

The disparity of cervical cancer in diverse populations

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Received 2 January 2008

Abstract

Significant disparities in cervical cancer incidence and mortality rates among minority groups have been documented in the United States, despite an overall decline in these rates for the population as a whole. Differences in cervical cancer screening practices have been suggested as an explanation for these disparities, as have differences in treatment among various racial and ethnic groups. A number of factors are attributed to these observed differences. As minority populations continue to grow in size over the next 50 years, persistent disparities will place an ever increasing burden on these populations and on the national healthcare system. Strategies to reduce cervical cancer disparities need to be employed in order to reverse these trends.

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Keywords: HPV; Cervical cancer; Disparity; Ethnicity

Introduction

Since the mid-1970's, the incidence of cervical cancer has steadily declined in the United States (US), as have mortality rates [1]. These declines can largely be attributed to wide-scale implementation of cytological screening programs utilizing the Papanicolaou (Pap) test. While declines in incidence and mortality rates for cervical cancer can be observed across all racial and ethnic groups in the US from 1995 to 2004, marked disparities in these rates persist [1].

Differences in cervical cancer incidence and mortality rates

Analysis of average annual incidence rates for cervical cancer, reported by the Surveillance Epidemiology and End Results (SEER) database [1] from 2000 to 2004, indicate that Hispanic women are diagnosed with cervical cancer almost twice as often, and African American women more than 1.5 times as

often as non-Hispanic white women (Fig. 1a). The incidence rate among Asian American/Pacific Islander (AA/PI) women is slightly higher than that of non-Hispanic white women, while American Indian/Alaskan Native (AI/AN) women have lower rates of diagnosis [1]. Similar differences are observed in the percent lifetime risk of being diagnosed with cervical cancer (Fig. 1b) [1]. While Fig. 1a states the annual incidence rate for AA/PI women as one group, considerable heterogeneity and range in incidence rates among subpopulations of AA/PI women exist. Analysis of the California Cancer Registry, 2000 to 2002, reveals that Chinese women have the lowest cervical cancer incidence rate (5.4 per 100,000) while Vietnamese women have the highest incidence rate (14.0 per 100,000) [2]. This variation can make national reported rates misleading, not just for AA/PI, but for other groups in which distinct subpopulations exist.

When the percentage of individuals diagnosed with cervical cancer among various racial and ethnic groups is examined by age, distinct trends can be observed in each group. For white women, the greatest percent prevalence is observed in those between 40 and 49 years of age, while Hispanic women and AA/PI women have broader prevalence peaks. African American women have a bimodal distribution of cervical cancer

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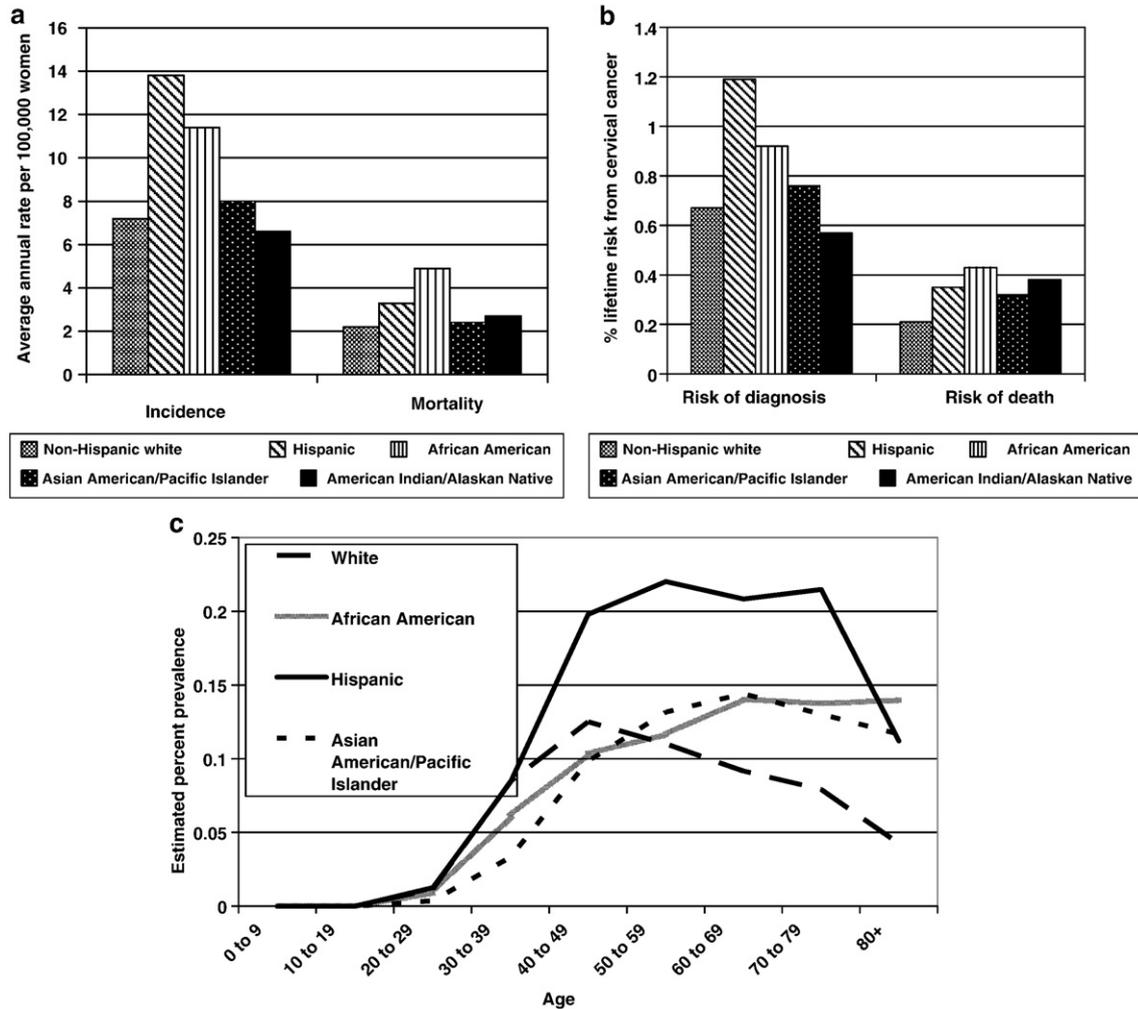


Fig. 1. a: Cervical cancer average annual incidence and mortality rates among various racial and ethnic groups in the US, 2000–2004 [1]. b: Lifetime risk of being diagnosed with or dying from cervical cancer among various racial and ethnic groups in the US [1]. c: Distribution of cervical cancer according to age and ethnic group in the US, 2004 [1].

prevalence rates, as there is an initial peak between ages 35 and 45 and then rates increase again at age 60 (Fig. 1c) [1].

