ORIGINAL RESEARCH

Analyzing factors associated with completion of guideline-adherent cervical cancer screening in a county safety-net clinic

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Cervical cancer remains a leading cause of cancer-related death in women globally. Nearly all cervical cancers are caused by human papillomavirus (HPV) infection. Significant disparities in cervical cancer screening and mortality exist. To better understand factors affecting timely completion of cervical cancer screening among patients attending safety-net clinics in Harris County, Texas, we evaluated characteristics associated with overdue screening. A retrospective chart review was conducted to examine a 3-month period for patients with Pap smear results and for patients with alerts for incomplete Pap smears. Most Pap smears were collected at well-woman (50%) or prenatal (11%) visits. Overdue Pap smear testing differed significantly by ethnicity, preferred language, index appointment type, pregnancy status at index appointment, diabetes status, last HbA1c values, and BMI. In unadjusted logistic regression analyses, patients from Hispanic/Latina backgrounds and those who did not speak English as their primary language had lower odds of being overdue in our patient sample. Patients attending annual/well-woman visits were less likely to be overdue. Patients with pre-diabetes had lower odds of being overdue compared to patients diagnosed with diabetes. Non-pregnant patients had higher odds of being overdue. When adjusting for all potential confounders, patients attending annual/well-woman visits were much less likely to be overdue compared to those with other appointment types (aOR 0.02, CI 0.001-0.25) and non-pregnant patients were much more likely to be overdue than pregnant patients (aOR 14.46, CI 5.36-39.01). Results of this evaluation will be used to develop targeted interventions to increase guideline-adherent cervical cancer screening.

INTRODUCTION

Cervical cancer remains a significant global health challenge, accounting for 10% of cancers in women and the fourth leading cause of cancer-related death in women worldwide.[1] Nearly all cervical cancers (99.7%) are caused by persistent human papillomavirus (HPV) infection, with types 16 and 18 responsible for ~70% of cervical cancers.[2-5] The long latency period from infection to cervical cancer development underscores the effectiveness of preventive strategies, with routine Pap testing being a cornerstone of prevention efforts.

Given the high rate of morbidity and mortality from cervical cancer, the World Health Organization aims to eliminate cervical cancer through emphasizing vaccination against HPV, screening, and treatment.[6] It has been projected that cervical cancer screening rates reaching 90% could eliminate cervical cancer in the United States within 10-20 years.[7] As recommendations for HPV DNA testing as the primary screening method increase,[5,8,9] cytology remains an important strategy, particularly among low-income, multiethnic women from underserved communities in the United States.

Significant disparities in cervical cancer screening exist, notably for women with limited educational attainment, Hispanic/Latina ethnicity, poverty, limited access to healthcare, incarceration, and transgender persons with a cervix.[8,10] These disparities are likely related to personal and structural barriers, such as lack of trust in providers and healthcare systems, anxiety and stigma, low health literacy, cost and insurance coverage, language barriers, lack of physician recommendation, time costs such as the ability to take off work, transportation, and neighborhood level factors, such as living in a more segregated area or in an ethnic enclave.[8,10,11] Notably, limited access to providers with shared cultural background or culturally sensitive care can be a barrier to receiving screenings for cervical cancer.[8] These findings translate into disparities in mortality as well, with Hispanic women in Texas border counties having a two-fold higher age-adjusted cervical cancer mortality rate than their non-Hispanic peers.[12-14] For Harris County, where our clinic is located, the Texas Cancer Registry identified 1,138 cervical cancer cases from 2018 to 2022, compared to 6,893 statewide; the age-adjusted rates for cervical cancer incidence is similar between Harris County and Texas at 9.8 and 9.5, respectively.[15] The Registry also identified 305 cervical cancer deaths from 2018 to 2022 in Harris County, compared to 2,068 statewide; the age-adjusted rates for cervical cancer mortality is similar between Harris County and Texas at 2.6 and 2.8, respectively.[16]

Primary care clinics that serve diverse, medically underserved communities, such as those in Harris County, Texas, face a unique and critical challenge in ensuring timely screening. As an example, our healthcare system serves a predominantly Hispanic population (52.3%, compared to 22.5% African American, 17.0% white, and 7.3% Asian and other backgrounds), as well as a predominantly uninsured (44.3%) population.[17] Our healthcare system achieved a cervical cancer screening rate of 68.2% in 2020.[18] In reviewing our individual clinic's data, our 2024 cervical cancer screening rate was 82.2% (L. Danek, personal communication). To develop effective, community-specific interventions, understanding the factors that contribute to delayed cervical cancer screening is essential. This study was conducted to evaluate the characteristics associated with overdue cervical cancer screenings among patients attending a community safety-net clinic in Houston, TX. By examining sociodemographic and clinical factors, this research aims to

identify key determinants of screening adherence and inform the development of targeted initiatives to improve guideline-adherent cervical cancer screening.

