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# Prevalence of cervical cancer and associated mortality in Grenada, 2000–2010

*A. Bahadoor-Yetman,*[1] *L. Riley,*[2] *A. Gibbons,*[2] *P. J. Fields,*[3] *V. Mapp-Alexander,*[4] *R. Hage,*[5] *and A. Baldwin*[6]

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**ABSTRACT**

**Objective.** *To assess cervical cancer prevalence and associated mortality in Grenada, West Indies during 2000–2010.*

**Methods.** *Records of visits to hospital and clinical facilities were obtained from the histopathology laboratory of the Grenada General Hospital. Records were de-identified and electronically compiled. Cervical cancer prevalence was assessed via cross-sectional analysis of this secondary data. Of a total 12 012 records, 2 527 were selected for analysis using sampling without replacement. Cases were matched to corresponding patient data from death registries, where possible, and used to calculate associated mortality rates.*

**Results.** *The observed prevalence of cervical cancer was 52.4 per 100 000 women (ages 15 and above). The highest rates of cervical cancer occurred in the 35–44 age group, with the second highest among 45–64-year-olds. A total of 65 deaths were attributable to cervical cancer during 2000–2010, more than 50% of which were among women > 65 years old. The observed mortality rate was 16.7 per 100 000, almost twice the rate estimated by WHO for the region.*

**Conclusions.** *This study demonstrates the need for a comprehensive cervical cancer-screening program in Grenada. Results should contribute to informing future studies on how to appropriately generate and execute public health policy for education, screening, prevention, and control of cervical cancer in Grenada.*

**Key words** Papillomavirus infections; public health policy; cervix uteri; uterine cervical diseases; squamous intraepithelial lesions of the cervix; Grenada.

Human papillomaviruses (HPVs) are sexually transmitted infections which may result in malignant disease; they contribute significantly to morbidity and mortality worldwide (1). HPVs are common and easily transmissible; infection may result from a single exposure to an infected individual (2). In fact, approximately 80% of the sexually active population becomes infected with at least one HPV subtype (3). However, most individuals are asymptomatic, as immunological processes may limit or reduce viral load, often to undetectable levels (1, 4–7). HPV subtypes are termed "low-risk" (LR) or "high-risk" (HR), based on their propensity to cause cancer (8). When HR-HPV sequences persist and viral oncoproteins are expressed, dysregulation of the host cell may result in lesions that may progress to cancer (9, 10).

Cervical cancer is the fourth most commonly diagnosed cancer among women worldwide, and disproportionately affects women in developing countries (11). Incidence rates in Latin America and the Caribbean are among the highest in the world (12, 13); regionally, it is the second-most frequently diagnosed cancer among women between 15 and 44 (12, 14). Globally, 80 to 85% of deaths due to cervical cancer occur in low- or middle-income countries. Although estimates exist for the

[1] Department of Microbiology, School of Medicine, St. George's University, St. George's, Grenada.
[2] School of Medicine, St. George's University, St. George's, Grenada.
[3] Windward Islands Research and Education Foundation, St. George's University, St. George's, Grenada.
[4] Pathobiology Department, School of Veterinary Medicine, St. George's University, St. George's, Grenada.
[5] Department of Anatomy, School of Medicine, St. George's University, St. George's, Grenada.
[6] Augusta University/University of Georgia Medical Partnership, Athens, Georgia, United States of America. Send correspondence to Amy Baldwin, email: baldwina@uga.edu.

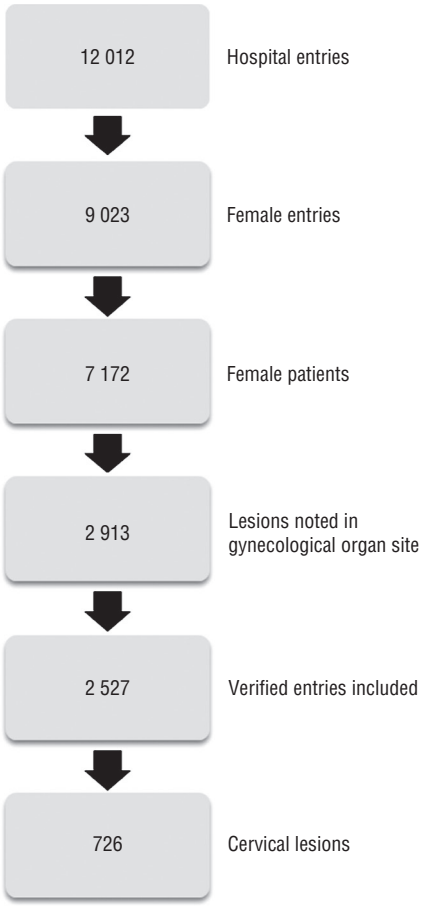
Caribbean region, little is known about the burden of cervical cancer in the Eastern Caribbean, including Grenada, and current WHO data are unavailable for either the region or country (15, 16).

