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Cervical Cancer Screening and Affordability of Medical Care: A Cross-Sectional Study

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Abstract

Objective: To determine if, among women aged 21-65, there is a positive association between avoiding healthcare due to cost and not being up to date on cervical cancer screening.

Methods: This cross-sectional study utilized the 2022 Behavioral Risk Factor Surveillance System dataset. A total of 123,275 women, aged 18-69 without a hysterectomy, were analyzed with bivariate and multivariate analyses. The outcome was length of time since last cervical cancer screening. The exposure was avoiding healthcare in the last 12 months due to cost.

Results: Women who avoided healthcare due to cost had higher odds of not being up to date on cervical cancer screening (aPOR 1.57; 95% CI 1.34,1.84). Risk factors included increased age (Aged 60-69: aPOR 4.02; 95% CI 3.16, 5.11), insurance status, certain races, lacking transportation, lacking primary healthcare providers, and location. Protective factors included increased annual income ($100,000+: aPOR 0.72; 95% CI 0.58, 0.89), speaking Spanish, increased education, and certain races.

Conclusions: This study demonstrates the effect of cost on cervical cancer screening and draws attention to the need for cost-effective health services for at-risk women.

Introduction

In 2020, the Centers for Disease Control and Prevention (CDC) reported an incidence of 7 new cases of cervical cancer per 100,000 population and a mortality rate of 2 deaths per 100,000 population.[1] Regular screening remains the primary method of prevention. The U.S. Preventive Services Task Force (USPSTF) recommends that women aged 21-29 be screened by Pap smear alone every three years. Women aged 30-65 can receive a Pap smear alone every three years, human papilloma virus (HPV) testing alone every five years, or co-testing with Pap smear and HPV every five years. The USPSTF does not consider one form of testing to be better than another for women aged 30-65; patients and their providers are able to choose their preferred test. Testing is not recommended for women younger than 21, older than 65, or those with a hysterectomy if they have a negative screening history. If women in these groups have a history of cervical lesions or cancer, testing may be recommended.[2]

While the incidence and mortality rates of cervical cancer are relatively low in the United States, it is estimated that the number of women who are overdue for cervical cancer screening has increased from 14% in 2005 to 23% in 2019.[3] Some risk factors for women who are not up to date on cervical cancer screening include being between the ages of 40-65 and being non-Hispanic white.[4,5] Variation for the prevalence of cervical cancer co-testing also exists between states; a 2020 study found that co-testing prevalence tended to be higher in Northeastern states and lower in Midwestern and Southern states.[5]

Another significant factor that plays a role in the underscreening of U.S. women is cost of health care to the individual.[6,7] In 2022, it was estimated that the average cost of health care per year in the United States was $13,493 per person, for a total of $4.5 trillion nation-wide.[8]

Insurance rates are also a factor, with an estimated 11% of U.S. adults aged 18-64 being uninsured.[9] A 2021 study of low-income women in North Carolina found that 71% of study participants indicated that cost was a significant barrier to cervical cancer screening.[10] This is especially prominent in women aged 45-65. A 2020 study found that women in this age group who were insured had 1.52 times the odds of being screened for HPV in the last five years compared to uninsured women of the same age.[11] Cost barriers are also prominent in rural areas that serve low-income, minority populations. A 2019 study looked at access to cervical cancer screening facilities in the Rio Grande Valley and Laredo regions in Texas. These areas are near the U.S./Mexico border, have cervical cancer mortality rates 30% higher than the rest of Texas, and have high numbers of uninsured people (33.5%). The study found that, at the clinics included in the analysis, 64% of patients were uninsured. The clinics were responsible for the costs of treatment for these patients; as such, the clinics used all of their yearly government funding early, leading to lack of cervical cancer screening services for uninsured women when the funding ran out.[12]

While many studies investigate cost of care as a covariate in cervical cancer screening rates, fewer studies have looked at cost as an exposure variable. This study will seek to address that gap and add to the body of research surrounding cost of care and disparities in cervical cancer screening rates. The results of this study are intended to make an impact in the understanding of cervical cancer screening as it pertains to cost of medical care and determine groups of women most at risk for not being up to date on cervical cancer screening. This study will seek to determine if, among women aged 21-65, there is a positive association between avoiding medical care due to cost and not being up to date on cervical cancer screening.