Differences exist regarding the stage of cancer at diagnosis among the various ethnic/racial groups. For example, white women are more likely to be diagnosed at an earlier stage than African Americans, American Indians, or Hispanics [3,4]. Non-Hispanic African Americans have a higher percentage of cervical cancer diagnosis at later stages than Hispanics and non-Hispanic whites [5–7].

Later stage of diagnosis may partially explain why mortality rates do not always parallel incidence rates (Fig. 1a). The average annual cervical cancer mortality rate from 2000 to 2004 for African Americans was more than twice that for non-Hispanic whites (2.2 deaths per 100,000), while the rate for Hispanic women was 1.5 times greater than that for non-Hispanic white women; these are different ratios than those observed for incidence rates (Fig. 1a) [1]. Mortality rates for AA/PI women were slightly higher than those for white women, as were those for AI/AN women. However, when the AI/AN population is broken down to those who live in Contract Health Service Delivery Area (CHSDA) counties (geographic areas under the jurisdiction of

Indian Health Services, often including a reservation or an area that borders a reservation), there is a marked difference; those that live in CHSDA counties have an annual mortality rate of 4.0 deaths per 100,000 persons, as compared with 1.1 per 100,000 for those living in non-CHSDA counties [1]. As previously noted, the heterogeneity within the AA/PI population can be observed when rates per subgroup are examined. For example, from 1999 to 2001, Japanese and Filipino women had the lowest mortality rates among this group of women (1.8–2.0 per 100,000 and 1.9–2.1 per 100,000, respectively), while Vietnamese women experience 4.3 to 4.5 annual cervical cancer deaths per 100,000 persons and Native Hawaiian women had the highest mortality rate of 6.1 to 7.0 per 100,000 [8].

Fig. 1b illustrates the lifetime risk of dying from cervical cancer for each group, which reflects similar trends as those seen in the mortality rates [1]. Hispanics and non-Hispanic whites have similar five-year survival rates (71% and 68%, respectively), and both have higher rates than those observed in African Americans (56%) [6]. African Americans have a significantly increased risk of death compared with non-Hispanic whites among patients with Stage 1 cervical tumors, but not at later stages [6]. For all types of

cancers, African American women have a 9% lower incidence rate, but an 18% higher death rate than white women [9].

When mortality rates among minority groups are dissected into US versus foreign-born women, a distinct rise in cervical mortality rates among foreign-born women between 1985 and 1996 can be observed [10]. This difference is primarily seen among Hispanic and AA/PI women. The ratio of mortality rates between foreign-born and US-born Hispanic women was 4.11, and 1.40 for AA/PI women. Conversely, US-born African American women have higher mortality rates (7.31 per 100,000) compared with foreign-born African American women (5.86 per 100,000) during this time period, although this may not be statistically significant [10]. Incidence and mortality rates for Hispanic women may be even higher than reported, as speculation exists that these women go back to their countries of origin to receive “traditional” treatments or to die. Furthermore, all groups of women, including those without legal status, who may not seek or receive conventional medical help would not be reflected in the data.

Disparities may be influenced by the geographic distribution of minority groups in the US. For example, states in the Deep South, such as Arkansas and Mississippi, have 11% to 38% higher cervical cancer death rates than the overall rate in the US [1]. There are regional differences associated with cervical cancer mortality rates among AI/AN, with higher rates observed in the Northern Plains and Southwestern regions of the US [11]. Mortality rates for AI/AN populations may not be accurate. Studies have demonstrated incorrect racial coding on state death certificates, with 41% of AI/AN in the US coded as non-native, indicating an underestimation of cancer mortality rates [11].

A handful of factors may contribute to these marked disparities, including differences in screening and follow-up rates, treatment, behavioral risk factors, and underlying biological variations. The initiation of sexual activity at an early age and an increased number of sexual partners have been shown to be risk factors for cervical cancer [12]. Data collected from the National Youth Risk Behavior Survey indicate that a greater percentage of African American students have their first sexual intercourse before the age of 13 compared with Hispanic and white students (16.5% vs. 7.3% and 4.0%, respectively) and that they are more likely to have four or more partners during their life than Hispanic or white students (28.2% vs. 15.9% and 11.4%, respectively). Race- or ethnic-specific molecular variations, which could perhaps lead to increased susceptibility, have not been identified to date for cervical cancer, as they have for uterine cancer [13]. Differences in screening and follow-up rates and in treatment are discussed below.

Differences in screening and follow-up rates

Observed disparities in incidence and mortality among various populations can be partially attributed to differences in screening practices, particularly for Hispanics and Asian Americans. The Healthy People 2010 initiative was established by the US Department of Health and Human Services. Healthy People 2010 was created to challenge US citizens to increase engagement in preventive health behaviors in order to reduce the

morbidity and mortality associated with a variety of preventable chronic diseases and other health-related issues, including cervical cancer. Its goal is for 90% of women from all populations to have had a Pap test within the past three years. The initiative has established goals to reduce these rates by the year 2010, to be achieved through an increased use of preventive measures. In order to monitor progress, various annual screening rates and engagement in preventive behavioral practices are documented and compared with the set goals [14,15]. This includes setting objectives for Pap screening adherence. It is important to note that approximately 55% to 60% of cervical cancer cases arise in women who have never been screened or who are not adherent with screening guidelines [16,17].

Table 1 summarizes the screening rates among the various ethnic/racial groups as reported in the Healthy People 2010 database (DATA2010). The overall goal is to increase this screening rate to 97% by 2010. In 2005, among women who have ever had a Pap test non-Hispanic white, African American, and AI/AN women all had similar rates, while Hispanic and Asian-only women had 7% and 17%, respectively, lower rates than non-Hispanic white women [15]. A different picture is seen when looking at screening rates in the past three years; African American and non-Hispanic white women have similar Pap testing patterns, but Asian women had a 24% lower rate than non-Hispanic white women, AI/AN women had a 10% lower rate, and Hispanic women had a 7% lower rate (Table 1) [15]. Screening rates for non-English speaking groups, particularly AA/PIs and Hispanics, may be underreported if the surveys that collect data are administered in English [18]. Interestingly, according to the data represented in Table 1, access to primary screening for African American women does not appear to be a factor leading to increased disease rates.