Grenada is a tri-island state in the Caribbean, comprised of Grenada, Carriacou and Petite Martinique, with a population of approximately 100 000; of these, 39 035 are women aged 15 years and older who are at risk for cervical cancer (17, 18). A 1998 survey classified 31% of the population as poor, of which 51% were women (17).

Earlier investigations into cancer rates in Grenada (1990–2000) estimated the incidence of cervical and uterine cancer at 60.7 per 100 000, higher than regional estimates (19). No other cervical cancer estimates have been published for Grenada and few publications focus on HPV-associated disease or cervical cancer mortality in the region (18, 20, 21). Factors limiting the availability of regional information likely include a lack of comprehensive cervical cancer screening programs and incomplete reporting, which may result partly from limited epidemiological data and difficulty accessing records which are primarily hand-written.

It is important to measure the burden of HPV-associated disease and comorbidities in Grenada (22). This study assesses current prevalence of cervical cancer and associated mortality using de-identified histopathology records of women seeking care at local hospitals and clinics from 2000 to 2010, supplemented by death registry records.

**FIGURE 1. Sample population derived from histopathology records of Grenada General Hospital 2000–2010, indicating the application of criteria to construct data set for analysis.**




***Source:*** Histopathology records, Grenada General Hospital, 2000–2010.

## MATERIALS AND METHODS

### Data Sources

Ten years of hand-written records (12 012 entries) from the histopathology logbooks of the Grenada General Hospital were compiled into an electronic master sheet covering the period from January 1, 2000 to December 31, 2009. Data was entered and analyzed in Excel v 12.3.1 (Microsoft, Redmond, USA). Subjects were self-selected, having sought treatment for medical reasons. Patient records were de-identified and assigned random codes. Logbook data was used to estimate prevalence of cervical lesions and cervical cancer (see Figure 1), as described below. Diagnoses for lesion stage and cancer were used as selection criteria for inclusion in further analyses, and sample size was a function of the number of hospital record entries over the ten-year study period.

Logbook data was supplemented with data from multiple other sources, including birth and death records from the Ministry of Health and the Ministry of Finance Statistical Office.

Population and age distribution data were obtained from census records for the period from January 2001 to December 2008 (23). Mid-year population estimates were used for standardized rate calculations and analyses in this cross-sectional study. The median year of 2005 was used as the basis for calculating prevalence rates. Mortality data was collected for 2000–2010.

### Inclusion and classification criteria

The analysis encompassed squamous cell carcinomas (*in-situ*, invasive, infiltrating, and differentiating) and sarcomas. These cancers were previously examined in a retrospective analysis of cervical cancer in the Dutch Caribbean Antilles (1983–1998) and in electronic database statistics (Surveillance, Epidemiology, and End Results, SEER) in the United States, where various diagnoses of carcinomas of the cervix were compared (24, 25). Prevalence of cervical lesions was estimated using cytological data from Pap smears. Low-grade dysplasia (cervical intraepithelial neoplasia, CIN, grade I/II), severe dysplasia (CIN III) and prevalence of cervical cancer were recorded from logbook records, using classifications based on the Bethesda System of histopathology and cytology (26).

Cervical lesions were categorized by age group, grade, and type. A similar model was previously used to analyze cervical lesion prevalence in the Dutch Antilles (1983–1998) (24). Reports of colposcopic-directed cervical biopsies and endocervical curettings, qualifying statements of cervical lesions and squamous intraepithelial (SIL) changes were collected from surgical records. A similar categorization and analysis was previously used in a study of cervico-vaginal Pap smears in girls under 18 in Barbados (1995–1999) (27).

