ORIGINAL RESEARCH

Hispanic Ethnicity and Cervical Cancer Precursors Among Low-Income Women in Arizona

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Purpose: In the United States, Hispanics are more likely to be diagnosed with cervical cancer compared to Non-Hispanic Whites. Annually, 250,000 to 1 million women are diagnosed with a precursor to CC. The aim of this study was to assess whether Hispanics have a higher prevalence of cervical dysplasia compared to Non-Hispanics Whites among a population of low-income women.

Patients and Methods: We analyzed the results of 10,911 cervical cytology tests administered between 2003 and 2016 that were funded through the Center for Disease Control and Prevention's (CDC) program for low-income, uninsured women entitled the National Breast and Cervical Cancer Early Detection Program (NBCCEDP). In the state of Arizona, the program is called the Well Women HealthCheck Program (WWHP). Logistic regression was used to identify increased risk of dysplasia, including low-grade squamous intraepithelial lesions (LSIL) and high-grade squamous intraepithelial lesions (HSIL/ICC), and multinomial logistic regression was used to assess increased likelihood for LSIL and HSIL/ICC as separate categories.

Results: In the crude analysis, Hispanic ethnicity was modestly associated with higher prevalence of LSIL (odds ratio (OR)=1.39, 95% CI=1.01–1.91), but this association was not statistically significant after adjusting for confounders. However, in the final models, lower income was independently associated with LSIL (adjusted odds ratio [aOR]=1.55, 95% CI=1.30–1.44), while smoking (aOR=2.88, 95% CI=1.21–6.84) and no history of Pap test within five years (aOR=3.54, 95% CI=1.61–6.99) were independently associated with HSIL.

Conclusion: After adjusting for confounding in a sample of low-income women with comparable Pap screening rates, ethnicity was not associated with greater prevalence of abnormal pap smears. However, other variables were independently associated with LSIL and HSIL. The higher proportion of LSIL cases among lower income individuals compared to those with higher incomes, and the higher proportion of HSIL cases observed among those screened least regularly stresses the importance of programs like WWHP: programs that target low-income, uninsured women. These programs help save lives.

Keywords: low-grade squamous intraepithelial lesions, high-grade squamous intraepithelial lesions, well women health check program, national breast and cervical cancer early detection program, COVID-19

Introduction

The introduction of the Papanicolaou smear screening test (Pap test) in the 1950's led to a 60% reduction in the incidence of cervical cancer in the United States (US).[1] It is anticipated that the development of human papillomavirus (HPV) vaccine will reduce the incidence even further.[2] However, some groups of women have benefitted from these advances more than others. Compared to non-Hispanic

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whites, Hispanic women have a 40% higher rate of cervical cancer diagnosis and are 26% more likely to die from the disease.[3] Between 2013–2017, the incidence of cervical cancer in Arizona (AZ) was 8.7 per 100,000 among Hispanics and 6.8 per 100,000 among non-Hispanic whites.[4]

While a diagnosis of cervical cancer (CC) is relatively uncommon in the US, the precursors to the disease, low-grade squamous intraepithelial lesions (LSIL) and high-grade squamous intraepithelial lesions (HSIL), are not.[5] Caused by persistent infection of a high-risk variant of the human papillomavirus (HrHPV), 1.4 million women are diagnosed with LSIL and 330,000 women are diagnosed with HSIL in the US every year.[6]

There are financial and emotional costs associated with cervical dysplasia diagnoses. Also, depending on insurance status and severity of disease, the cost of treating cervical pre-cancerous lesions range from a few hundred dollars for ablative treatments to thousands of dollars for excisional treatments.[7] Treating more advanced disease frequently requires excisional methods, which, in some cases, have been linked to adverse outcomes, such as preterm delivery (PTD), while new research has indicated that the higher risk for PTD associated with high grade cervical lesions may be due to the disease process itself rather than the treatment.[8–10] Treating more advanced disease frequently requires excisional methods, which, in some cases, have been linked to adverse outcomes, such as preterm delivery (PTD). It should be noted, however, that new research has indicated that the higher risk for PTD associated with high grade cervical lesions may be due to the disease process itself rather than the treatment.[11,12]

