Cervical Cancer Prevention through Human Papillomavirus (HPV) Vaccination: A Case Study in Ethiopia

Kelly Lenahan, MPH[1,2], Antoinette M. Stroup, PhD[2,3], Kitaw Demissie, MD, PhD[4]

[1]ISPOR, Lawrenceville, NJ, USA
[2]Rutgers School of Public Health, Department of Biostatistics and Epidemiology, Piscataway, NJ, USA
[3]Rutgers Cancer Institute of New Jersey, Cancer Prevention and Control Program, New Brunswick, NJ, USA
[4]SUNY Downstate Health Sciences University, Brooklyn, NY, USA

INTRODUCTION

- Human papillomaviruses (HPV) are key causal agents for cervical cancer, responsible for 99% of all cervical cancers.

- Cervical cancer is the 4th most common cancer in women globally and the 2nd most common cancer in women in Ethiopia.

- **About 31.5 million women in Ethiopia are at risk of contracting HPV and about 70% of women diagnosed with cervical cancer die from the disease.**

- Both primary and secondary prevention of HPV is available through HPV vaccinations and Papanicolaou (Pap) testing (with and without HPV DNA testing) and visual inspection with acetic acid (VIA).

- The World Health Organization (WHO), recommends a 2-dose HPV vaccination be started in females aged 9-13, prior to the onset of sexual activity.

- The older a female is, the more likely it is that she has been exposed to HPV, and thus the HPV vaccine is less effective (age contamination).

- **This study aimed to estimate (1) the number and percent immune and (2) the number of cervical cancer cases that may be averted after implementing a population-based HPV vaccination program in Ethiopia.**

Figures 1 and 2: Ethiopia Location and Locations of Pilot Programs

METHODS

- Adapted from a 2014 study by Frost et al.[1]

- Data came from previously published literature, WHO, and CDC.

- Immunity was calculated based on the number of vaccines on average a woman receives (32% receive 1 dose, 22% receive 2 doses, 46% receive 3 doses), the efficacy of each dose (1 dose is 80%, 2 doses is 89%, 3 doses is 99%), and age contamination.

- The equation to calculate % immunity is:

$$\frac{\sum V_\% P_C A[(D_1 * 0.32) + (D_2 * 0.22) + (D_3 * 0.46)]}{P_T}$$

Where:

$V_\%$ = percent of girls vaccinated P_c = 5-year cohort population
A = Age Contamination D_1 = Efficacy of 1 dose
D_2 = Efficacy of 2 doses D_3 = Efficacy of 3 doses
P_T = Population of total cohort

