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Application of the Carolina Framework for Cervical Cancer Prevention

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HIGHLIGHTS

- We present 2 applications of Carolina Framework for Cervical Cancer Prevention, which outlines 4 causes of cervical cancer incidence.
- North Carolina counties varied on cervical health indicators, but 2 high-need regions emerged.
- Key informants recommended improvements to existing programs and policies.

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ABSTRACT

Objective. The Carolina Framework for Cervical Cancer Prevention describes 4 main causes of cervical cancer incidence: human papillomavirus (HPV) infection, lack of screening, screening errors, and not receiving follow-up care. We present 2 applications of the Carolina Framework in which we identify high-need counties in North Carolina and generate recommendations for improving prevention efforts.

Methods. We created a cervical cancer prevention need index (CCPNI) that ranked counties on cervical cancer mortality, HPV vaccine initiation and completion, Pap smear screening, and provision of Pap tests to rarely- or never-screened women. In addition, we conducted in-depth interviews with 19 key informants from programs and agencies involved in cervical cancer prevention in North Carolina.

Results. North Carolina's 100 counties varied widely on individual CCPNI components, including annual cervical cancer mortality (median 2.7/100,000 women; range 0.0–8.0), adolescent girls' HPV vaccine initiation (median 42%; range 15%–62%), and Pap testing in the previous 3 years among Medicaid-insured adult women (median 59%; range 40%–83%). Counties with the greatest prevention needs formed 2 distinct clusters in the northeast and south-central regions of the state. Interviews generated 9 recommendations to improve cervical cancer prevention in North Carolina, identifying applications to specific programs and policies in the state.

Conclusions. This study found striking geographic disparities in cervical cancer prevention need in North Carolina. Future prevention efforts in the state should prioritize high-need regions as well as recommended strategies and applications in existing programs. Other states can use the Carolina Framework to increase the impact of their cervical cancer prevention efforts.

Introduction

Cervical cancer mortality in the U.S. has dropped precipitously in the last 60 years, with annual rates falling from 7.9 per 100,000 women in 1950 [1] to 2.4 per 100,000 in 2008 [2], largely due to widespread use of Pap screening [3]. Despite this remarkable achievement, reductions in mortality have slowed in recent years [2], likely due to a plateauing of screening. Over 4000 women still die of this preventable cancer each year [4]. Disparities in cervical cancer mortality include higher rates among African American, Hispanic, low-income women, and rural-dwelling women, especially in Appalachia and on the U.S.-Mexico border [2,4–11]. In addition, states within the U.S. demonstrate wide variation in cervical cancer mortality, ranging from 1.2 per 100,000 women in Utah to 3.8 per 100,000 women in Mississippi [2].

Given stalled progress and persistent disparities in mortality, the time is right for reevaluating and refining approaches to addressing cervical cancer. Toward this end, Cervical Cancer-Free North Carolina, a statewide initiative to reduce the burden of cervical cancer, developed the Carolina Framework for Cervical Cancer Prevention (see Box 1). The Carolina Framework guides prevention efforts by identifying and addressing 4 causes of cervical cancer incidence: human papillomavirus (HPV) infection; lack of cervical cancer screening; screening errors; and

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Box 1
Carolina Framework for Cervical Cancer Prevention.

Public health programs can better prevent cervical cancer by understanding four factors in the Carolina Framework [59,60]. The impact of these factors likely varies by geographic region, but they affect women globally

1. *Human papillomavirus (HPV) infection* is responsible for nearly all cases of cervical cancer [59]. In the U.S., prevalence of HPV infection among women peaks at more than 40% among 20- to 25-year-olds, with decreasing prevalence with older age [61]. Among high-risk populations, including women attending STI clinics or who are HIV-positive, prevalence can be greater than 60% [61]. Two strains of HPV, types 16 and 18, cause 70% of cervical cancer cases [59]. Estimates of the prevalence of these oncogenic types in U.S. women vary by region, and they range from 1.5% to 17.7% (HPV 16) and from 0.2% to 5.3% (HPV 18) [61]. The Centers for Disease Control and Prevention (CDC) recommend that all adolescents ages 11–12 receive HPV vaccine to protect against these strains of HPV [62]. In addition, females up to age 26 and males up to age 21 are eligible for catch-up vaccination if they have not already received the vaccine [63,64]. Unfortunately, rates of vaccination are far below the Healthy People 2020 goal of 80% vaccine completion among adolescent girls ages 13–17 [65]: only 33% of girls and 7% of boys in the U.S. had completed the three-dose vaccine series by 2012 [66]. Among adolescent girls in the U.S. who initiated HPV vaccine, 67% had completed the series (i.e., received all three doses) [66].