METHODS

Study Design

A retrospective chart review of electronic health records (EHRs) from a community safety-net clinic in Houston, TX, was conducted for female patients between 21 and 65 years old who had a non-emergent visit between January 1, 2024, and March 31, 2024. Charts were filtered to those with available Pap cytology results or health maintenance alerts (Care Gaps) for incomplete Pap smears. This study was approved by the Baylor College of Medicine Institutional Review Board.

The identified EHRs were reviewed to determine if Pap testing was completed within guideline-recommended intervals ("not overdue" or "overdue"). Our primary guideline was the United States Preventative Task Force, which recommends cytology only every 3 years for ages 21-29, then cytology and HPV co-testing every 5 years from ages 30 to 65.[8] Screening intervals for patients with prior abnormal results were determined using the mobile application from the American Society for Colposcopy and Cervical Pathology (ASCCP). Data extracted also included: Ethnicity (Hispanic or non-Hispanic); Preferred language (primarily speaks English, "Yes" or "No"); Appointment type indicated the categorization of the index appointment; Pregnancy status at the index appointment ("Yes," "No," or Unknown); Diagnosed with diabetes ("Yes," "No," or "Pre-diabetes"). The Hemoglobin A1c (HbA1c) was then categorized as "< 7" for controlled diabetes or pre-diabetes, "≥ 7 and < 9" for those who need additional intervention, "≥ 9" for uncontrolled diabetes, and "Not applicable" for those without either diagnosis. BMI was categorized into underweight (<18.5), normal (18.5 to 24.9), overweight (25.0 to 29.9), obesity classes 1-2 (30.0 to 39.9), and obesity class 3 (≥40.0). This information was collected to better understand factors that may be associated with timely cervical cancer screening using Pap smear in this sample.

Statistical Analyses

For bivariable comparisons, descriptive statistics and chi-square test were performed. Multivariable binary logistic regression modeled the odds of having an up-to-date Pap smear in patient charts for BMI, diabetes status, and ethnicity. We also examined whether HbA1c levels were associated with Pap smears using descriptive statistics and chi-square tests for bivariable comparisons. All analyses were performed using SAS statistics software version 9.4 (Cary, NC).

RESULTS

Patient Demographics

We identified 517 patients, then excluded those without adequate Pap testing notes that indicated whether they were overdue (n=46) for a final sample of 471 patients. The mean age was 43.3 years (SD 12.3, range 20 to 66), 82.0% identified as Hispanic/Latina, and 67.3% reported Spanish as their preferred language. Overweight (43.7%) and obesity (42.6%) were common in our population; mean BMI was 31.8 (SD 7.2, range 19.5 to 56.1). For patients with HbA1c data available (n=352), the mean HbA1c was 6.5% (range 4.7% to 16.5%).

Patients with Overdue Pap Smears

Overdue Pap smear testing differed significantly by ethnicity (p=0.04), preferred language (p=0.004), index appointment type (p<0.001), pregnancy status at index appointment (p=0.003), diabetes status (p<0.001), last HbA1c values (p<0.001), and BMI (p=0.03) (Table 1). Most patients had their Pap smear collected at an annual or well-woman visit (n=235, 49.9%).