Data collected during the 2001 California Health Interview Survey, a randomized telephone survey with over 25,000 respondents, revealed that Asian women are less likely to report ever having a Pap test or a recent (within the past three years) Pap test than all other ethnic/racial groups. No significant difference in screening rates was observed among African American, AI/AN, white, or Hispanic women [19,20]. Screening rates can vary significantly among subpopulations. For example, analysis of data collected from the 2001 California Health Interview Survey found that among Asian American respondents, Vietnamese women had the lowest screening rates (62.3%), while Filipino women had the highest screening rates (81.1%) [21].

When all other variables, such as socio-demographic characteristics, are adjusted for, US-born minorities have comparable

Table 1
Annual cervical cancer screening rates among various racial and ethnic groups in the US, Healthy People 2010, 2005 [15]

	% Ever had a Pap test	% Pap test within 3 years
Healthy People 2010 goal	97	90
Non-Hispanic white	95	79
Hispanic	88	74
African American	94	80
Asian	79	60
AI/AN	97	71

Pap screening rates to whites, while foreign-born women, including whites, have markedly lower screening rates than their US-born counterparts [22]. For AI/AN women, racial misclassification is reported as one of the most difficult obstacles in accurate and informative data collection [20].

Meta-analysis of the literature has revealed that disparities in cervical cancer screening rates become more pronounced as age increases [23]. Decreased screening and treatment of precancerous lesions likely contribute to the higher incidence of cervical cancer among older minority populations (Fig. 1c), and can also explain the observed later stages of diagnosis.

Adherence to follow-up after an abnormal Pap test is also low among minority groups [24,25]. Data collected through the National Breast and Cervical Cancer Early Detection Program (NBCCEDP), which provides funding to increase access to cervical and breast cancer screening for underserved women, followed over 10,000 participants with two Pap tests of abnormal squamous cells of undetermined significance or low-grade intraepithelial lesions [26]. Of those 10,000 participants, only 44% were followed-up according to established guidelines, which recommend colposcopy. Of the 56% who did not receive proper colposcopy follow-up, 28.3% received a third Pap test, and 27.7% received no follow-up. Furthermore, AI/AN women had the highest percentage of receipt of a third Pap test, rather than colposcopy, while African Americans had a higher percentage of no follow-up compared with other racial or ethnic groups [27].

Differences in treatment

While differences in screening rates can mostly explain the resulting disparity observed in incidence and mortality rates for minorities, they do not account for the increased rates documented for African American women, as their screening rates are consistently equal to or better than those reported for non-Hispanic white women (Table 1). A low rate of follow-up, as discussed above, is part of the explanation, but a marked difference in treatment is another potential explanation. Meta-analysis of treatment studies suggests that African Americans are less frequently treated for cervical cancer, or treated inappropriately [28]. Other factors that may contribute to disparities in treatment for African Americans include co-morbid conditions, poorer health, patients' refusal of treatment, and lack of physician recommendation for treatment [28].

A greater percentage of African Americans have no surgery, have radiation therapy only, or have no therapy as their first treatment after a cervical cancer diagnosis compared with Hispanics or non-Hispanic whites [6]. Among patients who have cervical cancer-directed surgery as part of their primary treatment, significantly more African Americans have local, non-radical surgery compared with other racial/ethnic groups. Alternatively, Hispanic women undergo a greater proportion of radical hysterectomies than other groups. This is despite the fact that African Americans have the greatest proportion of later stage (Stage 2, 3, and 4; 43%) tumors than Hispanics (37%) or non-Hispanic whites (34%) [6]. Determinants of treatment choice are not known. After adjusting for age at diagnosis, histology, stage, and first course of treatment, Hispanic patients

had a 26% decreased risk of death from invasive cervical cancer compared with non-Hispanic patients, while African American patients had a 19% increased risk of death [6]. Such differences in survival may be partially attributed to racial/ethnic variations in prognostic factors for cervical cancer, such as co-morbid conditions.

Del Carmen et al.[3] reviewed data from over 2300 women and reported that African American and Hispanic women over the age of 35 years diagnosed with Stage 1A(2) cervical cancer are less likely to be treated with a hysterectomy than their white counterparts. Differences in treatment have also been observed among other minority groups, and therefore may contribute to their higher mortality rates as well. SEER data analysis revealed persistent differences in the receipt of appropriate treatment between non-Hispanic whites, Hispanics, and American Indians, with non-Hispanic whites receiving appropriate treatment for their stage of diagnosis more often than patients in the other two groups, even after educational intervention for patients [4].

Barriers to the prevention of cervical cancer

As described above, observed differences in incidence and mortality rates of cervical cancer among various minority groups can be largely attributed to disparities in screening, follow-up, and treatment. Nonadherence to screening and follow-up may lead to later stages of diagnosis, which in turn can result in increased morbidity and mortality. Analyses of studies that examine the barriers to screening indicate that the major barriers are: cultural and personal (i.e., origin of birth, English language proficiency, level of acculturation, and patient-doctor relationship); socioeconomic (i.e., education level, income level, medical insurance, and medical costs); and institutional (i.e., physician recommendation and access to healthcare and regular source of care). An extensive review of these barriers has recently been published by Akers et al.[23] Many of these barriers are also factors in nonadherence to follow-up procedures when an abnormal Pap test is identified [24,29].

Cultural and personal barriers

For Hispanic and Asian American women, low levels of acculturation, lack of English proficiency, and foreign birth are highly associated with nonadherence to screening [30–34]. Many minority women who are noncompliant believe that Pap tests are only necessary when they have symptoms [21,23,21, 35,36]. Among women in an urban setting, the majority of whom are minorities, who have not been screened, there is a strong belief that the development of cancer is just bad luck, and they do not want to know if they have it [37]. A fatalistic attitude towards cervical cancer is common among Hispanic immigrants [37,38], which may contribute to their low screening rates. Women who do not get screened often mention that they do not get tested because others will think that they are having sex, and if they are not sexually active, they do not need to be screened, particularly among Hispanic and Asian women [39,40]. Personal barriers include discomfort at a doctor's touch, fear of finding cancer or other diseases, embarrassment, and pain [30,41–43].

Socioeconomic barriers

Data from 2000 generated by the Behavioral Risk Factor Surveillance Survey linked to state-specific NBCCEDP data indicate that among Hispanic and African American women, low income and lack of medical insurance were major barriers to Pap screening. The majority of these women reported medical costs as a barrier [44]. Similar barriers were reported for all racial/ethnic groups in the data obtained from the 2000 National Health Interview Survey [42], and confirmed in other studies [18,33,41].