Methods

Study Design and Setting

This is a cross-sectional study utilizing the 2022 Behavioral Risk Factor Surveillance System (BRFSS) data set. The BRFSS is a nation-wide, health behavior phone survey administered by the CDC and managed by state health departments. It includes data from all 50 U.S. states, as well as Washington D.C. and several U.S. territories. Adults over the age of 18 are selected randomly from a list of cell phone numbers or from a stratified list of landline phone numbers. One randomly chosen adult from each residence completes the survey over the phone by answering questions read by an interviewer. All responses are self-reported. To account for the complex sampling design, BRFSS responses are weighted.[13]

Study Population

Females aged 18-69 were included in analysis for this study. Current USPSTF guidelines for cervical cancer screening recommend females aged 21-65 be screened. The age variables in the BRFSS data set contain women aged 18-20 and 66-69 within existing categories; for this reason, additional ages were included in analysis beyond what is currently recommended for screening. Any woman younger than 18 or older than 69 was excluded from analysis. Additional excluded groups include all males and any female with a hysterectomy. Out of 445,132 observations, 123,275 females were included in the frequency analysis. Only observations without missing data were included in the bivariate analysis, for a final sample size of 71,566.

Outcome

The outcome variable used for this analysis was “How long has it been since your last cervical cancer screening?” The original response categories were, “1- Within the past year

(anytime less than 12 months ago)", "2- Within the past 2 years (1 year but less than 2 years ago)", "3- Within the past 3 years (2 years but less than 3 years ago)", "4- Within the past 5 years (3 years but less than 5 years ago)", "5- 5 or more years ago", "7- Don't know/unsure", and "9- Refused." Responses within the last three years (categories 1-3) were considered "up to date" while anything over three years (categories 4-5) was considered "not up to date." After recoding, the response categories used for this study were, "1-Up to date" and "2- Not up to date." Categories 7 and 9 were excluded.

Exposure

The exposure variable was, "Was there a time in the last 12 months when you needed to see a doctor but could not because you could not afford it?" The original response categories were "1- Yes", "2-No", "7- Don't know/not sure", and "9- Refused." Categories 1 and 2 were kept the same for the analysis while categories 7 and 9 were excluded.

Measures

Covariates included age (18-29/30-39/40-49/50-59/60-69), race/ethnicity (Non-Hispanic White/Non-Hispanic Black/Non-Hispanic Other Race/Non-Hispanic Multiracial/Hispanic), education level (Did not graduate high school/High school graduate/Attended college or technical school/College or technical school graduate), employment status (Employed/Unemployed), annual household income (<$25,000/$25,000-49,999/$50,000-99,999/$100,000 or more/Declined), health insurance status (Insured/Uninsured/Declined), location (Urban/Rural), language (English/Spanish), lack of reliable transportation (Yes/No), having a primary health care provider (Yes/No), and the number of poor mental health days per month (0 Days/1-13 Days/14+ Days). These variables were included as they were identified as

important variables in previous literature.[5-7,10] Any missing or refused responses were excluded from analysis, except if the number of missing responses was >10%. Categories with >10% missing responses had the category "Declined" included in analysis.

Data Analysis

Statistical analyses were performed using SAS Studio 3.82 (SAS Institute, Cary, NC). In order to make the study population representative of the U.S. population, weights supplied by the BRFSS were used. Frequency analysis was performed to describe the characteristics of the study population. Bivariate analysis was performed on the covariates for the outcome variable to generate crude prevalence odds ratios and confidence intervals. A multivariate analysis was also performed on the covariates for the outcome variable to determine confounders and generate adjusted prevalence odds ratios and confidence intervals. Backwards selection was used to eliminate covariates that were not significant.

Ethical Approval

This study used publicly available, de-identified, public health surveillance data and was therefore not subject to IRB approval.

Results

Demographic characteristics are described in Table 1. About 78% of the population was up to date on cervical cancer screening and 14% avoided seeing a doctor due to cost. The proportion of study participants in each age group gradually decreased with older ages. The majority of respondents were White (54.5%). About 65% of respondents attended or graduated from college or technical school. The majority of respondents were employed (63.7%). About 13% had an annual household income of <$25,000 while 23.1% had an annual household

income of $100,000 or more. Approximately 81% of respondents aged 18-64 had some kind of health insurance. The majority of women lived in urban areas (94.5%) and 90.8% had reliable transportation. English was the primary language (93.4%). About 83% of women had a primary health provider and 46.2% had zero poor mental health days per month.