It is believed that the higher incidence of cervical cancer observed among Hispanics is largely due to variations in Pap test coverage.[13] Compared to Non-Hispanic whites, Hispanic women are less likely to report having a Pap smear within the last 5 years.[5,14,15] Obstacles to screening among Hispanics in Arizona include cultural attitudes, linguistic barriers and immigration status; undocumented immigrants and new immigrants (undocumented immigrants residing in AZ for less than 5 years) are ineligible to receive health insurance.[16,17]

With a population of nearly 60 million people, Hispanics constitute the largest ethnic minority group in the US, and they are projected to comprise nearly one-third of the US population by 2060.[18–20] Gaining more understanding about the effects of cervical cancer

precursors among a population disproportionately affected by cervical cancer is of public health significance. Annually, US healthcare systems spend over one billion dollars evaluating and treating this condition.[6] The aim of this study was to assess the burden of cervical precancers among Hispanic women as compared to non-Hispanic whites, all of whom received screening through the Arizona division of the Center for Disease Control and Prevention's (CDC) National Breast and Cervical Cancer Early Detection Program (NBCCEDP), the Well Woman HealthCheck program (WWHP). The Pap screenings were administered in federally funded health care clinics located in Pima County between 2003 and 2016.

Materials and Methods
Study Design and Population
This is a cross-sectional analysis of 11,326 Pap tests and follow-up test results funded by Pima County's Well Women HealthCheck (WWHP) program between 2003 and 2016. WWHP was established in Arizona in 1993 as part of the National Breast and Cervical Cancer Early Detection Program (NBCCEDP). To be eligible to receive services under WWHP, women must be residents of Arizona, be uninsured or underinsured (have insurance that does not cover the services offered by the WWHP or have a co-pay of $100 or more for breast and cervical cancer screening and/or diagnostic services), do not have Medicare Part B, are not enrolled in the Arizona Health Care Cost Containment System (AHCCCS) and have a household income that does not exceed 250% of the federal poverty limit. WWHP provides clinical breast exams, mammograms, pelvic exams and pap tests. If screening tests are abnormal, the program offers colposcopy with or without biopsy and ultrasounds.[21] Patient navigators help women diagnosed with precancerous cervical lesions or cervical cancer enroll in the Breast and Cervical Cancer Treatment Program (BCCTP) offered through the state's Medicaid program, the Arizona Health Care Cost Containment System (AHCCCS).

Bi-annually, NBCCEDP grantees are required to submit a subset of standardized patient and clinical level program data known as Minimum Data Elements (MDEs) to the CDC consisting of information related to clinical encounters, including date of service, patient age, race, ethnicity, screening history (yes, no, not within the past 5 years and unknown), symptoms, indication for test, examination received, examination results, and final

diagnosis.[22] MDE demographics include age, race, and ethnicity, and on the intake form, Hispanic ethnicity is referred to as Hispanic/Latino.[22] In addition to demographic characteristics and clinical outcomes, MDEs also contain unique patient identifiers that can be used to track program utilization and health outcomes over time.[23] In addition to the MDEs, states can elect to collect data on other variables.[23] For example, the state of Arizona collects information on household size and smoking status, defined as "the use of tobacco or electronic nicotine (tobacco-like) products in the last 30 days." The complete dataset used for this study was extracted from Arizona's NBCCEDP database.

In total, 10,911 test results were included in the study; four hundred and four (404) cases were excluded because the women tested did not fit the study criteria as identifying as either Hispanic or Non-Hispanic white, and an additional 11 cases did not have a conclusive diagnosis. Prior to transferring the database to the University of Arizona for use in this study, the Arizona Department of Health Services (ADHS) removed all identifiers, including names, addresses, and zip codes from the NBCCEDP dataset. After review, the study was exempted from full human subjects review by the Mel and Enid Zuckerman College of Public Health Research Office.

