Clinical and Economic Impact of Human Papillomavirus Vaccination in 19- to 25-Year-Old Women Insured by Medicaid in the US

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INTRODUCTION

- Human papillomavirus (HPV) infections can lead to cervical intraepithelial neoplasia (CIN) and subsequent cervical cancer (CC)[1]
- There were an estimated 12,200 new CC cases and 4,210 related deaths in the United States (US) in 2010[1]
- The annual cost of cervical cancer in the US is estimated at $171.9 million[2,3]
- Papanicolaou (Pap) test screening has been shown to be effective in reducing cervical cancer incidence and related mortality[4]
- HPV vaccination can potentially reduce cervical disease and related healthcare costs
- Prior research on the potential impact of HPV vaccination in the US has concentrated largely on preadolescent females and has not yet thoroughly examined subpopulations that may be at higher risk

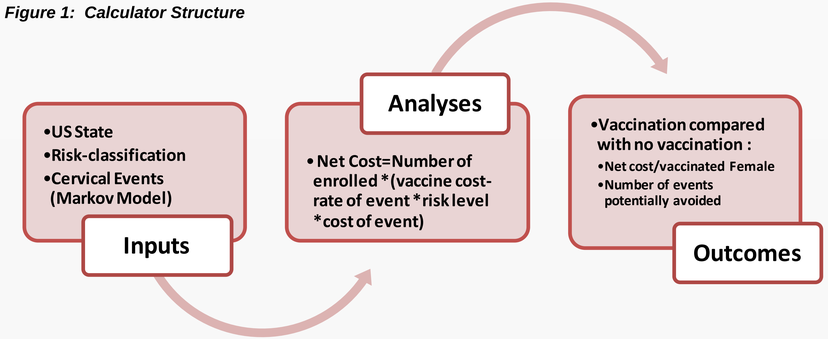
OBJECTIVE

- To estimate lifetime medical cost offsets associated with HPV vaccination in 19- to 25-year-old US females covered by Medicaid

METHODS

- A cost calculator was developed to evaluate HPV vaccination versus no vaccination nationwide (Figure 1)
- Lifetime rates of cervical events were obtained from a previously built Markov model of HPV infection and subsequent cervical disease; event rates and costs[5] ($US2009) are presented in Table 1
- States were categorized as low-, medium-, or high-risk based on cervical cancer incidence data from the National Cancer Institute[6] (Table 2); cervical events were adjusted based on states' risk classifications (0.8 for low-, 1.0 for medium-, and 1.2 for high-risk)
- Number of females enrolled in Medicaid by state were identified in the Medicaid Statistical Information System State Summary Datamart, supported by the Centers for Medicare & Medicaid[7]
- Primary study outcomes included net cost/vaccinated female (vaccination cost – discounted medical cost offset) and events potentially avoided with vaccination

Figure 1: Calculator Structure



METHODS continued

- Vaccine was assumed to provide 92.9% efficacy against infection with HPV types 16/18 and 37.4% cross-protection against 12 other high-risk HPV types;[8] in the more recent end of study analysis, higher vaccine efficacy estimates have been observed[9]
- Vaccine cost ranged from $132 to $168 per dose[10]
- 100% coverage for a 3-dose vaccination series and lifetime protection were assumed

Table 1: Clinical event costs and incidence rates per 1,000 women by vaccination status

Event	Cost	Rate per 1,000	
		Vaccination	No Vaccination
Abnormal Pap smear	$963	893	1,044
CIN1	$1,820	56	73
CIN2	$4,080	38	49
CIN3	$4,080	44	56
Cervical cancer incidence	$33,231	1	3
Cervical cancer mortality	N/A	0.35	0.62

Table 2: US states classified by risk of cervical cancer incidence

Risk Classification	US States
Low-risk	Alaska, Arizona, Colorado, Hawaii, Idaho, Iowa, Michigan, Minnesota, Montana, New Hampshire, North Dakota, Oregon, South Dakota, Utah, Vermont, Virginia, Washington
Medium-risk	Alabama, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Kansas, Maryland, Massachusetts, Missouri, Nebraska, Nevada, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Wisconsin
High-risk	Arkansas, District of Columbia, Kentucky, Louisiana, Maine, Mississippi, New Jersey, New Mexico, Rhode Island, Texas, West Virginia, Wyoming

RESULTS

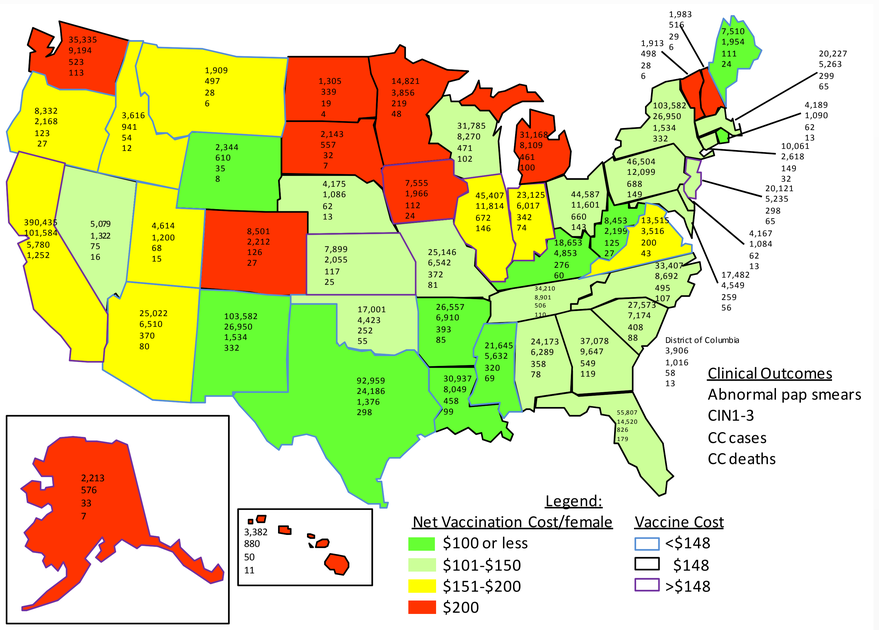
- States with the lowest, median, and highest number of events avoided were North Dakota, Oklahoma, and California, respectively (Table 3 and Figure 2)

Table 3: Clinical events potentially avoided with vaccination

Event	Minimum (ND)	Median (OK)	Maximum (CA)
Abnormal Pap smear	1,305	17,001	390,435
CIN1	136	1,770	40,649
CIN2	88	1,148	26,361
CIN3	96	1,254	28,793
Cervical cancer incidence	19	252	5,780
Cervical cancer mortality	4	55	1,252

RESULTS continued

Figure 2: Events potentially avoided, vaccine cost, and net cost of vaccination by US state



- Eleven states had a net cost of vaccination less than $100 (Figure 2)
- Net cost per vaccinated female ranged from $36 to $255 depending on vaccine cost and risk
- States with low net costs were those with either low vaccine costs, high risk of cervical cancer, or both

CONCLUSIONS

- Widespread HPV vaccination has the potential to substantially reduce the clinical and economic burdens associated with HPV-related cervical disease in women insured by Medicaid
- Benefits are greatest in states classified as high risk for cervical cancer

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