- Used three different approaches to estimate the number of cervical cancer cases that may be prevented each year, using a basic formula identified by Van Kriekinge et al.[2]
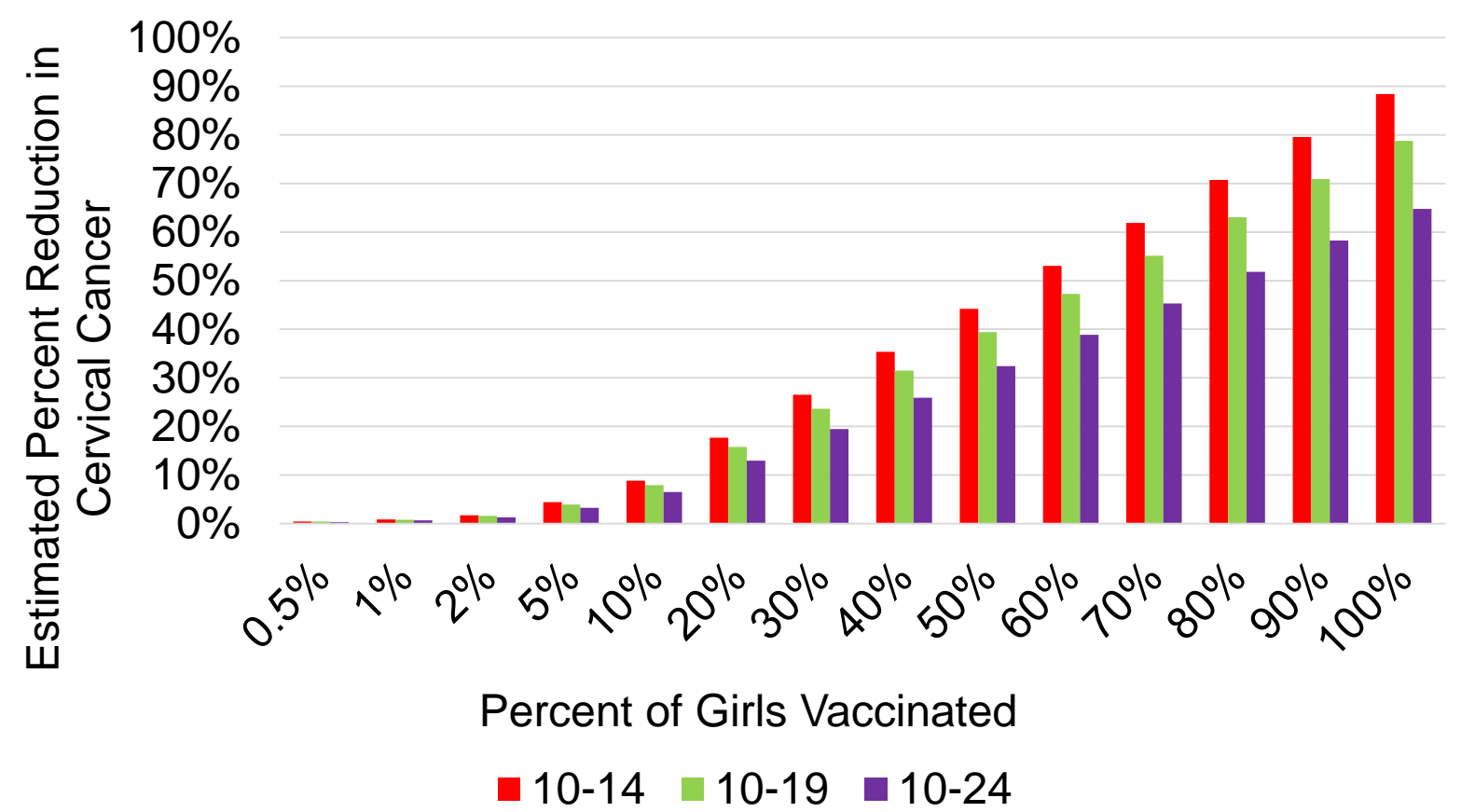
$$CC\ Prevented = CC_A V_\% V_e$$

Where:

CC Prevented = Number of cervical cancers prevented
CC_A = Annual number of cervical cancers diagnosed
$V_\%$ = percent of girls vaccinated
V_e = vaccine effectiveness

RESULTS

Figure 3: Estimated percent Immune from HPV Infections in Ethiopia for 3 Age Cohorts at Varying Rates of HPV Vaccination

- For girls aged 10-14 in Ethiopia, the range of the population who would be effectively immune to HPV infections would be estimated between 29,543 (0.5% vaccinated, 0.44% immune) to more than 5.9 million (100% vaccinated, 88.40% immune).

- The percent immunity declines in higher age cohorts due to age contamination.