Definition of Outcome Variables

In this study, an abnormal Pap smear included a diagnosis of LSIL or HSIL/CC. LSIL consisted of LSIL diagnoses, atypical squamous cells of undetermined significance (ASCUS) with concurrent high-risk HPV (HrHPV+) infection and mild cervical intraepithelial neoplasia (CIN 1) as determined by biopsy. HSIL included HSIL diagnoses, moderate and severe cervical intraepithelial neoplasia (CIN 2 and CIN 3, respectively) adenocarcinoma and cervical cancer (CC). Adenocarcinoma and CC were added to the HSIL category because of the limited number of cases (1 and 3, respectively). In addition to normal/ benign results, the reference group incorporated diagnoses of benign inflammation due to the transitory nature of the condition.

Statistical Analysis

To compare demographic differences between the two study groups (Non-Hispanic whites vs Hispanics), Chi Square tests were used to analyze differences in the distribution among categorical variables, and the Student's T-test was used to assess continuous variables. Odds ratios

(ORs) were calculated using logistic regression to evaluate the predictor of primary interest (Hispanic ethnicity) and cervical disease status. Before fitting the complete model, associations between the independent variables and the outcome variable were examined individually.

Following the bivariate analysis, multivariate logistic regression was conducted. First, the dependent variable was broken down into two categories (negative and positive). In this analysis, tests were classified as "positive" if they were diagnosed as LSIL or HSIL/CC. Multinomial logistic regression was used to investigate the relationship between the predictor variable and three different categories of cervical cytology (negative, LSIL & HSIL/CC). In this model, women with normal cytology served as the reference category for the dependent variable. The model estimated two odds ratios (ORs) simultaneously for each risk factor evaluated: the OR for LSIL versus normal and the OR for HSIL/CC versus normal. Independent variables available from the NBCCEDP database provided by ADHS, included age (years), income (USD), household size, ethnicity/race, smoking status, prior Pap test and country of birth (United States or Mexico). Variables such as poverty, ethnicity, smoking, immigration status and Pap screen history have been associated with cervical dysplasia in the literature.[24–28] A variable called "number of visits" was added to the model to adjust for the possible effect of multiple clinic visits by individual patients. Confounders were kept in the final model if they were significant at the p<0.05 level, and the adjusted odds ratio differed from the crude odds ratio by ≥10%. Potential effect modification was assessed, and if found, those variables were to be stratified and the effect modification documented. Data were analyzed using Stata version 1 (StataCorp LP, College Station, TX).[29]

Results

Participant characteristics are presented in Table 1. Seventy-eight percent (78%) of the participants were Hispanic and nearly three-quarters (73%) were born in Mexico. This is not surprising given Pima County's proximity to the Mexican border, and the NBCCEDP's role as the only screening program accessible to new and undocumented immigrants. Between 2003 and 2016, 44% of study participants received one Pap test, 38% received two to three Pap tests and 18% were screened four or more times. On average, non-Hispanic whites had fewer screening visits compared to Hispanics (Table 1).

Table 1 Patient Characteristics by Ethnicity

Characteristics	Non-Hispanic Whites (n=2419)	Hispanics (n=8492)	Total (n=10,911)	P-value
Number of Visits: mean (SD)	2.05 (1.44)	2.35 (1.65)		p<0.001
Age: mean (SD)	51.9 (7.32)	48.1 (9.72)		p<0.001
Age: n (%)				p<0.001
10–29	27 (1.10)	186 (2.20)	213 (2.00)	
30–49	883 (36.5)	4794 (58.8)	5677 (52.3)	
≥50	1509 (62.4)	3512 (39.0)	5012 (45.7)	
Smoking Status n (%)[a]				p<0.001
Non-smoker	2283 (93.3)	8223 (96.8)	10,506 (96.2)	
Smoker	136 (6.7)	269 (3.2)	405 (3.8)	
Income n (%)[a]				p<0.001
≤ $15,000	1148 (47.5)	5032 (60.4)	6180 (57.7)	
> $15,001	1265 (52.5)	3438 (39.6)	4703 (42.3)	
Household Size n (%)[a]				p<0.001
≤ 3	2233 (92.7)	5935 (70.0)	8168 (75.0)	
≥4	176 (7.3)	2540 (30.0)	2716 (25.0)	
Prior Pap n (%)[a]				p=0.211
Yes	2264 (93.6)	7869 (92.7)	10,133 (92.9)	
No	130 (5.70)	518 (6.10)	648 (5.94)	
Unknown	25 (0.7)	102 (1.20)	127 (1.16)	
Birth Origin n (%)[a]				p<0.001
United States	2102 (95.2)	700 (8.60)	2802 (27.0)	
Mexico	106 (4.80)	7454 (91.4)	7560 (73.0)	

Note: [a]Indicates missing value.