According to a survey of 230 African American and Hispanic women in low-income housing in Los Angeles, California, 57% of Hispanic and 80% of African American women had been screened in past two years. Furthermore, 23% of Hispanic and 18% of African American women had not received a Pap test in past three years. Among the uninsured women, only 36% had been screened in the past year, compared with 63% of the entire population surveyed [45]. While insurance status may influence screening compliance, and therefore impact stage of diagnosis, it is unclear if insurance status alone, regardless of race, is independently predictive of cervical cancer outcomes. Population-based analyses of over 7000 patients with newly diagnosed cancers (11 different types) indicated that for cervical cancer, the majority of patients, regardless of insurance status, did not receive guideline-recommended treatment [46].

Low education and income correlate with later stage of diagnosis among African American women [47]. Meta-analysis of studies identifying barriers to screening found that poverty was a strong predictor of screening, diagnosis, treatment, and survival odds regardless of other variables [34]. For Hispanic immigrants, fear of deportation is a commonly reported barrier to screening [38]. Low levels of education are also reliable indicators for nonadherence to screening [32,41]. When survival rates for cervical carcinomas were compared between 1553 white and African American women in the military healthcare system, no differences were observed. In this scenario, cost, health insurance, and other racially-related barriers did not exist. All patients had equal and direct access to primary care physicians and specialists [48].

Institutional barriers

Recommendation by a physician is strongly associated with having had a Pap smear [18,31,42,43]. Bazargan et al. found that women who admitted that no healthcare provider ever told them that they needed a Pap test (29%) were half as likely to report a current screen than those who had received a physician's recommendation [45]. There is a strong link between continuity of care and screening for all racial and ethnic groups [21,30,36,49,50].

Health access barriers include long wait times at health clinics, lack of transportation, no family support, and lack of available child care [30,37,50]. For those in managed care, many barriers were related to insurer or provider factors, such as long wait times and difficulty obtaining an appointment [49]. Specifically, Hispanics were more likely than non-Hispanic

whites to report that they did not have a usual source of care, had difficulty obtaining care, and experienced long wait times and a failure of communication with their healthcare provider, while Asian Americans were more likely to report dissatisfaction with quality of care provided by their usual source of care [49]. A usual source of care has been shown to be the strongest predictor of Pap testing in many populations [23,30,49,50].

Knowledge and attitudes surrounding HPV, cervical cancer, screening, and vaccination

Across all population groups, adherence to screening and the acceptance of prophylactic cervical cancer vaccines are linked to the depth of understanding regarding cervical cancer and its necessary cause, human papillomavirus (HPV) [51]. A focus group formed by the Centers for Disease Control and Prevention (CDC) found that regardless of background, public knowledge of HPV and its link to cervical cancer is low, and upon education, all participants expressed concern that they had not been previously informed about HPV. This general lack of knowledge serves as a barrier to vaccine uptake [52]. When participants were asked to suggest a "message source" for HPV awareness, African American participants felt that an African American spokesperson would be most effective, and they also voiced their distrust of government agencies [52]. A similar attitude of distrust among African American women was reported by Scarinci, et al [53].

Women who have never had a Pap test are more likely to say that did not know they could get cervical cancer [37] or report not knowing where to go for the test [39]. A greater percentage of Hispanic women are not aware of the Pap test compared with white non-Hispanic women [30]. Among Hispanic immigrants, women are not aware of the connection between HPV and cervical cancer. They have little knowledge about cervical cancer or where it is specifically found [35]. Similar levels of understanding the etiology of cervical cancer, along with traditional beliefs, are also recognized as factors that decrease Pap screening compliance among American Indian and Vietnamese women [54].

From a study involving over 300 low-income white, African American, and Hispanic women, most understood the purpose of a Pap test. However, many had poor knowledge of HPV, with African Americans and Hispanics scoring lower on the questionnaire for the majority of questions. The majority of these women expressed a desire to learn more about Pap tests and cervical cancer [55]. Chinese American women displayed a low level of knowledge regarding Pap tests, and this was related to their degree of English language fluency [56].

Recent meta-analysis of publications regarding HPV knowledge and vaccine acceptance found generally high levels of vaccine acceptance among Hispanic and African American women and parents [57]. However studies focusing on the factors that influence vaccine acceptance among racial and ethnic minorities are very limited [57]. One study of Californian parents conducted by phone survey did note differences in the acceptance of HPV vaccination among racial and ethnic groups. Hispanic parents are more likely than white parents to vaccinate their daughters before the age of 13 years, while African

American and Asian parents are least likely to accept vaccination of their young daughters [58]. In general, the meta-analysis revealed that, similar to Pap screening compliance, physician recommendation is likely to be one of the most influential factors in vaccine acceptance and uptake [57].

An evaluation of race-related differences among women in a rural region of North Carolina examined knowledge, attitudes, and information-seeking about HPV, cervical cancer, and the HPV vaccine [59]. The majority of respondents were African American. Compared with white respondents, African American women scored lower on the HPV-knowledge scale, and were less likely to believe they are at risk for cervical cancer and that vaccines are beneficial. In addition, most African American respondents thought the ideal age for vaccination is ≥ 17 years, while white respondents believed the opposite (the ideal age for vaccination is ≤ 17 years) [59]. Furthermore, unadjusted analyses on intentions to vaccinate themselves or their daughters differed by race. Approximately half of the women from both groups reported awareness of health and medical topics in the

media. This study is the first to identify notable differences by race in awareness, knowledge, and some attitudes about HPV, cervical cancer, and the HPV vaccine that remained even after accounting for education, income, and financial status. These findings suggest that communication strategies designed for African American women in the rural US may need to emphasize different information to maximize the benefits for cervical cancer prevention [59].

Programs to increase vaccine acceptability among minority groups may need to be tailored towards specific populations. A recent focus group analysis found that while all participating Hispanic and African American women thought prophylactic vaccination was a good idea, Hispanics unanimously said they were likely to get vaccinated, but African American women were more skeptical [53]. Both Hispanics and African American women stated that they would need to know more, and would wait to see if there were long-term side-effects. Furthermore, both African American and Hispanic women believed that women would be motivated to get vaccinated if they were aware