### Data management

A comprehensive database was created and all data were standardized and categorized by lesion type and age group. All samples were classified by organ site and coded for severity on a scale from 0–4, with "0" being no indicator or least severe and "4" being cancer. Where a patient had multiple listings, one record was entered per organ site, representing the earliest year in which that patient received their most severe diagnosis for that site.

Entries with duplicate names were cross-matched and re-verified with documentation from the logbooks, individual sample sheet records, formal hard-copy typed lab results, and cytology record cards where available. Data were divided into three equal spreadsheets and checked by three coders to minimize interpretation error. This process was repeated twice to verify data accuracy and correct errors.

Of the 12 012 entries, 9 023 were female. Some represented multiple visits by a single individual; in total, 7 172 females between the ages of 0 and 99 years were represented. For the selected sample, ages

ranged from 8–94 years. Records were de-identified and given random identification numbers. Allowing one diagnosis per patient per organ location resulted in 2 527 relevant histopathology logbook entries for inclusion in the study (see Figure 1).

Two hundred and four cervical cancer cases identified in the secondary review were matched to corresponding patient data from death registries collected from the Ministry of Health and used to calculate associated mortality rates. Mortality data were obtained for the period from January 1, 2000 to December 31, 2010. Data were cross-referenced with de-identified data from the logbooks to create an electronic file and identifier list. This sampling methodology follows similar previous work (19, 24, 26, 27).

### Statistical analysis

This study reports 95% confidence intervals (CIs); the margin of error for proportions used in hypothesis testing is +/– 1.2%. The significance level is set at $\alpha = 0.05$, as used in an analysis of cancer prevalence and mortality for Grenada in the previous decade (19). All reported rates were adjusted with reference to the World Standard Population to obtain age-standardized rates (ASRs) per 100 000 persons per year (28, 29). Prevalence rates for cervical cancer and mortality due to cervical cancer were compared to incidence rates reported for the greater Caribbean region and the world.

### Ethical review

Approval was obtained prior to the study from the St. George's University Human Subjects Institutional Review Board (IRB) [No. 12 005] and the Research Oversight Committee (ROC) of the Ministry of Health, Grenada, to ensure the ethical acceptability of this human subjects research.

## RESULTS

From 12 012 records at the Grenada General Hospital in the period from 2000 to 2010, 9 023 female patient entries were identified, representing 7 172 self-selected female patients (ages 8–94 years). Of these, 726 involved cervical lesions (including cancer).

Patients diagnosed with cervical lesions ranged from 12 to 92 years old, with a mean of 44.6 years. Table 1 shows the distribution of cervical diagnoses by severity and age group.

**TABLE 1. Cervical lesions by grade and age group, Grenada, 2000–2010.[a]**

| Age | Low-grade[b] | High-grade[c] | Cancer[d] |
|---|---|---|---|
| 12 – 24 | 20 | 7 | 4 |
| 25 – 34 | 32 | 15 | 37 |
| 35 – 44 | 52 | 30 | 62 |
| 45 – 64 | 56 | 33 | 60 |
| 65+ | 8 | 3 | 41 |
| Total | 168 | 88 | 204 |

***Source:*** Histopathology logbook records, Grenada General Hospital, 2000–2010.

[a] 169 of 726 cervical lesions are not included in the table due to incomplete diagnostic information and inability to sort under one of the above three categories.

[b] Cervical intraepithelial neoplasia (CIN), Grade I/II according to the Bethesda System of Classification (26, 46).

[c] Severe CIN, Grade III according to Bethesda System of Classification.

[d] Cervical cancers.

Of the 726 patients with cervical lesions, 204 were diagnosed as having cancer. Cervical cancer prevalence was highest in 2001, followed by 2000 and 2002 (Figure 2), and in the 35–44 age group, followed by the 45–64 age group (Table 1).

The observed prevalence rate of cervical cancer was 52.4 per 100 000 women aged 15 and above. Combining cervical and uterine cancers, as in the initial incidence study, prevalence was calculated at 74.3 per 100 000, higher than the 60.7 observed during the previous decade for Grenada (19).

Cervical cancer was the primary cause of death in 65 instances during the study period. A majority of these deaths were in women over 65 years old. Of the 65, 21 were identified through hospital records and 44 through death registries. The largest number of deaths was seen in 2008 ($n = 13$), but cervical cancer mortality varied widely over the ten-year period (Figure 3). The observed mortality rate was 16.7 per 100 000, higher than the incidence estimated by WHO for the larger region or than reported for the previous decade (19), (Table 2). Although these rates are not directly comparable, it is clear that cervical cancer and associated mortality is higher in Grenada than in WHO regional estimates.