Compared to non-Hispanic whites, Hispanics were significantly younger (p<0.001), less likely to smoke (p<0.001), more likely to live in larger households (p<0.001), have a lower income (p=0.013) and more likely to be born in Mexico (p<0.001). There was no significant difference in Pap screening history between the two groups.

Prevalence and characteristics associated with different categories of cervical dysplasia (negative, positive, LSIL & HSIL/CC) are displayed. In Table 2, bivariate analysis was used to explore individual factors related to different categories of disease. A total of 10,911 cases were analyzed: 10,575 negative test results (96.92%) and 336 positive test results (3.08%).

Within the positive test category, there were 275 (2.52%) cases of LSIL and 61 (0.56%) cases of HSIL/CC. Four cases of CC were identified; 3 of which were diagnosed in Hispanic women. In the bivariate analysis, Hispanic ethnicity was marginally associated with positive Pap test results (OR=1.39, 95% CI=1.01–1.91). Older age (≥50 years) was protective for abnormal Pap, LSIL and HSIL/CC (OR=0.32, 95% CI=0.18–0.57); (OR=0.39, 95% CI=0.20–0.75); (OR=0.16, 95% CI= 0.05–0.48), respectively, while the middle age group (30–49 years) was protective for abnormal Pap (OR=0.57, 95% CI=0.33–0.99).

Lower income (≤ $15,000) was associated with abnormal Pap results (OR=1.40, 95% CI=1.12–1.75) and LSIL (OR=1.52, 95% CI=1.18–1.95), while smoking was positively associated with HSIL/CC (OR=2.16, 95% CI=1.23–6.70). Absence of a Pap test within the past five years was associated with HSIL/CC prevalence (OR=2.68, 95% CI=1.03–4.42), and "unknown" Pap test history was associated with abnormal Pap (OR=3.02, 95% CI=1.61–5.67) and HSIL/CC (OR=7.99, 95% CI=3.14–20.4). Women born in Mexico were more likely to be diagnosed with an abnormal Pap test result (OR=1.49, 95% CI=1.14–1.94) and LSIL (OR=1.53, 95% CI=1.13–2.07) compared to women born in the US.

Results from the multivariate analysis are presented in Table 3. After adjusting for confounders, ethnicity was no longer associated with a higher likelihood of LSIL

Table 2 Cervical Cytology: Associations with Socio-Demographics (n=10,911)

