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Sociodemographic predictors of delayed- versus early-stage cervical cancer in California

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ABSTRACT

Purpose: We sought to evaluate and distinguish roles of sociodemographic predictors for delayed- versus early-stage cervical cancer.
Methods: Demographic variables for 13,624 cervical cancers having complete data for age at diagnosis (4 categories), race and ethnicity (4 categories), socioeconomic status (SES) quintiles, and marital status (3 categories) were extracted from the California Cancer Registry database for the period 1996 to 2005 and analyzed using multiple logistic regression as predictors of delayed- versus early-stage diagnosis.
Results: Fifty-eight percent of cervical cancers were among women younger than 50 years, compared with 46% of delayed-stage cases. Independent odds of delayed- versus early-stage cervical cancer were higher for older age categories within each race and ethnic group. Declining odds of delayed- versus early-stage diagnosis were evident for increasing SES quintiles among Asian or other (trend $P = .015$), non-Hispanic black ($P = .024$), Hispanic ($P = .001$), and non-Hispanic white ($P = .001$) women. Odds of delayed- versus early-stage cervical cancer were highest among unmarried compared with married women.
Conclusions: Our findings support evidence that older age, low SES, and unmarried status predict delayed-stage cervical cancer diagnosis in each of the four major race and ethic groups. The two lowest SES quintiles independently identified larger percentages of delayed-stage cervical cancers in each of the race and ethnicity groups assessed, particularly among Hispanic and non-Hispanic black women.

Introduction

Cancer of the cervix uteri (cervical cancer) is the second leading cause of cancer deaths among women in developing nations, ranking number 10 among women in economically developed populations [1]. During 2015, an estimated 12,900 women in the United States will be diagnosed with cervical cancer and approximately 4,100 will succumb to this disease [2]. Approximately 67% of cervical cancers diagnosed in the United States today are some form of epidermoid carcinomas, 27% are adenocarcinomas, with the remainder consisting of a collection of histologies that include other specified and unspecified carcinomas or sarcomas [3].

Regardless of high potential that human papilloma virus (HPV) vaccination holds for primary prevention of many cervical cancers [4–9], oncogenic HPV subtypes not currently covered by vaccinations [10,11] and inevitability of some screen-detectable non-HPV–related cervical cancers demand that the Papanicolaou (Pap) test remains part of a complete cancer control strategy [11,12]. Success of the Pap test (cervical cytology) is, in part, dependent on detection and treatment of preinvasive cervical dysplasia that is accomplished through regular Pap testing [13,14]. In addition to this role in primary prevention of cervical cancer, successful Pap testing has resulted in migration to earlier stage diagnosis of invasive cervical cancer [14–17] that predicts improved survival [18,19].

Ignoring other demographic characteristics, black and Hispanic women experience highest age-adjusted cervical cancer mortality in the United States, followed by white and Asian or Pacific Islander women [20]. Most deaths from cervical cancer occur among women diagnosed at late stage (II–IV) [14], whereas cervical cancers

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diagnosed at stage I (early stage) have 90% five-year relative survival [14]. Nevertheless, the nonmodifiable character of race and ethnicity and mixing of race and ethnic effects with age, socioeconomic status (SES), and marital status challenges how this information can be most efficiently used to enhance early detection of cervical cancer.

Previous studies reported increasing odds ratios [20–23] or relative risks [24] for contrasts of late- versus early-stage cervical cancer with progressively older age showing the greatest increase after the age of 65 years [20]. In addition to age, various investigations assessed roles of sociodemographic characteristics, including race [20,24], race and ethnicity [21–23], marital status [20,22], and some measure of SES [20,22–24] as predictors of late-stage cervical cancer. Among the studies that included SES, indices were based on ZIP code–level data [20,22,23] or an individual insurance status variable [24].

The California Cancer Registry (CCR) encompasses the statewide population of nearly 38 million and includes wide sociodemographic diversity for characteristics such as race and ethnicity, SES, and marital status [25]. Researchers in the CCR developed a complex community-based SES index using seven block group–level variables measured in the census for the year 1990 [26]. This index was extended to the period 1996 to 2005, using Year 2000 Census block group data and has been used to distinguish between race and ethnicity and SES in previous studies [27]. The large size and rich diversity of the California population, combined with the complex SES index developed by the CCR, provide a unique opportunity to assess independent roles of age, race and ethnicity, SES, and marital status as predictors of delayed- versus early-stage cervical cancer.

Objectives

This research sought to distinguish roles for age, SES, and marital status categories as independent predictors for odds of delayed- versus early-stage cervical cancer in each of four major race and ethnic segments of the California population and to evaluate whether low SES could be used to improve targeting of cervical cancer screening intended to reduce delayed-stage diagnosis.