## DISCUSSION

The objective of this study was to determine the prevalence of cervical cancer and associated mortality in Grenada during 2000–2010. Cervical cancer rates and associated deaths are known to be highest in low- to middle-income countries (30); the burden of disease is disproportionate for these populations (11). Data are lacking on rates of cervical cancer for the Eastern Caribbean, including Grenada. This study observed a cervical cancer prevalence of 52.4 per 100 000 in this population. This is higher than the WHO incidence estimates for the region of 23.6 per 100 000 (Table 2) (11).

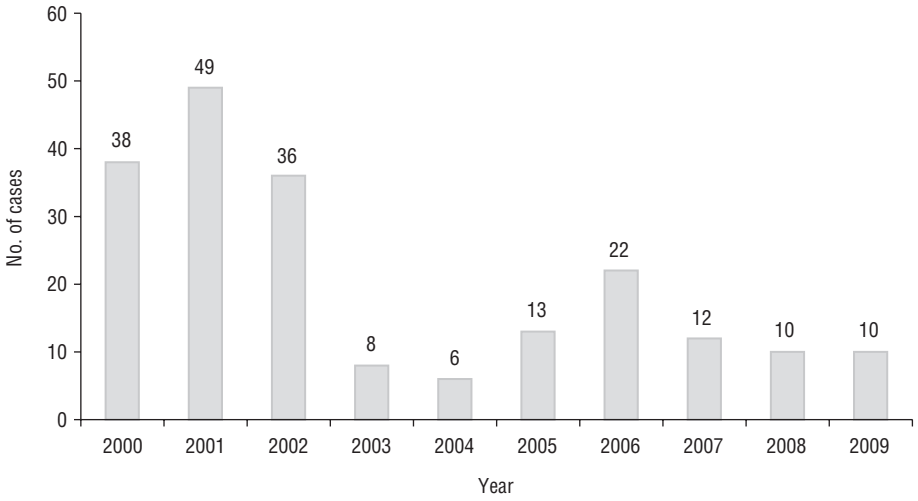
The highest overall prevalence of cervical cancer in this study was in the 35–44 age group, which is typical for disease progression to cancer in this population of women (31). In this study, the youngest individual with invasive squamous cell carcinoma was 19 years old. These results reflect the typical distribution of disease in both developing and developed nations (31, 32). A decline in cervical lesion and cancer prevalence was observed in women over 65 years of age, although they experienced the greatest cancer mortality.

A high incidence of cervical cancer was noted for 2001; this was likely attributable to multiple sensitization efforts about Pap smears and reproductive health conducted during that year, which resulted in the screening of a large number of women. Conversely, in 2004 and 2005, the island experienced hurricanes Ivan and Emily and many of the hospital's resources were redirected to survival efforts and rebuilding communities, resulting in a decrease in screening.

The morbidity associated with high-risk (HR) HPV infections, such as cervical cancer, is much greater when lesions are discovered later in disease progression. Treatment of more-advanced lesions can be quite costly. In some cases, limited financial resources may cause women to defer medical interventions in an effort to provide food and shelter for their dependents (33). However, this phenomenon has primarily been documented in developed countries; no comparable estimates are available for the Eastern Caribbean, which also faces substantial economic burdens (34–38).

