Cervical Cancer in North Carolina
Incidence, Mortality and Risk Factors

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THE DECLINE IN CERVICAL CANCER incidence and mortality seen over the past several decades[1] is perhaps one of the success stories of screening and early detection in the field of cancer control. The American Cancer Society estimates that in the United States in 2001 there were 12,900 cases of invasive cervical cancer and 4,400 deaths, representing only 2.0% of incident cancers in women and 1.6% of female cancer deaths.[2] Although no randomized trials have been conducted, observational studies suggest that the introduction of Papanicoloau (Pap) testing is responsible for the decline in cervical cancer incidence.[3, 4] Moreover, the five-year survival rate has not changed significantly since the 1970s, suggesting that the decline in mortality is attributable to the decline in incidence.[1]

Racial disparities in incidence and mortality of cervical cancer are large, but may be decreasing in size. During 1994-1998, the age-adjusted incidence for blacks was 61% higher than for whites, and the age-adjusted mortality 121% higher.[1] However, the rate of decline in incidence and mortality since the early 1980s has been higher for blacks than for whites. Although racial disparities are well documented by surveillance data, research has clearly demonstrated that socioeconomic status is as important if not more so than race in predicting cervical cancer incidence.[5, 6] For example, in one study, working-class, poor white women had a higher incidence than black women in the same socioeconomic strata.[6] Other research suggests that differences in the prevalence of risk factors, including income, education, and sexual activity, between blacks and whites account for most of the differences in rates.[7]

Evidence of disparities in cervical cancer incidence and mortality have led the recently formed Center to Reduce Health Disparities (CRCHD) within the National Cancer Institute to select cervical cancer as its first initiative. Although the morbidity and mortality from cervical cancer is small compared to other cancers, it is a good candidate for addressing the socioeconomic, racial, and geographic issues underlying disparities because the evidence supporting the effectiveness of screening and treatment is strong. As part of our participation in the CRCHD initiative, we undertook analyses of data from both the North Carolina Central Cancer Registry (CCR) and the NC Behavioral Risk Factor Surveillance System (BRFSS) to evaluate state trends in cervical cancer incidence, mortality, and screening.

Methods

Data were obtained from the NC CCR on cervical cancer incidence, mortality, and stage at diagnosis for the years 1990-1997. These data were compared to national estimates from the Surveillance, Epidemiology and End Result (SEER) Program of the National Cancer Institute.[1] North Carolina data were age-adjusted to the 1970 US population, which is the standard used by SEER.

Information on cervical cancer screening was obtained from the North Carolina Behavioral Risk Factor Surveillance System, a state-based telephone survey of a random sample of noninstitutionalized adults of age 18 or older in households with telephones. Two outcomes were examined for female respondents: whether they had had a Papanicolou (Pap) smear in the last three years, and whether they had ever had a Pap smear. Data from each year between 1990-98 were analyzed. In addition, sociodemographic information such as age, race/ethnicity, age, income, and urban vs. rural residence were examined for disparities in screening behavior. Urban residence was defined as residence in the following counties: Buncombe, Cumberland, Davidson, Durham,

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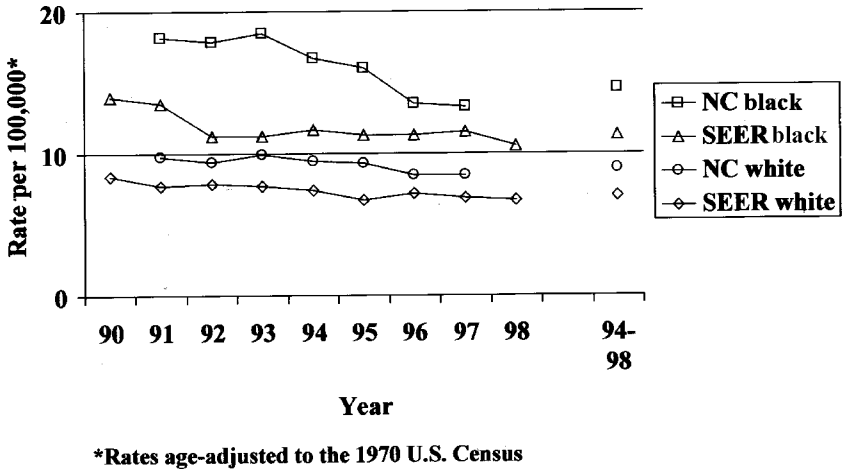