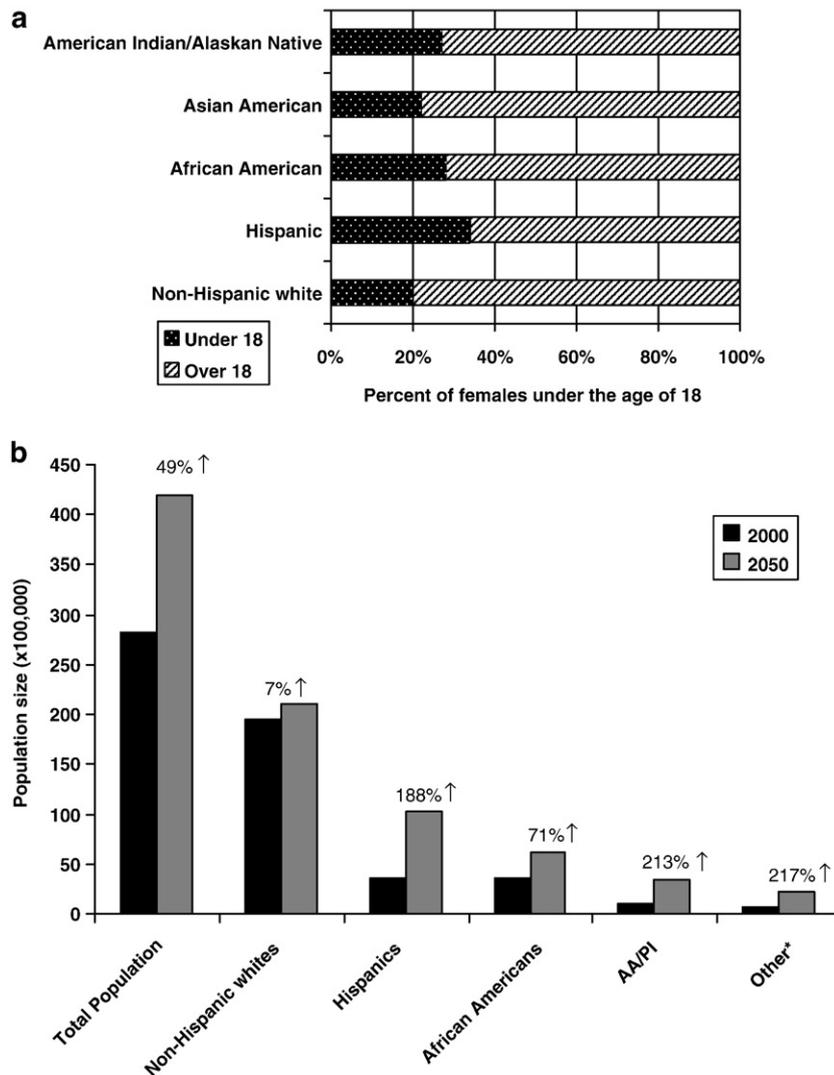


Fig. 2. a: Distribution of US females under the age of 18 by racial/ethnic group, 2006 [60]. b: Estimated change in US population demographics, according to racial and ethnic group, 2000–2050 [61]. * This includes American Indians/Alaskan Natives and those who identified themselves as belonging to 2 or more groups.

of high vaccine efficacy, low vaccine costs, and more information regarding HPV and cervical cancer. Both groups believed that public dissemination from multiple, credible sources would motivate women to get vaccinated. African American and Hispanic women had concerns about cost, side-effects, and a lack of information, while African American women expressed additional concerns of what their partners would think, that vaccination would provide a false sense of protection leading to unsafe behaviors, and a lack of trust in the system [53].

US demographics and projected population changes

Should the existing disparities in cervical cancer persist, we may begin to see a reversal in the overall national decline in incidence and mortality rates. Over the next few decades, minority groups will increase in size and make up a larger percentage of the population. As of July 2006, Hispanics comprised 20% of the total US female population under the age of 18 years. This is second only to non-Hispanic whites (57.4%) [60]. Furthermore, when each population is analyzed individually, non-Hispanic whites have the lowest proportion of females under the age of 18 years (20.4%) when compared with Hispanics (34%), African Americans (28%), AI/AN (27%), and Asian Americans (21.7%) (Fig. 2a) [60]. A greater percentage of under-screened minority women will result if current screening trends continue as these populations age.

The US Census Bureau projects that by the year 2050, the Hispanic population will have increased by 188% of its 2000 estimate, and will then comprise 24.4% of the US population [61]. Similar increases are projected for African Americans, Asian Americans, and other minority groups (including AI/AN and those who identified themselves as belonging to two or more groups) (Fig. 2b) [61]. These estimates include immigration projections; the US Census Bureau estimates that by 2050, annual net immigration (numbers immigrating in minus those emigrating out of the country) will exceed one million persons [62].

Effective strategies to overcome disparities

Since disparities in cervical cancer screening and follow-up rates and treatment practices among minority populations may lead to higher incidence and mortality rates, many projects have been launched at the federal, state, and local levels to determine effective methods of reducing these disparities. Federally funded initiatives, such as the NBCCEDP, provide funding for screening and programs that increase awareness in target communities [26,63].

In order for cancer patients to receive timely diagnosis and treatment, the Patient Navigator Academy, a program from the National Cancer Institute, uses patient navigators to overcome barriers to care and helps patients “navigate” the healthcare system. Navigators represent a wide range of racial and ethnic populations from different geographical locations. Patient navigators are involved in scheduling appointments, coordinating insurance, community outreach, forming partnerships in the community, and encouraging clinical trial participation [64].

Community partnerships have been established across the country. The Special Populations Networks (SPNs) initiative, established by the National Cancer Institute in 2000, aims to reduce cancer disparities by educating healthcare providers and community leaders and providing community outreach programs [65]. SPNs include five national, two regional, and 11 local programs — the major goal was to promote cancer awareness research in the minority and underserved communities, targeting most minority populations [66]. The utilization of lay healthcare workers in community outreach programs and telephone counseling, and the availability of culturally-appropriate educational materials have all been shown to improve screening and follow-up rates among minority women [67–72].

Newly developed prophylactic vaccines, which target the most prevalent oncogenic HPV types responsible for approximately 77% of all cervical cancers and 54% of high-grade precancerous lesions in the US, are well-tolerated and effective [73–77]. Prophylactic vaccines can provide primary prevention against cervical cancer and strategies employed to enhance screening and follow-up rates can be extended to promote vaccination.

Conclusion

Higher incidence and mortality rates, disparities in screening and treatment, and lower survival rates for minority populations are not unique to cervical cancer, and have been well documented for other cancers [4,78,79]. Continued health disparities coupled with growing population sizes will lead to ever increasing burdens on the US healthcare system, and will significantly impact the societal infrastructure of these communities due to increased morbidity and mortality. While the factors that lead to observed disparities in incidence and mortality rates are not identical for each group (i.e., a lack of English proficiency is a significant barrier to screening for Hispanics and Asian Americans but not for African Americans or American Indians), prevention and early detection of cervical cancer through increased awareness are universal goals.

