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Age Differences in Hysterectomy-Corrected Cervical Cancer Incidence Trends in Puerto Rico, 2001-2023

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Introduction

Puerto Rico (PR) has among the highest cervical cancer incidence rates in the US (11.5 vs 7.5 cases per 100 000 women).[1] From 2001 to 2019, late-stage cervical cancer incidence increased in PR 4.5% annually, evidencing that increasing trends were not solely explained by early detection.[2] Despite high human papillomavirus (HPV) vaccination (77.0% among 13- to 17-year-olds) and screening uptake (79.3%),[3,4] PR remains far from achieving the World Health Organization cervical cancer elimination goal (≤4 cases per 100 000 women). We evaluated hysterectomy-corrected and uncorrected cervical cancer incidence trends in PR.

Methods

This cross-sectional study analyzed data from 2001 to 2023 from the PR Central Cancer Registry database. Cervical cancer cases were identified using the *International Classification of Diseases for Oncology, Third Edition* (site codes C53.0-C53.9; histology codes 8010-8671 and 8940-8941). Incidence rates were hysterectomy corrected and age standardized to the US 2000 population. Hysterectomy prevalence was obtained from the Behavioral Risk Factor Surveillance System (eMethods in Supplement 1). Joinpoint Regression Program software version 5.4.0.0 (National Cancer Institute) was used to estimate average annual percentage change (AAPC) and annual

+ Supplemental content

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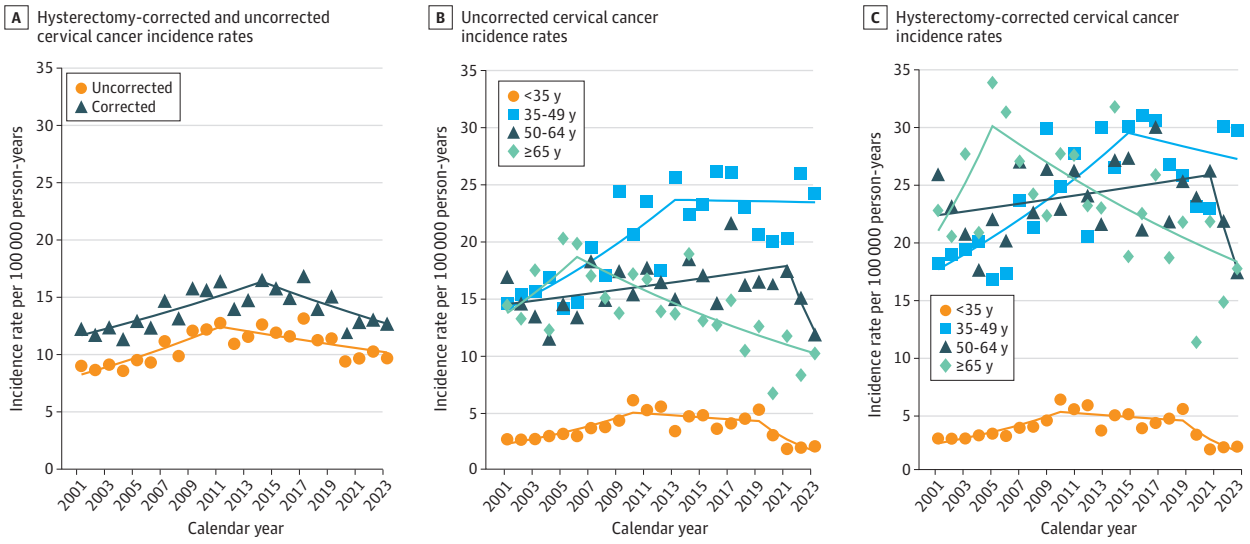
Figure. Scatter Plots of Cervical Cancer Incidence Trends Among Women in Puerto Rico Overall and by Age at Diagnosis, 2001 to 2023



Plots show overall cancer incidence rates (A), uncorrected incidence rates (B), and hysterectomy-corrected incidence rates (C).

percentage changes (APCs). Analyses were conducted in February 2026, and statistical significance was defined as 2-sided $P < .05$ using the empirical quantile method. The University of PR Comprehensive Cancer Center institutional review board approved this study as exempt because deidentified data were used. This study follows the STROBE reporting guidelines.

Table. AAPCs and APCs of Cervical Cancer Incidence Rates in Puerto Rico, 2001-2023[a]