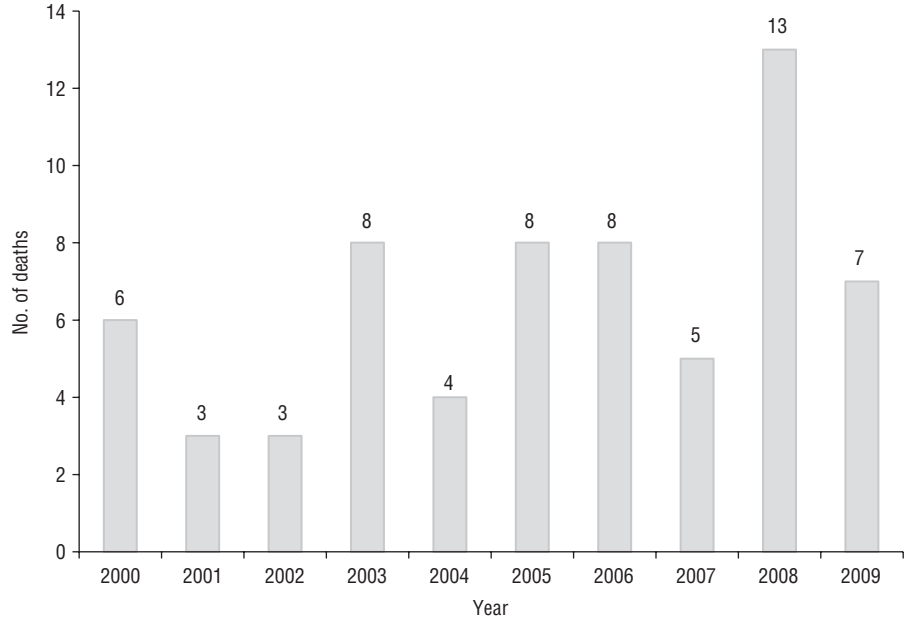
A knowledge and attitudes assessment in the 1990s reported that approximately twenty new cases of cervical and/or uterine cancer were diagnosed per year among Grenadian women (unpublished data, 39). This was not observed in the current study, where new cancer cases varied widely over the ten-year period, largely coinciding with times when screening efforts were implemented and emphasized. Cervical and uterine cancer incidence rates from 1990 to 2000 were estimated at 60.7 per 100 000 in a previous study in Grenada. This study by Asulin *et al.* featured

**FIGURE 2. Prevalence of cervical cancer in Grenada, 2000–2010 (*n* = 204).**




***Source:*** Histopathology logbook records, Grenada General Hospital, 2000–2010.

**FIGURE 3. Annual cervical cancer mortality in Grenada, 2000–2010 (*n* = 65).**




***Source:*** Histopathology logbook records, Grenada General Hospital, 2000–2010.

**TABLE 2. Age-standardized rates of cervical cancer and associated mortality.[a,b]**

| | World | Developing Countries | Developed Countries | Caribbean | Grenada |
|---|---|---|---|---|---|
| Cervical Cancer | 15.1 | 15.6 | 13.0 | 23.6 | 52.4 |
| Mortality | 7.6 | 8.1 | 5.5 | 10.6 | 16.7 |

***Source:*** Figures for Grenada from current study based on histopathology logbook records, Grenada General Hospital, 2000–2010. All other figures from WHO 2015 Human Papillomavirus and Related Diseases Report - World (15, 28).

[a] Rates are per 100 000 women.

[b] Rates for Grenada represent prevalence, all other rates represent incidence.

a relatively small sample size, combined cervical and uterine cancer diagnoses, and sampled only five years out of the ten-year period (19). The current study observed a cervical cancer prevalence in Grenada of 52.4 per 100 000 women for 2000–2010, higher than estimated WHO incidence rates for the region (Table 2). Combined cervical and uterine cancer prevalence was estimated at 74.3 per 100 000. Due to differences in study design, the current results are not directly comparable with Asulin *et al.* (19).

A total of 65 cervical cancer deaths were observed during the study period; the overall cervical cancer mortality rate was 16.7 per 100 000 women. This is nearly twice the rate calculated for 1990–2000, and is also higher than global (7.6) and developing countries (8.1) rates from the WHO (Table 2) (11, 19). The rates for the previous decade may not be truly representative due to small sample size (as noted above, these two studies cannot be directly compared). The WHO estimates cervical cancer mortality for the Caribbean at 10.6 per 100 000. This study finds prevalence rates in Grenada nearly twice as high as in developing countries and globally, and almost four times the rate reported for a similar ethnic group in the United States, highlighting the severity of disease and the burden associated with cervical cancer in Grenada.

Cervical cancer screening has been shown to be simple to perform, fast, and inexpensive, and has significantly contributed to disease reduction where effectively implemented (5, 39, 40–41). Historically, women in the Caribbean (including Grenada) have not participated in routine Pap tests. One regional study from Jamaica indicated that 90% of women who died of cervical cancer were never screened, and most women who had heard of the Pap smear believed it was for the sole "purpose of detecting rather than preventing cervical cancer" (42, 43). Screening options such as the Pap smear are available in Grenada and cost-free in outpatient clinics. In spite of this, many women do not go in for regular visits or consultations due to stigmas and taboos associated with pelvic examinations and disease affecting the genital region (32, 44); this could, in part, explain the high rates of cervical cancer observed in this study.