Reducing the future incidence and mortality rates of cervical cancer may require physicians to increase their own knowledge and awareness of cervical cancer and its prevention so that they are better able to educate their patients. A variety of federally- and community-based programs targeting minority groups have been implemented to increase public awareness of HPV, cervical cancer, and screening [26,65,72]. Additionally, widespread use of newly available cervical cancer vaccines could greatly contribute to the reduction of these disparities by preventing infection with oncogenic HPV types known to be the causative agents of approximately 77% of cervical cancer cases [51,73]. While screening will continue to be an important and necessary tool in cervical cancer prevention for all women, vaccination will provide protection to those women who are not screened regularly, leading to a reduction in incidence and mortality rates for all women. Concerted efforts are needed to ensure that daughters of women who are not currently getting screened will have education about and access to primary prevention vaccination, as well as access to future screening as secondary

prevention against cervical cancer. In addition, physicians need to be encouraged to recommend state-of-the-art therapy for patients, regardless of their race and socioeconomic status.

Conflict of interest statement

LSD has received research support from MGI PHARMA, received honoraria and served on the Advisory Board for Merck and received research support and served on the Advisory Board for GSK. JSS has received research grants or contracts, honoraria or consulting fees during the last three years from GSK. IS and LF have no conflicts of interest to disclose. GP is a member of the “Future Generation HPV Vaccines Advisory Board” for Merck.

References

- [1] Ries L, Harkins D, Krapcho M, Mariotto A, Miller BA, Feuer EJ, Clegg L, Eisner MP, Horner MJ, Howlader N, Hayat M, Hankey BF, Edwards BK, editors. SEER Cancer Statistics Review, 1975–2004. Bethesda, MD: National Cancer Institute; 2007. based on November 2005 SEER data submission, posted to the SEER web site.
- [2] McCracken M, Olsen M, Chen MS, Jemal A, Thun M, Cokkinides V, Deapen D, Ward E. Cancer incidence, mortality, and associated risk factors among Asian Americans of Chinese, Filipino, Vietnamese, Korean, and Japanese ethnicities. *CA Cancer J Clin* 2007;57:190–205.
- [3] del Carmen MG, Montz FJ, Bristow RE, Bovicelli A, Cornelison T, Trimble E. Ethnic differences in patterns of care of stage 1A(1) and stage 1A(2) cervical cancer: a SEER database study. *Gynecol Oncol* 1999(75): 113–7.
- [4] Gilliland FD, Hunt WC, Key CR. Trends in the survival of American Indian, Hispanic, and Non-Hispanic white cancer patients in New Mexico and Arizona, 1969–1994. *Cancer* 1998;82:1769–83.
- [5] Howe HL, Wu X, Ries LA, Cokkinides V, Ahmed F, Jemal A, Miller B, Williams M, Ward E, Wingo PA, Ramirez A, Edwards BK. Annual report to the nation on the status of cancer, 1975–2003, featuring cancer among U.S. Hispanic/Latino populations. *Cancer* 2006;107:1711–42.
- [6] Patel DA, Barnholtz-Sloan JS, Patel MK, Malone Jr JM, Chuba PJ, Schwartz K. A population-based study of racial and ethnic differences in survival among women with invasive cervical cancer: analysis of Surveillance, Epidemiology, and End Results data. *Gynecol Oncol* 2005;97:550–8.
- [7] Saraiya M, Ahmed F, Krishnan S, Richards TB, Unger ER, Lawson HW. Cervical cancer incidence in a prevaccine era in the United States, 1998–2002. *Obstet Gynecol* 2007;109:360–70.
- [8] Chu KC, Chu KT. 1999–2001 cancer mortality rates for Asian and Pacific Islander ethnic groups with comparisons to their 1988–1992 rates. *Cancer* 2005;104:2989–98.
- [9] Jemal A, Siegel R, Ward E, Murray T, Xu J, Thun MJ. Cancer statistics, 2007. *CA Cancer J Clin* 2007;57:43–66.
- [10] Seeff LC, McKenna MT. Cervical cancer mortality among foreign-born women living in the United States, 1985 to 1996. *Cancer Detect Prev* 2003;27:203–8.
- [11] Espey D, Paisano R, Cobb N. Regional patterns and trends in cancer mortality among American Indians and Alaska Natives, 1990–2001. *Cancer* 2005;103:1045–53.
- [12] Comparison of risk factors for invasive squamous cell carcinoma and adenocarcinoma of the cervix: collaborative reanalysis of individual data on 8,097 women with squamous cell carcinoma and 1,374 women with adenocarcinoma from 12 epidemiological studies. *Int J Cancer* 2007;120: 885–91.