In unadjusted logistic regression analyses (Table 2), patients who did not primarily speak English had lower odds of being overdue compared to patients who primarily speak English (OR 0.56, CI 0.38-0.83). Patients whose index visits were categorized as annual/well-woman exams were less likely to be overdue (OR 0.01, CI 0.00-0.10). Patients with pre-diabetes had lower odds of being overdue compared to patients diagnosed with diabetes (OR 0.26, CI 0.14-0.48)). Compared to patients with a normal BMI, those with an overweight BMI were less likely to be overdue (OR 0.47, CI 0.26-0.83). In contrast, non-Hispanic/non-Latina patients had higher odds of being overdue compared to Hispanic patients (OR 1.65, CI 1.02-2.66). Patients who were not pregnant (OR 2.50, CI 1.35-4.63) or with unknown pregnancy status (OR 11.56, CI 1.25-107.04) at the index appointment were more likely to be overdue compared to pregnant patients. After adjusting the model for all potential confounders (Table 2), patients who had an annual/well-women visit were much less likely to be overdue compared to those with an unknown appointment (aOR 0.02, CI 0.001-0.25) and women who were not pregnant at the index appointment were much more likely to be overdue than pregnant women (aOR 14.46, CI 5.36-39.01).

CONCLUSION & DISCUSSION

Our clinic and healthcare system serve a predominantly Hispanic population from diverse countries of origin. Hispanic women have historically been more likely to present with advanced cervical cancer, as well as with differences based on region of origin (nativity), recency of immigration, or socioeconomic status.[19-24] Thus, it is critical to ensure these populations receive timely screening to reduce their risk of cervical cancer. Facilitators to

Table 1. Overdue status for Pap tests by patient characteristics for female patients with a primary care visit at a community safety-net clinic (January 1 – March 31, 2025, N=471)

	Not overdue n (%)	Overdue n (%)	p-value
Ethnicity			0.04
Hispanic	202 (52.3)	184 (47.7)	
Non-Hispanic	34 (40.0)	51 (60.0)	
Primarily speaks English			0.004
Yes	61 (40.4)	90 (59.6)	
No	175 (54.7)	145 (45.3)	
Appointment type			<0.001
Annual/ well-woman	168 (71.5)	67 (28.5)	
Cervical cancer management	8 (15.4)	44 (84.6)	
Follow-up	12 (30.0)	28 (70.0)	
Other	47 (4.6)	66 (58.4)	
Unknown	1 (3.2)	30 (96.8)	
Pregnant at appointment			0.003
Yes	37 (69.8)	16 (30.2)	
No	198 (48.1)	214 (51.9)	
Missing	1 (16.7)	5 (83.3)	
Diabetic			<0.001
No	132 (48.2)	142 (51.8)	
Yes	49 (40.5)	72 (59.5)	
Prediabetic	53 (72.6)	20 (27.4)	
HbA1c recent values			<0.001
A1c < 7	167 (59.2)	115 (40.8)	
HbA1c ≥ 7 and < 9	18 (46.2)	21 (53.8)	
HbA1c ≥ 9	15 (39.5)	23 (60.5)	
Not applicable	36 (32.1)	76 (67.9)	
BMI			0.03
≤24.9	25 (39.1)	39 (60.9)	
25 - 29.9	119 (57.8)	87 (42.2)	
30 - 34.9	38 (41.3)	54 (58.7)	
35 - 39.9	29 (50.0)	29 (50.0)	
40+	25 (49.0)	26 (51.0)	

cervical cancer screening in Hispanic women include health status, insurance coverage, belief of perceived benefit, marital status, age, residency duration, and having a usual source of care.[25-29] When considering our results, wherein Hispanic patients have lower odds of being overdue for cervical cancer screening, access to healthcare coverage and a usual source of care through our system are likely key components in our screening rates. Most of our patients have coverage through the Harris County Financial Assistance Program or through Medicaid during pregnancy. However, access to county financial assistance is variable across Texas due to differences in eligibility requirements, which also impacts care for cervical cancer after diagnosis.[14]

Table 2. Multivariable logistic regression examining overdue status for Pap tests by patient characteristics for female patients attending a primary care visit at a community safety-net clinic (January 1 – March 31, 2025, N=471)