	Normal n=10,575 (96.92%)	Positive n=336 (3.08%)		LSIL n=275 (2.52%)		HSIL/ICC n=61 (0.56%)	
	n (%)	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Ethnicity							
Non-Hispanic white (Ref)	2359 (97.5)	60 (2.48)	1.00	47 (1.99)	1.00	13 (0.49)	1.00
Hispanic	8216 (96.8)	276 (3.20)	1.32 (1.00–1.75)	228 (2.76)	1.39 (1.01–1.91)[a]	48 (0.44)	1.06 (0.57–1.96)
Age[d]							
10–29 (Ref)	197 (93.4)	14 (6.64)	1.00	10 (4.74)	1.00	4 (1.90)	1.00
30–49	5332 (96.3)	207 (3.74)	0.57 (0.33–0.99)[a]	166 (3.00)	0.61 (0.32–1.18)	41 (0.74)	0.38 (0.13–1.07)
≥50	4689 (97.8)	107 (2.23)	0.32 (0.18–0.57)[c]	92 (1.92)	0.39 (0.20–0.75)[b]	15 (0.31)	0.16 (0.05–0.48)[c]
Smoking Status[d]							
Non-smoker (Ref)	10,187 (97.0)	138 (3.00)	1.00	116 (1.14)	1.00	22 (1.86)	1.00
Smoker	388 (95.8)	19 (4.20)	1.40 (0.85–2.30)	12 (3.10)	0.96 (0.52–1.76)	7 (1.10)	2.86 (1.23–6.70)[a]
Income[d]							
≤ $15,000	5963 (96.5)	217 (3.49)	1.40 (1.12–1.75)[b]	183 (2.96)	1.52 (1.18–1.95)[c]	34 (0.55)	1.01 (0.61–1.65)
> $15,000 (Ref)	4584 (97.5)	119 (2.52)	1.00	92 (1.96)	1.00	27 (0.57)	1.00
Household Size[d]							
≤ 3 (Ref)	8243 (97.0)	253 (3.00)	1.00	201 (2.37)	1.00	52 (0.6)	1.00
≥4	2698 (97.1)	80 (2.9)	1.03 (0.81–1.32)	56 (2.0)	0.94 (0.71–1.24)	24 (0.90)	1.49 (0.88–2.52)
Prior Pap[d]							
Yes (Ref)	9825 (97.0)	308 (3.04)	1.00	261 (2.58)	1.00	47 (0.46)	1.00
No	631 (97.4)	17 (2.62)	0.86 (0.53–1.41)	8 (1.23)	0.50 (0.26–0.97)[a]	9 (1.39)	2.68 (1.03–4.42)[b]
Unknown	116 (91.3)	11 (8.66)	3.02 (1.61–5.67)[b]	6 (4.72)	2.10 (0.97–4.54)	5 (3.94)	7.99 (3.14–20.4)[c]
Birth Origin[d]							
United States (Ref)	2898 (97.7)	69 (2.33)	1.00	55 (1.85)	1.00	14 (0.47)	1.00
Mexico	7320 (96.6)	259 (3.42)	1.49 (1.14–1.94)[b]	213 (2.81)	1.53 (1.13–2.07)[b]	46 (0.61)	1.30 (0.71–2.37)

Notes: [a]p<0.05; [b]p< 0.01; [c]p<0.001; [d]Indicates missing values.
Abbreviations: LSIL, Low-grade squamous intraepithelial lesion; HSIL, High grade squamous intraepithelial lesion.

Table 3 Factors Associated with Ethnicity (Non-Hispanic Whites/Hispanics) and Positive Pap Smear Results, LSIL & HSIL: Adjusted Models

	Model 1 aOR (95% CI) Positive vs Negative	Model 2 aOR (95% CI) LSIL vs Negative	Model 3 aOR (95% CI) HSIL vs Negative
Characteristic			
Ethnicity			
Non-Hispanic White (Ref)	1.00	1.00	1.00
Hispanic	0.99 (0.74–1.33)	1.04 (0.75–1.45)	0.85 (0.45–1.61)
Number of Visits	1.34 (1.28–1.41)[c]	1.37 (1.30–1.44)[b]	1.19 (1.04–1.36)[b]
Age			
10–29 (Ref)	1.00	1.00	1.00
30–49	0.49 (0.27–0.86)[a]	0.52 (0.27–1.01)	0.38 (0.13–1.09)
≥50	0.28 (0.15–0.51)[c]	0.32 (0.16–0.63)[b]	0.15(0.05–0.48)[b]
Smoking Status			
Non-Smoking (Ref)	1.00	1.00	1.00
Smoker	1.44 (0.88–2.38)	1.14 (0.62–2.09)	2.88 (1.21–6.84)[a]
Income			
≤ $15,000	1.43 (1.13–1.80)[b]	1.54 (1.30–1.44)[c]	0.96 (0.58–1.60)
> $15,000 (Ref)	1.00	1.00	1.00
Household Size			
≤3 (Ref)	1.00	1.00	1.00
>3	0.97 (0.75–1.25)	0.88 (0.66–1.17)	1.48 (0.85–2.58)
Prior Pap			
Yes (Ref)	1.00	1.00	1.00
No	0.79 (0.47–1.34)	0.63 (0.31–1.30)	3.54 (1.61–6.99)[b]
Unknown	3.16 (1.67–5.96)[c]	2.86 (1.19–2.00)[a]	9.33 (3.55–24.5)[c]
Birth Origin			
US (Ref)	1.00	1.00	1.00
Mexico	1.43 (0.90–2.27)	1.63 (0.97–2.74)	1.51(0.53–4.36)