- [13] Santin AD, Bellone S, Siegel ER, Palmieri M, Thomas M, Cannon MJ, Kay HH, Roman JJ, Burnett A, Pecorelli S. Racial differences in the overexpression of epidermal growth factor type II receptor (HER2/neu): a major prognostic indicator in uterine serous papillary cancer. *Am J Obstet Gynecol* 2005;192:813–8.
- [14] Healthy People 2010. US Department of Health and Human Services; 2000.
- [15] DATA 2010. The Healthy People 2010 database. The Centers for Disease Control and Prevention; 2007.
- [16] Saslow D, Runowicz CD, Solomon D, Moscicki AB, Smith RA, Eyre HJ, Cohen C. American Cancer Society guideline for the early detection of cervical neoplasia and cancer. *CA Cancer J Clin* 2002;52:342–62.
- [17] Spence AR, Goggin P, Franco EL. Process of care failures in invasive cervical cancer: systematic review and meta-analysis. *Prev Med* 2007;45: 93–106.
- [18] Kagawa-Singer M, Pourat N. Asian American and Pacific Islander breast and cervical carcinoma screening rates and healthy people 2000 objectives. *Cancer* 2000;89:696–705.
- [19] De Alba I, Ngo-Metzger Q, Sweningson JM, Hubbell FA. Pap smear use in California: are we closing the racial/ethnic gap? *Prev Med* 2005;40: 747–55.
- [20] Swan J, Breen N, Burhansstipanov L, Satter DE, Davis WW, McNeel T, Snipp CM. Cancer screening and risk factor rates among American Indians. *Am J Public Health* 2006;96:340–50.
- [21] Kandula NR, Wen M, Jacobs EA, Lauderdale DS. Low rates of colorectal, cervical, and breast cancer screening in Asian Americans compared with non-Hispanic whites: cultural influences or access to care? *Cancer* 2006;107: 184–92.
- [22] Goel MS, Wee CC, McCarthy EP, Davis RB, Ngo-Metzger Q, Phillips RS. Racial and ethnic disparities in cancer screening: the importance of foreign birth as a barrier to care. *J Gen Intern Med* 2003;18:1028–35.
- [23] Akers AY, Newmann SJ, Smith JS. Factors underlying disparities in cervical cancer incidence, screening, and treatment in the United States. *Curr Probl Cancer* 2007;31:157–81.
- [24] Engelstad LP, Stewart SL, Nguyen BH, Bedeian KL, Rubin MM, Pasick RJ, Hiatt RA. Abnormal Pap smear follow-up in a high-risk population. *Cancer Epidemiol Biomarkers Prev* 2001;10:1015–20.
- [25] Cardin VA, Grimes RM, Jiang ZD, Pomeroy N, Harrell L, Cano P. Low-income minority women at risk for cervical cancer: a process to improve adherence to follow-up recommendations. *Public Health Rep* 2001;116: 608–16.
- [26] The Centers for Disease Control and Prevention. National Breast and Cervical Cancer Early Detection Program; 2007.
- [27] Benard VB, Lawson HW, Ehemann CR, Anderson C, Helsel W. Adherence to guidelines for follow-up of low-grade cytologic abnormalities among medically underserved women. *Obstet Gynecol* 2005;105:1323–8.
- [28] Shavers VL, Brown ML. Racial and ethnic disparities in the receipt of cancer treatment. *J Natl Cancer Inst* 2002;94:334–57.
- [29] Ell K, Vourlekis B, Muderspach L, Nissly J, Padgett D, Pineda D, Sarabia O, Lee PJ. Abnormal cervical screen follow-up among low-income Latinas: Project SAFE. *J Womens Health Gend Based Med* 2002;11: 639–51.
- [30] Coronado GD, Thompson B, Koepsell TD, Schwartz SM, McLerran D. Use of Pap test among Hispanics and non-Hispanic whites in a rural setting. *Prev Med* 2004;38:713–22.
- [31] De Alba I, Sweningson JM. English proficiency and physicians’ recommendation of Pap smears among Hispanics. *Cancer Detect Prev* 2006;30:292–6.
- [32] Nguyen TT, McPhee SJ, Nguyen T, Lam T, Mock J. Predictors of cervical Pap smear screening awareness, intention, and receipt among Vietnamese-American women. *Am J Prev Med* 2002;23:207–14.
- [33] Rodriguez MA, Ward LM, Perez-Stable EJ. Breast and cervical cancer screening: impact of health insurance status, ethnicity, and nativity of Latinas. *Ann Fam Med* 2005;3:235–41.
- [34] Newmann SJ, Garner EO. Social inequities along the cervical cancer continuum: a structured review. *Cancer Causes Control* 2005;16:63–70.
- [35] McMullin JM, De Alba I, Chavez LR, Hubbell FA. Influence of beliefs about cervical cancer etiology on Pap smear use among Latina immigrants. *Ethn Health* 2005;10:3–18.
- [36] Taylor VM, Schwartz SM, Yasui Y, Burke N, Shu J, Lam DH, Jackson JC. Pap testing among Vietnamese women: health care system and physician factors. *J Community Health* 2004;29:437–50.
- [37] Behbakht K, Lynch A, Teal S, Degeest K, Massad S. Social and cultural barriers to Papanicolaou test screening in an urban population. *Obstet Gynecol* 2004;104:1355–61.
- [38] Scarinci IC, Beech BM, Kovach KW, Bailey TL. An examination of sociocultural factors associated with cervical cancer screening among low-