Age group and time frame	AAPC (95% CI)	*P* value	APC (95% CI)	*P* value
Hysterectomy corrected				
Overall				
2001-2023	0.4 (−0.5 to 1.2)	.29	NA	NA
2001-2014	NA	NA	2.6 (1.5 to 4.9)	<.001
2014-2023	NA	NA	−2.7 (−6.5 to −0.8)	.01
<35 y				
2001-2023	−1.5 (−3.6 to 0.5)	.13	NA	NA
2001-2010	NA	NA	8.5 (4.9 to 25.3)	.02
2010-2019	NA	NA	−1.7 (−6.0 to 4.7)	.44
2019-2023	NA	NA	−20.2 (−44.7 to −8.6)	.003
35-49 y				
2001-2023	2.0 (0.6 to 3.8)	.006	NA	NA
2001-2015	NA	NA	3.7 (2.3 to 20.0)	.01
2015-2023	NA	NA	−1.0 (−17.2 to 2.1)	.57
50-64 y				
2001-2023	−1.1 (−3.5 to 2.6)	.38	NA	NA
2001-2021	NA	NA	0.7 (−3.4 to 32.0)	.25
2021-2023	NA	NA	−17.4 (−38.4 to 2.1)	.19
≥65 y				
2001-2023	−0.6 (−2.9 to 1.9)	.45	NA	NA
2001-2005	NA	NA	9.4 (−1.5 to 48.0)	.14
2005-2023	NA	NA	−2.7 (−12.4 to −1.2)	.03
Uncorrected				
Overall				
2001-2023	0.9 (0.3 to 1.6)	.01	NA	NA
2001-2011	NA	NA	4.1 (2.7 to 6.4)	<.001
2011-2023	NA	NA	−1.6 (−3.2 to −0.5)	.006
<35 y				
2001-2023	−1.4 (−3.5 to 0.5)	.14	NA	NA
2001-2010	NA	NA	8.7 (5.1 to 24.6)	.02
2010-2019	NA	NA	−1.7 (−5.8 to 4.7)	.43
2019-2023	NA	NA	−20.1 (−44.1 to −8.8)	<.001
35-49 y				
2001-2023	2.3 (1.0 to 3.8)	<.001	NA	NA
2001-2013	NA	NA	4.4 (2.7 to 17.7)	.003
2013-2023	NA	NA	−0.1 (−12.3 to 2.0)	.85
50-64 y				
2001-2023	−0.8 (−2.2 to 1.2)	.35	NA	NA
2001-2021	NA	NA	1.0 (0.0 to 8.3)	.05
2021-2023	NA	NA	−17.6 (−29.7 to 0.1)	.06
≥65 y				
2001-2023	−1.3 (−2.2 to 0.8)	.14	NA	NA
2001-2006	NA	NA	6.3 (−1.5 to 35.5)	.16
2006-2023	NA	NA	−3.5 (−9.8 to −2.1)	.02

Abbreviations: AAPC, average annual percentage change; APC, annual percentage change; NA, not applicable.

[a] Puerto Rico's 2017 incidence counts and rates are based on the first 6 months of reported data coupled with half of the population estimate (January to June 2017). Data from July to December 2017 are excluded to account for the population shift that occurred due to Hurricane Maria. Because of the impact of COVID-19, the 2020 incidence data are excluded from APCs.

Results

Overall, 4636 cervical cancer cases were diagnosed in PR between 2001 and 2023 (median [IQR] diagnosis age, 49 [38-63] years). Annual hysterectomy-corrected incidence rates surpassed 11.5 cases per 100 000 women from 2001 to 2023. The AAPC for hysterectomy-corrected cervical cancer incidence from 2001 to 2023 was 0.4% (95% CI, −0.5% to 1.2%), and that for noncorrected cervical cancer was 0.9% (95% CI, 0.3% to 1.6%). In age-stratified analysis, a significant increase was observed among women aged 35 to 49 years (AAPC, 2.0%; 95% CI, 0.6% to 3.8%), while stable trends were observed for other age groups (**Figure**).

For the APCs (**Table**), a significant annual 2.6% increase (95% CI, 1.5% to 4.9%) in cervical cancer incidence was observed from 2001 to 2014, followed by a significant annual −2.7% decrease (95% CI, −6.5% to −0.8%) from 2014 to 2023. Among women younger than 35 years, incidence rates significantly increased from 2001 to 2010 (APC, 8.5%; 95% CI, 4.9% to 25.3%), followed by a stable trend from 2010 to 2019 (APC, −1.7%; 95% CI, −6.0% to 4.7%), and a marked significant decrease from 2019 to 2023 (APC, −20.2%; 95% CI, −44.7% to −8.6%).

Among women aged 35 to 49 years, hysterectomy-corrected incidence rates increased significantly 3.7% annually from 2001 to 2015 (95% CI, 2.3% to 20.0%), and then remained stable from 2015 to 2023. Among women aged 50 to 64 years, incidence rates showed stable trends throughout the study period. For women aged 65 years or older, incidence rates were initially stable, followed by a significant decrease during 2005 to 2023 (APC, −2.7%; 95% CI, −12.4% to −1.2%).

Discussion

This cross-sectional study found declines in cervical cancer incidence in PR since 2014, particularly among women younger than 35 years since 2019, possibly in association with HPV vaccination efforts. Vaccination was approved by the US Food and Drug Administration and became available in the US and PR in 2006. In PR, Act No. 9 (2010) required private health insurers to cover HPV vaccination for adolescents aged 11 to 18 years, and a school-entry requirement for children aged 11 to 12 years was implemented in 2018.[5]

The increasing cervical cancer incidence among women aged 35 to 49 years observed between 2001 and 2023 is of public health concern and underscores the need to assess adherence to screening and timely follow-up care. According to Behavioral Risk Factor Surveillance System data, screening uptake in PR has remained stable over time (79.3%), despite some disruptions in health services caused by 2017 hurricanes and the 2020 COVID-19 pandemic.[2,3] However, these events, along with a decrease in the number of gynecologists in PR, may have affected follow-up care.[6]

Limitations include lack of individual-level information on HPV vaccination and cervical cancer screening; study strengths include the estimation of population-based and hysterectomy-corrected incidence rates. In conclusion, these findings show that overall cervical cancer incidence trends are stabilizing in PR. The decline among women younger than 35 years is consistent with HPV vaccination uptake, while increases among women aged 35 to 49 years warrant public health interventions. Continued surveillance is essential to monitor disease burden and prevention strategies.

ARTICLE INFORMATION

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Supervision: Ortiz.

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SUPPLEMENT 1.

eMethods.

SUPPLEMENT 2.

Data Sharing Statement