	Pap overdue OR (95% Confidence Interval)	Pap overdue aOR (95% Confidence Interval)
Ethnicity		
Hispanic	Referent	Referent
Non-Hispanic	**1.65 (1.02-2.66)**	0.72 (0.34-1.51)
Primarily speaks English		
Yes	Referent	Referent
No	**0.56 (0.38-0.83)**	0.84 (0.46-1.53)
Appointment type		
Annual/ well woman	**0.01 (0.00-0.10)**	**0.02 (0.001-0.25)**
Cervical cancer management	0.18 (0.02-1.54)	0.34 (0.02-4.83)
Follow-up	**0.08 (0.01-0.64)**	0.09 (0.01-1.29)
Other	**0.05 (0.01-0.36)**	0.14 (0.01-2.01)
Unknown	Referent	Referent
Pregnant at appointment		
Yes	Referent	Referent
No	**2.50 (1.35-4.63)**	**14.46 (5.36-39.01)**
Missing	**11.56 (1.25-107.04)**	2.22 (0.11-45.92)
Diabetic		
No	0.73 (0.48-1.13)	1.00 (0.44-2.27)
Yes	Referent	Referent
Prediabetic	**0.26 (0.14-0.48)**	0.68 (0.26-1.76)
HbA1c recent values		
A1c < 7	Referent	Referent
HbA1c ≥ 7 and < 9	0.59 (0.30-1.16)	1.50 (0.50-4.48)
HbA1c ≥ 9	1.31 (0.53-3.25)	0.88 (0.28-2.71)
Not applicable	1.81 (0.86-3.81)	3.58 (0.95-13.56)
BMI		
≤24.9	Referent	Referent
25 - 29.9	**0.47 (0.26-0.83)**	0.59 (0.29-1.16)
30 - 34.9	0.91 (0.48-1.75)	1.23 (0.56-2.69)
35 - 39.9	0.64 (0.31-1.32)	0.92 (0.38-2.22)
≥40	0.67 (0.32-1.40)	0.95 (0.38-2.37)

Additionally, our results indicate that non-pregnant patients should be a target for intervention in our patient population, as they are more likely to be overdue for screening than pregnant patients. This is likely explained by pregnant patients receiving a Pap smear during initial prenatal visits, a standard operating procedure in our clinic. Non-pregnant patients may be reluctant to schedule annual exams due to cultural beliefs,[30,31] concerns about the test or results,[32-34] time constraints,[32,33,35] history of trauma,[36-39] or other barriers, as discussed in the Introduction. Our results highlight the importance of developing similar standard operating procedures for non-pregnant patients and of exploring culturally tailored approaches, including self-collection methods, to increase screening rates among medically

underserved patients with a cervix in our clinic. Therefore, we are now developing a multi-component initiative to address our identified gaps, including (1) increased scheduling for annual/well-woman visits, including actively re-scheduling patients who missed their annual/well-woman visits, as our results identified this visit type as a significant predictor of cervical cancer screening (2) provider education on the importance of a strong recommendation to complete cervical cancer screening,[31,40,41] (3) patient education from providers and ancillary staff on cervical cancer and screening,[25,42-46] and (4) working with our healthcare system to implement self-collected vaginal HPV swabs, which can increase screening rates in hard-to-reach populations.[18,32,47-52] Notably, a previous trial within our healthcare system demonstrated self-collected HPV screening increased cervical cancer screening rates.[18]

Recently, on May 17, 2024, the US Food and Drug Administration (FDA) extended the indications for two HPV tests previously approved for primary HPV screening to include self-collected vaginal specimens in healthcare settings where specimens can be processed by trained personnel and transported to a testing laboratory under controlled conditions.[53-55] These expanded indications were approved to encourage cervical cancer screening, particularly for patients who are not routinely receiving such screenings. The Onclarity HPV Assay by Becton, Dickinson and Company (BD) uses amplification of HPV L1 fragment and detects 14 high-risk HPV types, including detecting types 16/18/45 specifically as well as types 31/33/35/39/51/52/56/59/66/68. The Cobas HPV Test by Roche Molecular Systems similarly utilizes amplification and genotyping of HPV 16 and 18 specifically and pooling results from 12 remaining high-risk HPV types 31/33/35/39/45/51/52/56/58/59/66/68. The Cobas HPV Test is a rapid test and is able to process 96 samples in 5 hours.

The generalizability of our study is likely limited, as patients from Hispanic/Latinx backgrounds are over-represented and our sample size is small. However, our study results are particularly relevant to clinics and health centers serving a predominantly Hispanic/Latinx immigrant population and/or medically underserved patients, as they likely experience similar gaps that can be addressed through training, adopting primary prevention strategies (e.g., HPV vaccination, another area of quality improvement in our clinic), and supplemental screening technologies that may be more acceptable to communities with diverse populations.

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The authors have no disclosures to report.

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