In the unadjusted analysis (Table 2), multiple variables were identified as risk factors for not being up to date on cervical cancer screening. The reference category for the prevalence odds ratios was “Up to Date.” Women who avoided the doctor due to cost had 1.82 times the odds of not being up to date on cervical cancer screening compared to women who did not avoid the doctor due to cost (95% Confidence Interval 1.63, 2.03). The risk factors for not being up to date on cervical cancer screening were as follows:, increasing age (aged 60-69: POR 3.50; 95% CI 3.05, 4.00), being multiracial (POR 1.13; 95% CI 0.92, 1.39), being unemployed (POR 1.34; 95% CI 1.24, 1.45), being uninsured (POR 2.41; 95% CI 2.05, 2.83), living in a rural area (POR 1.34; 95% CI 1.20, 1.50), lack of transportation (POR 1.89; 95% CI 1.57, 2.27), lack of a primary health care provider (POR 2.15; 95% CI 1.93, 2.39), and having 14 or more poor mental health days a month (POR 1.24; 95% CI 1.13, 1.37). Protective factors include the following: being a race other than White or multiracial (Black: POR 0.70 (0.61-0.81), being educated (Graduated from college or technical school: POR 0.63; 95% CI 0.52, 0.75), increased annual income ($100,000 or more: POR 0.53; 95% CI 0.46, 0.60), and speaking Spanish (POR 0.76; 95% CI 0.61,0.94).

In the adjusted analysis (Table 3), the variables “employment status” and “poor mental health days per month” were found to be non-significant and were removed. All other variables were significant. The reference category for the adjusted prevalence odds ratios was “Up to Date.” Women who avoided the doctor due to cost had 1.57 times the odds of not being up to

date on cervical cancer screening compared to women who did not avoid the doctor due to cost (95% Confidence Interval 1.34, 1.84). The following variables were also found to be risk factors for not being up to date on cervical cancer screening: increasing age (Aged 60-69: aPOR 4.02; 95% CI 3.16, 5.11), being "other race, non-Hispanic," (aPOR 1.25; 95% CI 0.92, 1.70), being uninsured (aPOR 1.72; 95% CI 1.34-2.22), living in a rural area (aPOR 1.20; 95% CI 1.02, 1.40), lacking of transportation (aPOR 1.52; 95% CI 1.26, 1.84), and lack of a primary health care provider (aPOR 2.23; 95% CI 1.90, 2.620). Protective factors included the following: being Black (aPOR 0.64; 95% CI 0.51, 0.80), being educated (Graduated from college or technical school: aPOR 0.68; 95% CI 0.53, 0.87), increased annual income ($100,000 or more: aPOR 0.72; 95% CI 0.58, 0.89), and speaking Spanish (aPOR 0.72; 95% CI 0.58, 0.89).

Discussion

This study found that there was a positive association between avoiding medical care due to cost and not being up to date on cervical cancer screening. Covariates found to be risk factors for not being up to date on cervical cancer screening were age, certain races/ethnicities, insurance status, location, lack of transportation, and lack of a primary care provider. Covariates found to be protective factors included being Black, non-Hispanic; having a higher education status; having a higher annual household income; and speaking Spanish.

These results are largely in line with those of currently published studies. In a 2021 study, 75% of low-income women in North Carolina indicated that cervical cancer screening would cost them more than they could afford to pay.[10] Reasons cited included out-of-pocket costs, losing pay from having the time off work, and costs associated with transportation. Another recent study looked at the impact of patient navigation services on breast and cervical

cancer screening rates for women in rural and border towns in Texas.[14] The study found that women who did not access these services due to the cost of screening were less likely to have received Pap smear testing. Similarly, a 2019 study found that, among uninsured and underinsured women in New Jersey, women who lived in areas with high unemployment rates had higher odds of delayed follow-up care for abnormal cervical cancer screening results than women in areas of lower unemployment rates.[15]

One area where the results of this study differed from others was in the age of the participants. This study found that younger women were more likely to be up to date on cervical cancer screening than older women. Contrary to this, a 2021 study found that women aged 21-29 were less likely to be up to date on cervical cancer screening than women who were older.[4] Another study found that women aged 18-20 had the lowest prevalence of three-year cervical cancer screening between 2003 and 2014. However, this paper acknowledged that, while women aged 50-65 had similar rates of screening as women aged 30-39, the rates for the older age group were overall lower.[16] More research is needed to understand which age groups are most at risk for lack of cervical cancer screening.