Notes: Model 1. adjusted for age, number of visits, income, prior Pap history; model 2. adjusted for age, income and prior Pap history; model 3. adjusted for age, smoking status and prior Pap test history; [a]p<0.05, [b]p<0.01, [c]<0.001.
Abbreviations: aOR, adjusted odds ratio; US, United States; Ref, reference.

(Adjusted Odds Ratio [aOR]=1.04, 95% CI=0.75–1.45). Number of visits was positively associated with abnormal Pap smears, LSIL and HSIL ((aOR=1.34, 95% CI=1.28–1.41); (aOR=1.37, 95% CI=1.30–1.44); (aOR=1.19, 95% CI=1.04–1.36, respectively)). This is not surprising given that more abnormal findings are going to be uncovered through more screening; this is especially true of HPV disease, given its transient nature and unpredictable course.

The oldest age group (≥50 years) remained protective in all three disease categories: positive Pap test (aOR=0.28, 95% CI=0.15–0.51), LSIL (aOR=0.32, 95% CI=0.16–0.63) and HSIL/CC (aOR=0.15, 95% CI 0.05–0.48). The middle age group (30–49 years) remained

protective for abnormal Pap test (aOR=0.49, 95% CI=0.27–0.86). In the final model, lower income remained associated with a higher likelihood for an abnormal Pap test (aOR=1.43, 95% CI=1.13–1.80) and LSIL (aOR=1.54, 95% CI=1.30–1.44), and smoking remained associated with higher HSIL/CC prevalence (aOR=2.88, 95% CI=1.21–6.84). Absence of Pap test within past five years remained associated with higher HSIL/CC prevalence (aOR=3.54, 95% CI=1.61–6.99) and "unknown" Pap test history remained associated with higher likelihood to be diagnosed with an abnormal Pap test (aOR=3.16, 95% CI=1.67–5.96) or HSIL/CC (aOR=9.33, 95% CI=3.55–24.5). Mexican nativity was no longer statistically significant in the final model.

Discussion

In this study, we looked at risk factors for cervical pre-cancerous lesions among low-income women living in Pima County, AZ. Among our sub-sample of NBCCEDP recipients, there was no statistically significant difference in Pap test history between Hispanics and non-Hispanic whites and no significant difference in the prevalence of abnormal Pap test results. These findings are inconsistent with current research that puts Hispanics at higher risk for cervical dysplasia.[29–31] This finding may be due to the comparable screening histories between the two groups in our study.[32] Nevertheless, we did identify other independent risk factors, including smoking, lower income and Pap smear history.

Among our sample of 10,911 Pap test results, 3.08% were diagnosed as abnormal; 3.20% among Hispanics compared to 2.48% among non-Hispanic whites. In a nation-wide study that looked at cervical dysplasia among NBCCEDP recipients between 2002–2012, 2.35% of Hispanics presented with abnormal Pap smear results.[33] These findings suggest that our sample of Arizona residents may be at greater risk for abnormal Pap findings compared to national data, thus supporting the need for more in-depth study in this population. When we divided positive tests results into two categories, the prevalence of LSIL was 2.68% among Hispanics compared to 1.94% among non-Hispanic whites. The overall prevalence of HSIL/CC was 0.56% with little difference between Hispanics (0.57%) and non-Hispanic whites (0.54%). A large-scale study of 1,761,146 Pap test results collected between 2007 and 2011 revealed an HSIL prevalence of 0.25%, an LSIL prevalence of 1.54%.[34] After removing the 4 cases of cervical cancer in our database, HSIL prevalence remained relatively high (0.52%).[35]