Figure 4: Estimated Percent of Incident Cervical Cancer Cases Averted by Varying HPV Vaccination Effectiveness
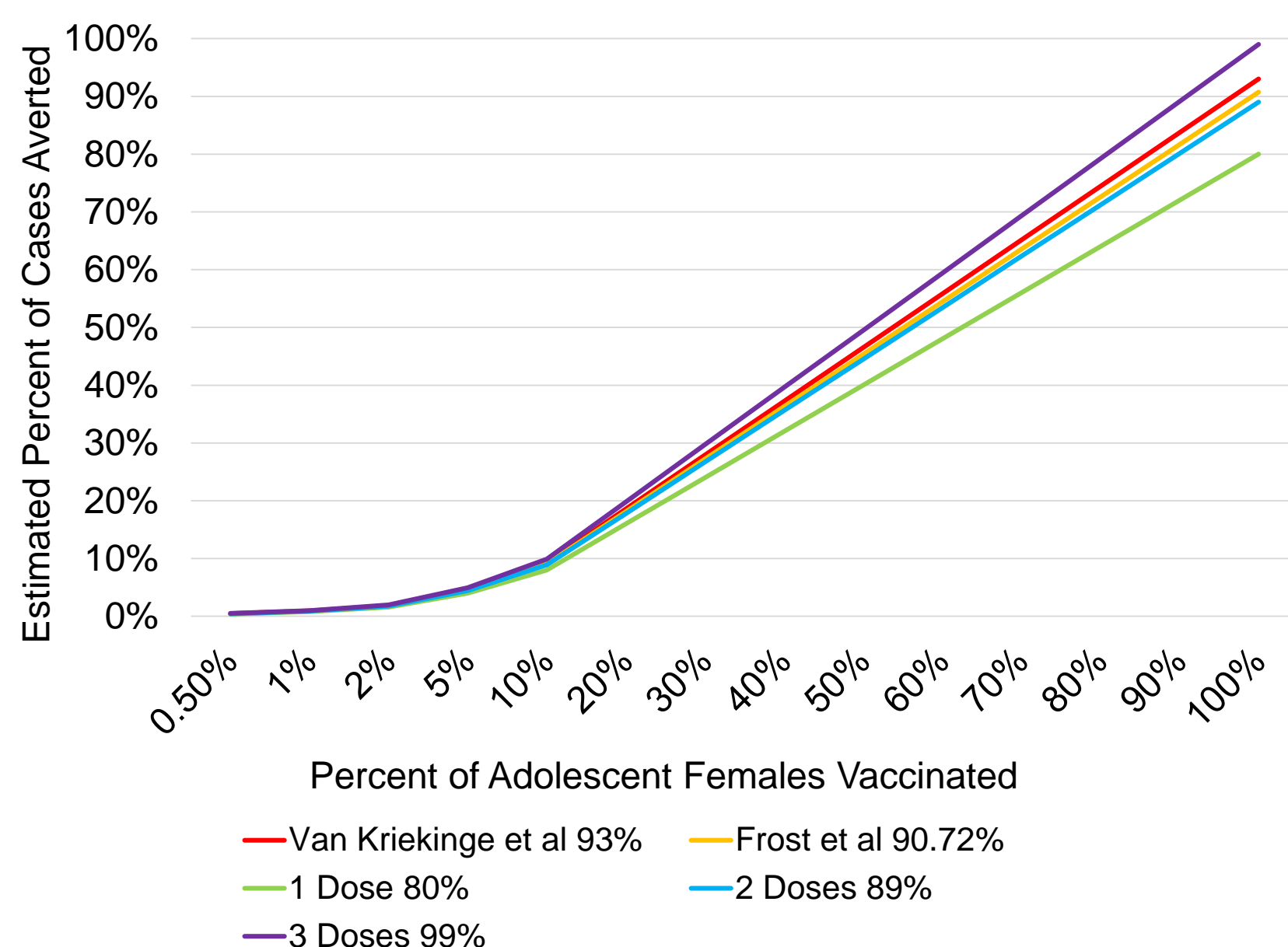
- The percent of incident cervical cancer cases averted varies based on the percent of population vaccinated. The higher the percentage of population vaccinated; the greater percentage of cervical cancer cases are averted.

LIMITATIONS

- Case study is based on steady-state conditions and uses data derived from the US, which may not hold in Ethiopia. Data for Ethiopia is limited outside of the large cities, which makes it challenging to calculate deaths averted as cervical cancer cases are expected to be under reported

- The uptake of the vaccine in Ethiopia may be low due to cultural differences in sexual practices or due to mistrust of modern medicine in the rural villages

- Limited to the effects of the HPV vaccine in females

CONCLUSION

Based on the calculations, the implementation of a full HPV vaccination program in Ethiopia will result in a significant reduction in cervical cancer cases. More cancer cases are averted with higher vaccination rates in the population. It is important to vaccinate women at a younger age to prevent HPV infection.

REFERENCES

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