- income Latina immigrants of reproductive age. *J Immigr Health* 2003;5:119–28.
- [39] Byrd TL, Peterson SK, Chavez R, Heckert A. Cervical cancer screening beliefs among young Hispanic women. *Prev Med* 2004;38:192–7.
- [40] Taylor VM, Jackson JC, Tu SP, Yasui Y, Schwartz SM, Kuniyuki A, Acorda E, Lin K, Hislop G. Cervical cancer screening among Chinese Americans. *Cancer Detect Prev* 2002;26:139–45.
- [41] del Carmen MG, Findley M, Muzikansky A, Roche M, Verrill CL, Horowitz N, Seiden MV. Demographic, risk factor, and knowledge differences between Latinas and non-Latinas referred to colposcopy. *Gynecol Oncol* 2007;104:70–6.
- [42] Coughlin SS, Breslau ES, Thompson T, Benard VB. Physician recommendation for Papanicolaou testing among U.S. women, 2000. *Cancer Epidemiol Biomarkers Prev* 2005;14:1143–8.
- [43] Taylor VM, Yasui Y, Burke N, Nguyen T, Acorda E, Thai H, Qu P, Jackson JC. Pap testing adherence among Vietnamese American women. *Cancer Epidemiol Biomarkers Prev* 2004;13:613–9.
- [44] Adams EK, Breen N, Joski PJ. Impact of the National Breast and Cervical Cancer Early Detection Program on mammography and Pap test utilization among white, Hispanic, and African American women: 1996–2000. *Cancer* 2007;109:348–58.
- [45] Bazargan M, Bazargan SH, Farooq M, Baker RS. Correlates of cervical cancer screening among underserved Hispanic and African-American women. *Prev Med* 2004;39:465–73.
- [46] Harlan LC, Greene AL, Clegg LX, Mooney M, Stevens JL, Brown ML. Insurance status and the use of guideline therapy in the treatment of selected cancers. *J Clin Oncol* 2005;23:9079–88.
- [47] Schwartz KL, Crossley-May H, Vigneau FD, Brown K, Banerjee M. Race, socioeconomic status and stage at diagnosis for five common malignancies. *Cancer Causes Control* 2003;14:761–6.
- [48] Farley JH, Hines JF, Taylor RR, Carlson JW, Parker MF, Kost ER, Rogers SJ, Harrison TA, Macri CI, Parham GP. Equal care ensures equal survival for African-American women with cervical carcinoma. *Cancer* 2001;91:869–73.
- [49] Phillips KA, Mayer ML, Aday LA. Barriers to care among racial/ethnic groups under managed care. *Health Aff (Millwood)* 2000;19:65–75.
- [50] O'Malley AS, Forrest CB. Beyond the examination room: primary care performance and the patient–physician relationship for low-income women. *J Gen Intern Med* 2002;17:66–74.
- [51] Walboomers JM, Jacobs MV, Manos MM, Bosch FX, Kummer JA, Shah KV, Snijders PJ, Peto J, Meijer CJ, Munoz N. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *J Pathol* 1999;189:12–9.
- [52] Friedman AL, Sheppard H. Exploring the knowledge, attitudes, beliefs, and communication preferences of the general public regarding HPV: findings from CDC focus group research and implications for practice. *Health Educ Behav* 2007;34:471–85.
- [53] Scarinci IC, Garcés-Palacio IC, Partridge EE. An examination of acceptability of HPV preventive vaccination among African American women and Latina immigrants. *J Womens Health* 2007;16(8):1224–33.
- [54] Risendal B, DeZapian J, Fowler B, Papenfuss M, Giuliano A. Pap smear screening among urban Southwestern American Indian women. *Prev Med* 1999;29:510–8.
- [55] Breitkopf CR, Pearson HC, Breitkopf DM. Poor knowledge regarding the Pap test among low-income women undergoing routine screening. *Perspect Sex Reprod Health* 2005;37:78–84.
- [56] Yu ES, Kim KK, Chen EH, Brintnall RA. Breast and cervical cancer screening among Chinese American women. *Cancer Pract* 2001;9:81–91.
- [57] Brewer NT, Fazekas KI. Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Prev Med* 2007;45:107–14.
- [58] Constatine N, Jerman P. Acceptance of human papillomavirus vaccination among Californian parents of daughters: a Representative Statewide Analysis. *J of Adolesc Health* 2007;40:108–15.
- [59] Cates JR, Brewer NT, Fazekas KI, Mitchell CE, Smith JS. Race-related differences in knowledge and attitudes about HPV vaccination in the rural Southern United States. In: 17th ISSSTD World Congress. Washington: Seattle; 2007.
- [60] Population Estimates. The US Census Bureau; 2007.
- [61] U.S. Census Bureau, 2004. U.S. interim projections by age, sex, race, and Hispanic Origin; 2004.
- [62] US Census Bureau. Interim projections of the U.S. population by age, sex, race, and Hispanic Origin: summary methodology and assumptions; 2004.
- [63] Ryerson AB, Benard VB, Major AC. The National Breast and Cervical Cancer Early Detection Program: 1991–2002 National Report. Atlanta, GA: The Centers for Disease Control and Prevention; 2005.
- [64] Fowler T, Steakley C, Garcia AR, Kwok J, Bennett LM. Reducing disparities in the burden of cancer: the role of patient navigators. *PLoS Med* 2006;3:e193.
- [65] Freeman HP, Vydelingum NA. The role of the special populations networks program in eliminating cancer health disparities. *Cancer* 2006;107:1933–5.
- [66] Jackson FE, Chu KC, Garcia R. Special Populations Networks—how this innovative community-based initiative affected minority and underserved research programs. *Cancer* 2006;107:1939–44.
- [67] Hansen LK, Feigl P, Modiano MR, Lopez JA, Escobedo Sluder S, Moimpour CM, Pauler DK, Meyskens FL. An educational program to increase cervical and breast cancer screening in Hispanic women: a Southwest Oncology Group study. *Cancer Nurs* 2005;28:47–53.
- [68] Margolis KL, Lurie N, McGovern PG, Tyrrell M, Slater JS. Increasing breast and cervical cancer screening in low-income women. *J Gen Intern Med* 1998;13:515–21.
- [69] Miller SM, Siejak KK, Schroeder CM, Lerman C, Hernandez E, Helm CW. Enhancing adherence following abnormal Pap smears among low-income minority women: a preventive telephone counseling strategy. *J Natl Cancer Inst* 1997;89:703–8.
- [70] Mock J, McPhee SJ, Nguyen T, Wong C, Doan H, Lai KQ, Nguyen KH, Nguyen TT, Bui-Tong N. Effective lay health worker outreach and media-based education for promoting cervical cancer screening among Vietnamese American women. *Am J Public Health* 2007.
- [71] Taylor VM, Hislop TG, Jackson JC, Tu SP, Yasui Y, Schwartz SM, Teh C, Kuniyuki A, Acorda E, Marchand A, Thompson B. A randomized controlled trial of interventions to promote cervical cancer screening among Chinese women in North America. *J Natl Cancer Inst* 2002;94:670–7.
- [72] Wasserman M, Bender D, Lee S-YD. Use of preventive maternal and child health services by Latina Women. *Med Care Res Rev* 2007;64:4–45.
- [73] Smith JS, Lindsay L, Hoots B, Keys J, Franceschi S, Winer R, Clifford GM. Human papillomavirus type distribution in invasive cervical cancer and high-grade cervical lesions: a meta-analysis update. *Int J Cancer* 2007;121:621–32.
- [74] The Future II Study Group. Quadrivalent vaccine against human papillomavirus to prevent high-grade cervical lesions. *N Engl J Med* 2007;356:1915–27.
- [75] Harper DM, Franco EL, Wheeler CM, Moscicki AB, Romanowski B, Roteli-Martins CM, Jenkins D, Schuind A, Costa Clemens SA, Dubin G. Sustained efficacy up to 4.5 years of a bivalent L1 virus-like particle vaccine against human papillomavirus types 16 and 18: follow-up from a randomised control trial. *Lancet* 2006;367:1247–55.
- [76] Paavonen J, Jenkins D, Bosch FX, Naud P, Salmerón J, Wheeler CM, Chow S-N, Apter DL, Kitchener HC, Castellsague X, de Carvalho NS, Skinner SR, Harper DM, Hedrick JA, Jaisamrarn U, Limson GAM, Dionne M, Quint W, Spiessens B, Peeters P, Struyf F, Wieting SL, Lehtinen MO, Dubin G, for the HPV PATRICIA study group. Efficacy of a prophylactic adjuvanted bivalent L1 virus-like-particle vaccine against infection with human papillomavirus types 16 and 18 in young women: an interim analysis of a phase III double-blind, randomised controlled trial. *Lancet* 2007.
- [77] Villa LL, Costa RL, Petta CA, Andrade RP, Paavonen J, Iversen OE, Olsson SE, Hoyer J, Steinwall M, Riis-Johannessen G, Andersson-Ellstrom A, Elfgrén K, Krogh G, Lehtinen M, Malm C, Tamms GM, Giacoletti K, Lupinacci L, Railkar R, Taddeo FJ, Bryan J, Esser MT, Sings HL, Saah AJ, Barr E. High sustained efficacy of a prophylactic quadrivalent human papillomavirus types 6/11/16/18 L1 virus-like particle vaccine through 5 years of follow-up. *Br J Cancer* 2006;95:1459–66.
- [78] Clegg LX, Li FP, Hankey BF, Chu K, Edwards BK. Cancer survival among US whites and minorities: a SEER (Surveillance, Epidemiology, and End Results) program population-based study. *Arch Intern Med* 2002;162:1985–93.
- [79] The American Cancer Society. Cancer facts and figures, 2007. Atlanta: American Cancer Society; 2007.