (most deprived)	3.3	3.0	2.4	3.7	0.5	0.5	0.3	0.8	10.5	10.4	9.3	11.7
Q2	2.4	2.3	1.7	2.9	0.5	0.5	0.2	0.8	7.5	7.3	6.4	8.4
Q3 (least deprived)	2.3	2.1	1.6	2.7	0.3	0.3	0.1	0.6	6.3	6.1	5.3	7.1
TOTAL	2.7	2.5	2.2	2.7	0.4	0.4	0.3	0.5	8.1	8.0	7.5	8.4

CR: Crude Rate; ASR: Age-standardised incidence rate; Q: quartile; CI: confidence interval

Table 3. Five-year net survival by stage at diagnosis and socioeconomic status. Women diagnosed with vulvar/vaginal and cervical cancer in the Community of Madrid. 2018-2020.

Vulvar/vaginal cancer

	Q1 (most deprived)		Q2		Q3 (least deprived)		Total	
	NS	**95%CI**	**NS**	**95%CI**	**NS**	**95%CI**	**NS**	**95%CI**
Local (FIGO I)	74.7	(41.6-90.7)	76.7	(52.1-89.8)	72.9	(41.4-89.3)	74.2	(56.7-85.5)
Local-advanced (FIGO II-III)	45.2	(24.1-64.2)	25.3	(9.3-45.2)	32.3	(7.5-61.1)	36.5	(23.2-49.9)
Advanced (FIGO IV)	17.1	(3.6-39.1)	15.3	(3.4-35.3)	15.3	(3.4-35.3)	11.3	(2.8-26.3)
Total	55.5	(39.6-68.8)	48.5	(35.2-60.5)	44.1	(28.1-59.0)	50.2	(41.4-58.3)

Cervical cancer

	Q1 (most deprived)		Q2		Q3 (least deprived)		Total	
	NS	**95%CI**	**NS**	**95%CI**	**NS**	**95%CI**	**NS**	**95%CI**
Local (FIGO I)	89.3	(81.0-94.1)	91.8	(81.8-96.4)	98.1	(79.3-99.8)	92.5	(88.0-95.4)
Local-advanced (FIGO II-III)	68.0	(58.4-75.8)	66.1	(54.8-75.2)	75.0	(60.3-84.9)	69.2	(63.0-74.6)
Advanced (FIGO IV)	23.4	(12.8-35.9)	27.5	(12.4-44.9)	32.4	(14.7-51.6)	26.6	(18.1-35.9)
Total	68.9	(62.9-74.1)	68.5	(61.4-74.6)	77.8	(69.9-83.9)	71.1	(67.2-74.5)

Q: Quartile; NS: Net Survival; CI: Confidence interval

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Table 4: Excess hazard of death (EHR) estimates from flexible parametric models: crude (Model 1), adjusted by sociodemographic variables (Model 2) and adjusted by sociodemographic and tumour variables (Model 3).

	A) Vulvar/vaginal cancer			B) Cervical cancer		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
Stage (FIGO)						
Local (FIGO I)	ref			ref		
Local-advanced (FIGO II-III)	5.9 (2.8-12.5) ***	4.8 (2.4-9.7) ***	4.6 (2.4-9.1) ***	5.0 (2.9-8.7) ***	4.4 (2.5-7.6) ***	4.0 (2.3-6.9) ***
Advanced (FIGO IV)	22.1 (10.2-48.2) ***	20.0 (9.5-42.0) ***	22.6 (10.7-47.6) ***	22.2 (12.7-38.8) ***	17.7 (10.1-31.3) ***	15.2 (8.6-26.8) ***
Age groups						
20-34 years				ref		
35-49 years	ref			0.7 (0.4-1.3)		0.7 (0.4-1.4)
50-64 years	0.9 (0.3-2.9)		0.7 (0.2-2.3)	1.0 (0.6-1.8)		1.1 (0.6-1.9)
65-79 years	1.4 (0.4-4.6)		1.1 (0.3-3.8)	1.2 (0.7-2.3)		1.2 (0.6-2.3)
+80 years	2.3 (0.7-7.6)		2.1 (0.6-6.9)	2.4 (1.2-4.9) *		2.6 (1.3-5.2) **
Quartiles – Socioeconomic Status (SES)						
Q1 - most deprived level	ref			ref		
Q2	1.2 (0.7-2.1)		1.0 (0.6-1.8)	0.9 (0.6-1.3)		1.0 (0.7-1.4)
Q3-least deprived level	1.1 (0.6-2.0)		0.9 (0.5-1.8)	0.7 (0.5-1.1)		0.7 (0.5-1.1)
Country of birth						
Spain	ref			ref		
Foreign country	1.8 (0.8-4.1)		1.3 (0.5-3.3)	0.9 (0.6-1.2)		0.8 (0.6-1.2)
Grade of histological differentiation						
Grade I	ref			ref		
Grade II			1.1 (0.5-2.6)			1.3 (0.7-2.5)
Grade III			4.5 (1.9-10.8) ***			2.0 (1.1-3.8) *
Grade IV			2.6 (0.3-26.9)			6.7 (1.8-25.4) **
Unknown			1.2 (0.5-2.5)			1.6 (0.8-3.0)
N	219	219	219	634	634	634

***** p<.001, ** p<.01, * p<.05**

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553 **Figures**

554 Figure 1. Distribution of stage at diagnosis by socioeconomic status and cancer. Vulvar, vaginal and
555 cervical cancer for women in the Community of Madrid. 2018-2020.

556 Figure 2. Five-year net survival for women diagnosed with vulvar/vaginal and cervical cancer in the
557 Community of Madrid. 2018-2020. SES: Socioeconomic status; Q1: most deprived level; Q3: least
558 deprived level; Loc-adv: Locally-advanced tumours.

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