Limitations of this study include the potential for misclassification of mortality arising from variations in the interpretation and reporting of causes of death by physicians on death certificates (45). Moreover, the return to Grenada of retirees from the baby-boomer generation and the fact that some locally-diagnosed patients leave Grenada to pursue treatment abroad, could each affect the accuracy of estimates of cervical cancer and associated mortality. Another limitation is the lack of a random sample of the

population, as data was retrospectively gathered from records of patients seeking medical care. Accordingly, these results may not accurately represent the general population of women in Grenada; cervical cancer rates may be different than observed in this assessment. Despite these limitations, the cervical cancer prevalence and associated mortality rates presented in this study, abstracted from all available handwritten documentation on the island, are novel for Grenada.

## Conclusions

The prevalence of cervical cancer and associated mortality during 2000–2010 in Grenada are considerably higher than in both developed countries and in WHO estimates for the region. With more than 50% of Grenada's population at risk, it is of vital importance to promote and encourage awareness, cervical cancer screening, education, and uptake of vaccination programs. The onus lies on policymakers, healthcare providers and researchers in Grenada to create a comprehensive screening and prevention program to reduce cervical cancer and its devastating effects.

If left unaddressed, the current situation could have profound implications for the quality and sustainability of life of women in Grenada. An effective, active screening and vaccination program should be introduced as quickly as possible. HR-HPV testing and HPV vaccination are not yet available in Grenada; implementation of both these cervical cancer reduction measures should be a priority. Additionally, adding measures to ensure patient compliance and cervical lesion/disease management, and introducing more qualified specialists on the island to provide expert consultations for advanced stage disease would help reduce the current burden of cervical disease. Together, these policy measures would reduce the future burden of HPV-associated disease, including cervical cancer, and its associated healthcare costs in Grenada.

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**Conflicts of interest.** None.

**Disclaimer.** Authors hold sole responsibility for the views expressed in the manuscript, which may not necessarily reflect the opinion or policy of PAJPH and/or PAHO/WHO.

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**RESUMEN**

## Prevalencia del cáncer cervicouterino y mortalidad asociada en Granada, 2000-2010

***Objetivo.*** Evaluar la prevalencia del cáncer cervicouterino y la mortalidad asociada en Granada, Antillas Menores, entre el 2000 y el 2010.

***Métodos.*** Se obtuvieron los registros de las visitas al hospital y a consultorios clínicos a partir del laboratorio de histopatología del Hospital General de Granada. Se borraron los datos personales de los registros y se los compiló electrónicamente. La prevalencia de cáncer cervicouterino se evaluó por medio del análisis transversal de estos datos secundarios. De un total de 12 012 registros, fueron seleccionados para el análisis 2 527 mediante un método de muestreo sin reemplazo. Los casos se compararon con los datos correspondientes de pacientes en los registros de defunciones, cuando fue posible, y se usaron para calcular las tasas de mortalidad asociadas.

***Resultados.*** La prevalencia observada de cáncer cervicouterino fue 52,4 por 100 000 mujeres (de 15 años o más). Las tasas más elevadas de cáncer cervicouterino se observaron en el grupo de edad de 35 a 44 años, seguido por el grupo de 45 a 64 años. Del 2000 al 2010, 65 defunciones fueron atribuibles al cáncer cervicouterino, más del 50% en mujeres mayores de 65 años. La tasa de mortalidad observada fue 16,7 por 100 000, casi el doble de la calculada por la Organización Mundial de la Salud para la región.

***Conclusiones.*** Este estudio indica la necesidad de establecer un programa integral de detección del cáncer cervicouterino en Granada. Los resultados deben servir como base para estudios futuros sobre cómo generar y ejecutar apropiadamente políticas de salud pública para la educación en la materia, la detección, la prevención y el control del cáncer cervicouterino en Granada.

**Palabras clave** Infecciones por papillomavirus; políticas públicas de salud; cuello del utero; lesiones intraepiteliales escamosas de cuello uterino; neoplasias del cuello uterino; Grenada.