In our study, women who smoked were nearly 3 times more likely to be diagnosed with HSIL/CC. This is not an unusual finding. Studies have linked cigarette smoking to increased risk of HSIL and cervical cancer.[36] A large-scale study that followed women diagnosed with ASCUS or LSIL over a two-year period found an association between smoking intensity and duration with progression to HSIL[37] Furthermore, research has determined that among HPV infected individuals, smoking has been linked to reoccurrence of HSIL after treatment and progression to invasive cervical disease.[38]

Screening history was associated with abnormal Pap tests and HSIL. Women who did not receive a Pap screen within the previous five years were 2.9 times more likely to be diagnosed with HSIL compared to women who were screened more regularly. Participants who responded "unknown" to the question about Pap test history were 3.16 times more likely to have an abnormal Pap smear and 7.75 times more likely to be diagnosed with HSIL/CC; however, due to the large standard error, one must be cautious interpreting the result. In a study looking at cancer diagnosis and stage among NBCCEDP recipients, Miller et al found that women who had been rarely or never screened and women with "unknown" Pap histories were more likely to be diagnosed with cancer, and at later stages, compared to women who were screened regularly.[39] It may be of value to explore this finding further in order to determine whether this is an issue of social desirability bias, lack of English language proficiency, poor health literacy or a combination of factors.

When compared to a group with a comparable Pap screening history, as in this study, Hispanic ethnicity was not an independent risk factor for cervical dysplasia. This finding supports the hypothesis that cervical cancer differences in Hispanic vs non-Hispanic white women may be driven by access to care rather than by ethnicity. Nationally, Hispanic women are screened less frequency than non-Hispanic whites, especially among women of Mexican origin.[40,41] The US is home to five million Mexican-born women, both documented and undocumented, making it the largest female immigrant group living in the United States.[19] Screening programs like the NBCCEDP are essential; they help save lives. It was encouraging to see patients returning for annual screenings and follow-up visits, especially given the lack of healthcare options for new and undocumented immigrants in Arizona.

This study adds to the existing research on cervical cancer precursors, especially among Hispanic immigrants. As the disease advances, so do associated treatment costs and concerns. Given that much of the literature pertaining to Hispanics and cervical disease focuses exclusively on cervical cancer, assessing prevalence and risks associated with cervical dysplasia is relevant. With the introduction of the HPV vaccine in 2006, there has been enhanced monitoring of cervical dysplasia to help gage the efficacy of the vaccine. Currently, the Human Papillomavirus Vaccine Impact Monitoring Project (HPV-IMPACT) monitors rates of moderate and severe dysplasia (CIN2+) in an effort to assess the efficacy of the HPV vaccine.[42] Given the disruption of the COVID-19 pandemic, screening is

more important than ever. A study comparing the percentage of woman receiving cervical cancer screening pre and during the pandemic (January 1 – September 30, 2019 vs January 1 – September 30, 2020) found that the screening rate declined significantly across all ages and ethnicities during the second time period.[43] It will take time to assess the full impact of the pandemic. In the meanwhile, it is important to study the factors related to cervical dysplasia among high-risk populations in hopes of developing more effective prevention programs.

A number of weaknesses can be found with this study. Temporality of risk factors associated with cervical disease cannot be established given its cross-sectional design. In addition, because the sub-sample size of HSIL was small, only strong associations could be detected. Conducting a similar study of NBCCEDP beneficiaries across the state would help confirm or dispel these findings. In addition, a number of factors that have previously been associated with cervical dysplasia were not available, including oral contraceptive use, sexually transmitted infection status, parity, age at first intercourse, number of sexual partners and HPV genotype.[18] And finally, this study may lack generalizability given it specific geographic focus.

Conclusion

The prevalence of cervical dysplasia among our study participants, the majority of whom (78%) were Hispanic, speaks to the need for continued screening, particularly given the relatively high prevalence of HSIL. Considering that it will take decades to detect a significant reduction in cervical cancer prevalence resulting from the HPV vaccination, ongoing research is needed to identify communities with a higher burden of cervical disease in order to target cervical cancer screening and vaccination services where they are needed most.

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Disclosure

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