Figure 1. Cervical cancer incidence, by race

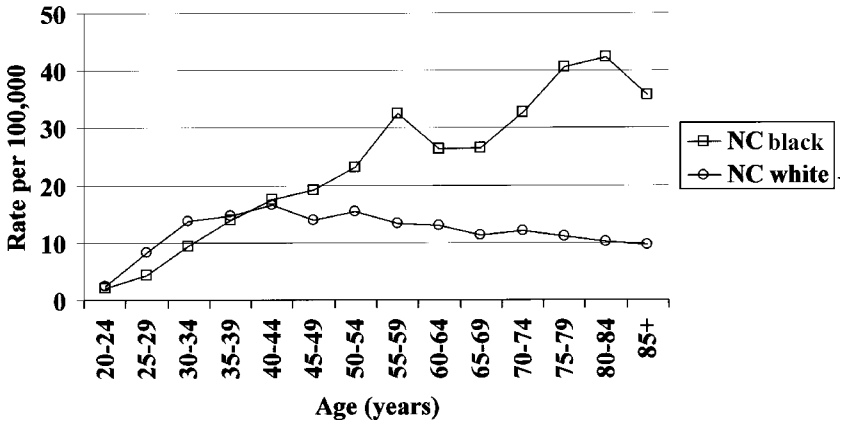


Figure 2. Age-specific cervical cancer incidence, 1994-1998, by race

Forsyth, Gaston, Guilford, Mecklenburg, Onslow, or Wake. Data were weighted and analyzed using SUDAAN (version 7.0) to account for the complex sampling design. Women who reported having had a hysterectomy were excluded from analyses.

In addition, we report on the limited data sources for risk factors for cervical cancer that are relevant to the North Carolina population.

Results

Incidence and Mortality. Nationally and in North Carolina, the rates of cervical cancer are declining. Although NC has higher rates of cervical cancer incidence than the national average (in 1997, 9.3/100,000 for the entire NC population vs. 7.7/100,000 for the US), the rate of decline may be greater in NC and this gap appears to be narrowing. Incidence rates examined separately by race reveal that both in North Carolina and nationally, blacks have much higher incidence rates than whites (Figure 1). The disparity in incidence between blacks and whites appears to be decreasing, however; in 1997, the incidence rate for blacks in NC was 56% higher than that for whites (13.3/100,000 vs. 8.5/100,000) as compared to 86% higher in 1991. The notable decline in cervical cancer incidence among black women is seen mainly in women over age 50 (data not shown).

Examination of age-specific rates (Figure 2) for NC residents show that while white women experience a gradual decline in incidence beyond age 45, black women have an increasing incidence throughout their lifespan. Although SEER data are not shown on this slide, the age-specific incidences for North Carolina are higher than SEER rates for most age and race categories.

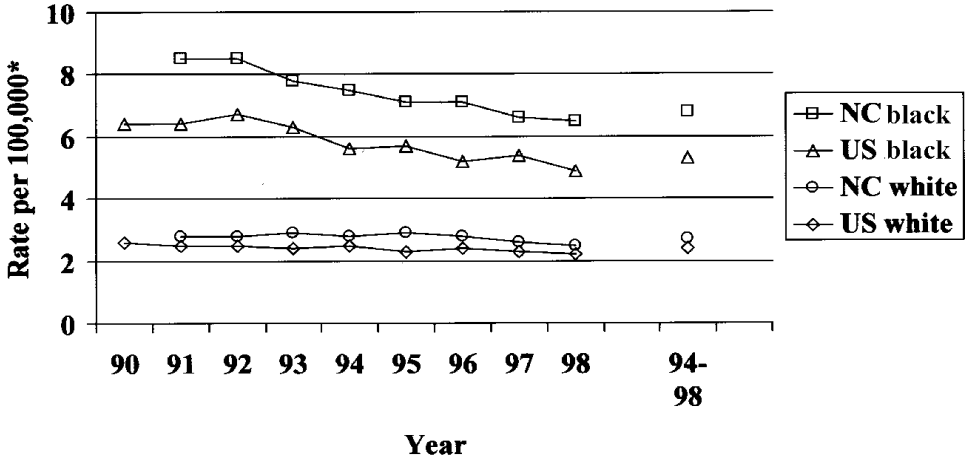
The proportion of women diagnosed at different stages is displayed in Table 1. These proportions are overall similar between NC and SEER; both registries, however, suggest that black women are less likely to have a cancer diagnosed at a local stage versus a regional or distant stage. In addition, black women are more likely to have a stage classified as unknown.