2. *Lack of screening* for cervical cancer is responsible for a little over half of new cervical cancers. According to national recommendations, most adult women younger than age 65 should receive a Pap test every three years [67–69]. Targeting women without recent Pap tests is a crucial goal in cervical cancer prevention, as detection of precancerous lesions or cervical cancer using a Pap test is most common among women whose previous test was greater than three years earlier or who had never been screened [19,60,70–73]. Less than three-fourths of all U.S. women have received a timely Pap test [74], and certain subgroups have even lower rates of adherence to this recommendation [16,74]. In North Carolina, 88% of women report receiving a Pap test in the last three years [75], though rates are likely to be much lower given errors in self-report [74]. Particularly at risk for cervical cancer are women who have never received a Pap test [70,76].

3. *Pap screening errors* (false-negative tests) are responsible for around a third of new cervical cancers [72]. Although a Pap test is a powerful screening tool, 23% to 70% of Pap tests in low-risk women fail to detect cervical abnormalities when present [77]. To reduce the number of false negatives, the USPSTF (and other regulatory agencies) recommends co-testing with Pap and HPV DNA tests every 5 years for women ages 30–65 [41]. Unfortunately, HPV DNA tests have higher rates of false-positives and could lead to overdiagnosis [78], so it is important that clinicians follow guidelines that balance the risks of false-positives and false-negatives, such as the USPSTF co-testing recommendation.

4. *Inadequate follow-up care* is responsible for around a tenth of new cervical cancer cases [72]. Most often, this involves women who have received abnormal results on Pap or HPV DNA tests, but who do not receive confirmatory tests or treatment. The causes of loss to follow-up are likely complex but reflect the deeply fractured health care system in the US [19].

not receiving follow-up care. In this paper, we discuss 2 applications of the Framework for prioritizing cervical cancer prevention efforts in North Carolina.

We first used the Carolina Framework to characterize counties in terms of prevention need. We next used the Carolina Framework to identify recommendations for improving cervical cancer prevention in North Carolina. In this way, we aim to demonstrate practical applications of the Carolina Framework for guiding prevention efforts that will ultimately reduce the burden of cervical cancer.

Methods

Application 1. Prioritizing counties by cervical cancer prevention need

To understand the range of cervical cancer prevention need among the 100 counties in North Carolina, we selected 5 indicators based on the Carolina Framework and availability of data.

Data sources

Cervical cancer mortality. The North Carolina State Center for Health Statistics provided age-adjusted annual cervical cancer mortality rates per 100,000 women for each of the state's 100 counties for the period from 1998 to 2007 [4]. We chose to focus on cervical cancer mortality instead of incidence because incidence is subject to several well-known biases [12,13].

HPV vaccination (initiation and completion). The North Carolina Immunization Registry (NCIR) (http://www.immunize.nc.gov/providers/ncir.htm) is an electronic database that over 90% of the state's primary care providers use to document vaccination. The North Carolina Immunization Branch provided county-level NCIR data on HPV vaccination among girls, ages 13–17, with active records in the registry. Measures were HPV vaccine initiation (i.e., percentage who received ≥ 1 dose) and completion (i.e., percentage who received 3 doses, among those who initiated). We chose this completion measure, instead of absolute levels of completion, because it does not confound completion with initiation.

Pap test screening among Medicaid-insured women. Community Care of North Carolina (CCNC) provided county-level data on the percentage of Medicaid-insured women, ages 21–64, who received at least 1 Pap test between 2009 and 2011. Previous research has found that Medicaid-insured women are somewhat more likely to receive Pap tests than women with other insurance types [14]. Thus, these data likely overestimate the prevalence of Pap screening among other women in the state, comprising a conservative measure of cervical cancer prevention need. Reliable county-level data on screening among privately-insured women were unavailable.

Pap test screening among women without recent tests. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides cervical cancer screening services to low-income and under- and uninsured adult women who do not have Medicaid, a population with low rates of regular Pap testing [15–17]. The program targets these higher-risk women by requiring that at least 20% of women newly-enrolled in state programs qualify as rarely- or never-screened (i.e., having had no Pap in the previous 5 years). For this study, the North Carolina Breast and Cervical Cancer Control Program (NC BCCCP) provided county-level data from 2010 to 2012 on the percentage of newly-enrolled women who qualified as rarely- or never-screened.

Analysis. We created a cervical cancer prevention need index (CCPNI) that reflected each county's performance on all 5 indicators, with higher scores signifying greater need. For cervical cancer mortality,