Materials and methods

This population-based, nonconcurrent cohort study evaluated odds ratios for demographic predictors of cervical cancer occurrence among Asian or other, non-Hispanic black, Hispanic, and non-Hispanic white California residents for the period 1996 to 2005. Data for all invasive cervical epidermoid carcinomas (M-8050-8052, 8070-8076, 8082-8084) and adenocarcinomas (M-8140, 8144-8145, 8147, 8200, 8210, 8240, 8245, 8246, 8255, 8260, 8263, 8310, 8323, 8380, 8384, 8430, 8441, 8460-8461, 8480, 8482, 8490, 8501, 8523, 8542, 8560, 8570, 8574) [28] having valid stage at diagnosis [29] codes were extracted from the CCR research database for the period 1996 to 2005. Independent demographic variables included in the analysis were age at diagnosis (21–29, 30–49, 50–65, and ≥66 years), SES quintiles (1 low–5 high), and marital status as never married; separated, divorced, or widowed (SDW), and married. Using Year 2000 Census block group–level data, SES quintile scores were computed using methods described by Yost et al. [26] and assigned to study subjects based on the place of residence at diagnosis. SES index variables included education, median income, percentage living below the poverty level, median rent, median house value, proportion with a blue-collar job, and proportion in the workforce without a job that were older than 16 years.

Analytic methods

Analyses used unconditional logistic regression to isolate independent associations between demographic variable categories assessing race and ethnicity-specific odds ratios for delayed- versus early-stage cervical cancer. The dependent variable used in all analyses was delayed stage at diagnosis of invasive cervical cancer, defined by the American Joint Committee on Cancer Staging, sixth revision as stages II to IV, versus early-stage (stage I) [29]. Staging categories were derived from Collaborative Staging [30] for the period 2004 to 2005. Categorical independent variables for the full model were arranged to form dichotomous (0 or 1) contrasts with the referent category, comparing delayed- versus early-stage cervical cancer forming odds ratios for each variable [e.g., log (stage at diagnosis) = $\beta_0 + \beta_1$Age + β_2Race/Ethnicity + β_3SES + β_4Marital status]. Tests for two-way interactions between SES and each demographic covariate as a predictor of stage at diagnosis were performed by introducing product terms for SES by age, SES by race and ethnicity, and SES by marital status to the full model building each of three separate regression equations [e.g., assessing interaction between SES and race and ethnicity as log (stage of diagnosis) = $\beta_0 + \beta_1$Age + β_2Race/Ethnicity + β_3SES + β_4Marital status + β_5SES × Race/Ethnicity]. Trend tests were determined by treating ordinal categories of dependent variables as continuous in the logistic regression model. Analyses were completed using SEER*Stat [31] and Statistical Analysis Software, version 9.3 [32].

Results

Among the 15,082 cervical cancers diagnosed among California residents from 1996 to 2005, 536 (3.5%) consisted of an array of nonspecific cancer types that were not classified as epidermoid carcinomas or adenocarcinomas, 27 (0.2%) were some form of basal cell carcinoma, 135 (0.9%) were sarcomas, and 20 (0.1%) were aged less than 21 years, making a total of 14,364 eligible study participants. An additional 740 (5.2%) of the 14,364 eligible study subjects were missing age ($n = 190$ [1.3%]) or marital status ($n = 550$ [3.8%]), leaving 13,624 cases available for analysis.

Table 1 summarizes counts and percentages for delayed- versus early-stage cervical cancer for categories of each demographic variable depicting significant differences between delayed- versus early-stage cervical cancer for age, SES, and marital status in each race and ethnic group. Combined counts for all race and ethnic groups showed that 68.4% of early-stage cervical cancers were among women aged less than 50 years, traditionally classified as premenopausal. In contrast, most (53.7%) delayed-stage cervical cancers were among women aged 50 years and older (postmenopausal). Approximately 13% of the cervical cancers were classified as Asian or other, 6% were non-Hispanic black, 37% Hispanic, and 44% were non-Hispanic white.

Table 2 summarizes adjusted odds ratios with lower and upper 95% confidence interval limits for delayed- versus early-stage cervical cancer for each demographic variable, stratified by race and ethnicity. Race and ethnicity-specific findings adjusted for other covariates depict increasing odds of delayed- versus early-stage cervical cancer for increasing age categories (trend $P < .001$), with declining odds ratios for increasing SES quintiles for Asian or other (trend $P = .015$), non-Hispanic black (trend $P = .024$), Hispanic (trend $P < .001$), and non-Hispanic white (trend $P < .001$) women. These odds ratios depict lower values for higher SES quintiles in each of the race and ethnic groups, except highest SES among non-Hispanic blacks. Slightly elevated independent odds ratios for contrasts of delayed- versus early-stage cervical cancer are seen for never married and SDW versus married women in each of the major race and ethnic groups.