Smaller declines are seen in cervical cancer mortality. Once again, rates in North Carolina are higher than national rates (in 1998, 3.2/100,000 in NC vs. 2.5/100,000 in the US, or 28% higher). Both nationally and in NC, the decline in black mortality seems to account for the overall decline, whereas mortality in white women appears constant (Figure 3). Although the pattern is not as consistent with mortality as with incidence, the decline in black mortality also appears to be predominantly in women over age 50 (data not shown). Age-specific mortality rates, also reflect marked disparities between blacks and whites. Similar to the incidence pattern, black women experience an increase in mortality rates throughout the lifespan. Unlike the incidence pattern, white women also continue to have increasing mortality throughout the lifespan (data not shown).

Screening Behavior. Data from the Behavioral Risk Factor Surveillance System (BRFSS) reveal that, overall from 1990-1999, the proportion of women who report having had a Pap test within the last three years has remained remarkably constant (Table 2). Black women are slightly more likely to report having had a Pap smear, and women who are neither white nor black are the least likely to report having had this test, although these differences are not statistically significant. Other factors that appear to decrease the likelihood of having a Pap smear in the last three years are older age, lower education, lower income, being from a rural area, or being uninsured. These sociodemographic characteristics that are associated with not having a recent Pap test are similar to those seen in national BRFSS data.[8]

Table 1. Stage at diagnosis

	Localized (%)	*Regional* (%)	*Distant* (%)	*Unknown* (%)
North Carolina black	46	41	8	5
North Carolina white	59	30	8	3
SEER black	44	36	9	11
SEER white	56	30	7	6



***Rates age-adjusted to the 1970 U.S. Census**

Figure 3. Cervical cancer mortality, by race

We also examined the proportion of women stating they had ever had a Pap smear (Table 3). This number is very high and has remained essentially constant. Unlike results for the outcome of having had a Pap in the last three years, whites are more likely than blacks to report ever having had a Pap test. Other finding are similar: older age, low education or income, being from a rural area, and being uninsured are all associated with never having had a Pap test.

We performed logistic regression analyses to analyze the independent effects of these factors on the likelihood of ever having a Pap test or having a Pap test in the last three years (Table 4). Among women ages 18-64, having had a Pap test within the last three years was associated with younger age, higher education, having insurance, and having had a recent checkup. In three related models (recent Pap for over age 65, and ever having had a Pap for 18-64 and for over 65), we found similar characteristics to be significant predictors of having a Pap test: younger age (in two of three models), reporting a recent checkup, and having greater than a high school education. Race was not associated in any models with having had a Pap test, and insurance status was not consistently associated.

Risk Factors. Risk factors for cervical cancer are, compared to other malignancies, well understood.[4] Cervical cancer is strongly linked to aspects of sexual behavior and to infection with certain subtypes of the human papilloma virus (HPV). Multiple sexual partners, initiation of sexual activity at an early age, and sexual behavior of the woman's male sexual partners have all been shown to increase the risk of cervical cancer. In addition, use of oral contraceptives is associated with an excess risk, although this may be due to related sexual behaviors or to screening frequency. Tobacco use is also associated with cervical cancer. Other factors are parity, the number of live births, which worldwide is associated with cervical cancer, and possibly nutritional status.[9]

Few data exist on the prevalence of risk factors for cervical cancer, either in NC or for the US.[10,11] BRFSS has included questions on sexual behavior only sporadically in the last decade; however, the Youth Risk Behavior Survey provides an opportunity to measure and track sexual behavior trends among school age youth.[12] Conducted in 1993, 1995, and 1997 by the Department of Public Instruction, it contains questions on sexual behavior and contraception. We examined results from the high school survey (grades 9-12). In this four-year time period, there has been little change in the numbers of students who report sexual activity, and

Table 2. NC women who report having had a Pap smear in the last three years

	# respondents	*# with Pap*	*Percent (95% CI)*
Overall, 1990-99	10761	9446	88.3 (87.6-89.0)
Race			
White	9071	7958	88.4 (87.6-89.1)
Black	2668	2376	89.2 (87.6-90.6)
Other	348	299	84.2 (78.9-88.4)
Hispanic ethnicity			
Yes	242	216	88.9 (83.1-92.9)
No	11842	10417	88.4 (87.8-89.1)
Age groups			
18-29	2949	2709	90.4 (88.9-91.6)
30-39	3131	2887	92.8 (91.8-93.7)
40-49	2126	1907	88.9 (87.1-90.5)
50-59	1171	1031	88.2 (86.0-90.1)
60-69	1125	944	84.4 (81.9-86.7)
70+	1522	1102	73.7 (71.2-76.1)
Education			
Less than HS	2058	1575	77.4 (75.2-79.5)
HS or GED	4043	3548	88.2 (87.0-89.3)
Post HS	5975	5504	92.2 (91.4-93.0)
Income			
<$10,000	1420	1115	80.1 (77.5-82.4)
$10,000-$24,999	3329	2864	86.3 (84.8-87.7)
$25,000-$49,999	3436	3160	91.7 (90.6-92.7)
$50,000 +	2276	2122	92.8 (91.5-94.0)
Urban			
Yes	3990	3596	90.6 (89.5-91.6)
No	8119	7055	87.4 (86.5-88.2)
Geographic area			
Eastern	3513	3082	88.2 (86.8-89.4)
Piedmont	5592	4962	89.3 (88.3-90.2)
Western	1375	1156	85.1 (82.9-87.1)
Has health insurance			
Yes	9846	8738	89.3 (88.5-90.0)
No	1369	1112	82.3 (79.8-84.6)
Was there a time when you needed to see a doctor but could not afford to go?			
Yes	1675	1407	83.9 (81.6-85.9)
No	9551	8454	89.2 (88.4-89.9)
Routine checkup			
Within 2 Years	10,875	10,047	93.0 (82.4-93.5)
2 to 5 years	556	342	62.7(57.9-67.2)
More than 5 years	593	213	35.0(31.7-40.6)

Table 3. NC women who report ever having had a Pap smear

	# respondents	*# with Pap*	*Percent (95% CI)*
Overall, 1990-99	10859	10394	95.4 (94.8-95.9)
Race			
White	9151	8803	95.9 (95.4-96.4)
Black	2693	2557	94.4 (93.0-95.5)
Other	350	320	89.5 (84.5-93.0)
Hispanic Ethnicity			
Yes	244	230	93.3 (87.7-96.4)
No	11946	11449	95.5 (95.0-95.9)
Age Groups			
18-29	2961	2778	92.0 (90.6-93.2)
30-39	3138	3089	98.8 (98.4-99.1)
40-49	2129	2090	97.8 (96.6-98.6)
50-59	1179	1151	97.8 (96.7-98.6)
60-69	1139	1091	96.0 (94.4-97.1)
70+	1582	1419	89.9 (88.2-91.5)
Education			
Less Than HS	2106	1924	91.2 (92.7-89.5)
HS or GED	4072	3918	95.8 (96.6-95.0)
Post HS	6002	5826	96.5 (97.1-95.9)
Income			
<$10,000	1448	1333	91.3 (89.2-93.0)
$10,000-$24,999	3352	3197	94.9 (93.7-95.8)
$25,000-$49,999	3444	3365	97.4 (96.6-97.9)
$50,000 +	2288	2234	97.1 (96.1-97.9)
Urban			
Yes	4021	3882	96.5 (95.8-97.2)
No	8195	7817	94.9 (94.2-95.5)
Geographic Area			
Eastern	3542	3386	95.1 (94.1-95.9)
Piedmont	5642	5424	96.0 (95.3-96.6)
Western	1393	1323	94.8 (93.2-96.0)
Has health insurance			
Yes	9948	9553	95.8 (95.2-96.2)
No	1371	1291	93.8 (91.9-95.3)
Was there a time when you needed to see a doctor but could not afford to go?			
Yes	1690	1628	95.6 (93.8-96.8)
No	9640	9225	95.5 (94.9-96.0)
Routine checkup			
Within 2 years	10,959	10,592	96.4 (96.0-96.8)
2 to 5 years	557	513	91.3(87.5-94.0)
More than 5 years	602	511	83.0(78.4-86.8)

Table 4. Characteristics associated with having a Pap test in the last 3 years among women 18-64

	OR (95% CI)
Age, per year	0.98 (0.97-0.98)
Race	
White	0.89 (0.71-1.11)
Black	1.0
Education	
Less than high school (HS)	0.42 (0.34-0.53)
HS or GED	0.71 (0.57-0.89)
Beyond HS	1.0
Urban	
Yes	1.23 (0.99-1.53)
No	1.0
Geographical regions	
Eastern NC	0.90 (0.68-1.19)
Piedmont	1.12 (0.85-1.48)
Western NC	1.0
Has health insurance	
Yes	1.65 (1.24-2.19)
No	1.0
Was there a time when you needed to see a doctor but could not afford to go?	
Yes	0.96 (0.74-1.24)
No	1.0
Time since last checkup	
<2 years	8.49 (6.53-11.03)
2-5 years	1.0

mostly NC levels are higher than national averages. Overall, in 1997, 61% of high school students report ever having sexual activity; 13% report having sexual activity before age 13; 23% report having had sexual intercourse with more than four persons; and 18% report drinking alcohol or using drugs the last time they had sexual intercourse. Importantly, condom use seems to have increased among those reporting having sex in the last three months, from 51% in 1993 to 61% in 1997. Eight percent reported being pregnant or getting someone pregnant. These data suggest that sexual activity among youth is an appropriate target for cervical cancer and STD prevention.

Information on HPV prevalence could provide important information on cervical cancer risk among North Carolina residents. However, we know of no studies of HPV prevalence that have been conducted in NC. The State Center for Health Statistics does track reportable cases of other sexually transmitted diseases, which we examined to provide insight into sexual behavior and thus risks for HPV transmission in NC.[13] Rates of syphilis appear to be declining (29.0 per 100,000 in 1996 to 6.2 in 2000); rates of gonorrhea, to be essentially stable (249.5 in 1996 to 231.6 in 2000); rates of chlamydia, to be increasing (206.3 in 1996 to 285.4 in 2000); and rates of HIV, to be stable (22.6 in 1996 to 19.0 in 2000). All of these are reportable diseases; these rates, however, are influenced by changes in use of tests to detect them (for example, the increasing use of screening for chlamydia). Given the variability in trends in different STDs, it is impossible to predict whether HPV prevalence (and thus risk for cervical cancer) is increasing or decreasing in the NC population. For all four of these sexually transmitted diseases, however, consistent trends are seen of highest rates in blacks, followed by Hispanics, who in turn have higher rates than whites.

Summary

1. Declines in cervical cancer incidence and mortality in North Carolina parallel trends seen at the national level; however, NC incidence and mortality remain significantly higher than national averages.

2. Disparities between black and white women in cervical cancer incidence and mortality are pronounced but may be decreasing. The disparity in incidence rates is most pronounced for women over age 50.

3. Although screening rates are high overall, no significant improvement is seen in the last decade. Older age, low education and income, and not having had a recent checkup are associated with never having a Pap test. Black women are slightly more likely than white women to have had a recent Pap test.

4. Lack of data on HPV prevalence and sexual behavior limits our understanding of risk for cervical cancer among residents of North Carolina.

Conclusions

Although progress continues in cervical cancer incidence and mortality, large disparities remain, and North Carolina is above the national average in incidence and mortality. Populations that are in need of increased interventions are minority populations, especially those in older age groups; women of all races of low socioeconomic status; and women who do not see a provider regularly. State and local interventions, including the Breast and Cervical Cancer Control Program[14] and the activities of the North Carolina Advisory Committee on Cancer Coordination and Control,[15,16] will continue efforts among these highest risk groups in order to facilitate further declines in cervical cancer incidence and mortality.

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