Strengths of this study include a large sample size and a small number of missing data. The dataset participants were also chosen using randomization methods; this allowed for reduced selection bias. One limitation was that the variable categories for “age” could not be changed. For this reason, additional ages had to be included in analysis beyond those recommended by the USPSTF. This may have resulted in skewed results for this variable. Similarly, a participant was considered “up to date” on cervical cancer screening if they had been screened within three years; this does not include women who may be screened every

five years. This may have skewed the results for the number of women not up to date on cervical cancer screening. Another limitation is that there are likely additional variables that are important for the model that were not included in the dataset. Some variables that may have been helpful to include in the model were citizenship/immigrant status, inability to understand medical instructions due to language barriers, more specific location data such as regions within states, and feeling uncomfortable with health care provider due to provider gender or the provider's racial bias. Lastly, as this study relied on self-reported health behavior data, self-reporting bias may be a factor in the quality of the results.

This study highlighted the importance of considering cost factors for women who are not up to date on cervical cancer screening. It also drew attention to the need for more cervical cancer screening services for low income and underinsured women. The results of this study can be used within the context of other current research to create cost-effective screening opportunities for the women who need it most. Future directions for research include gaining a greater understanding of age differences in cervical cancer screening rates and understanding differences in cost as a factor in screening rates in more specific areas within states.

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Tables

Table 1: Characteristics of Study Population

Variable	N (Weighted %)
Cervical Cancer Screening	
Up to Date	54,616 (78.7%)
Not Up to Date	16,950 (21.3%)
Avoided Doctor Due to Cost	
Yes	13,910 (13.9%)
No	109,365 (86.1%)
Age in Years	
18-29	19,919 (26.1%)
30-39	23,802 (23.2%)
40-49	23,639 (18.5%)
50-59	25,328 (16.6%)
60-69	30,587 (15.7%)
Race/Ethnicity	
White Only, non-Hispanic	87,323 (54.5%)
Black Only, non-Hispanic	11,530 (12.8%)
Other Race Only, non-Hispanic	7,131 (9.0%)
Multiracial, non-Hispanic	3,219 (3.6%)
Hispanic	14,072 (20.2%)
Education Level	
Did Not Graduate High School	6,157 (10.1%)
Graduated High School	25,382 (24.5%)
Attended College/Technical School	33,242 (31.1%)
Graduated College/Technical School	58,494 (34.4%)
Employment Status	
Employed	78,354 (63.7%)
Unemployed	42,779 (36.3%)
Annual Household Income	
<$25,000	15,164 (13.3%)
$25,000-$49,999	23,412 (19.5%)
$50,000-$99,999	31,003 (22.5%)
$100,000 or more	30,664 (23.0%)
Declined	23,032 (21.7%)
Insurance Status Aged 18-64	
Insured	97,531 (81.1%)
Uninsured	7,247 (8.2%)
Declined	18,479 (10.7%)
Location of Respondent	
Urban	109,430 (94.5%)
Rural	13,845 (5.5%)
Language of Respondent	
English	118,696 (93.4%)
Spanish	4,579 (6.6%)
Lack of Transportation	
Yes	5,138 (9.2%)
No	62,225 (90.8%)
Primary Care Provider	
Yes	107,528 (83.1%)
No	15,747 (16.9%)
Poor Mental Health Days Per Month	
0 Days	58,803 (46.2%)
1-13 Days	41,630 (33.7%)
14+ Days	22,842 (20.1%)

N=123,275

Table 2: Unadjusted relationship between cervical cancer screening status and sample characteristics.

	Cervical Cancer Screening		
Variable	**Up to Date***	**Not Up to Date†**	**POR (CI)**
Avoided Doctor Due to Cost			
Yes	4,688 (10.8%)	2,277 (18.1%)	1.82 (1.63-2.03)
No	49,928 (89.2%)	14,673 (81.9%)	REFERENCE
Age in Years			
18-29	5,659 (15.8%)	748 (7.1%)	REFERENCE
30-39	10,014 (23.1%)	2,826 (23.2%)	2.24 (1.95-2.58)
40-49	12,105 (22.4%)	3,030 (20.7%)	2.06 (1.78-2.39)
50-59	13,196 (21.2%)	3,934 (21.8%)	2.30 (1.99-2.65)
60-69	13,642 (17.4%)	6,412 (27.3%)	3.50 (3.05-4.00)
Race/Ethnicity			
White Only, non-Hispanic	41,796 (62.1%)	13,560 (66.1%)	REFERENCE
Black Only, non-Hispanic	4,459 (12.1%)	969 (9.0%)	0.70 (0.61-0.81)
Other Race Only, non-Hispanic	2,193 (6.2%)	686 (5.6%)	0.85 (0.68-1.07)
Multiracial, non-Hispanic	1,322 (3.5%)	476 (4.2%)	1.13(0.92-1.39)
Hispanic	4,846 (16.2%)	1,259 (15.1%)	0.85 (0.68-1.07)
Education Level			
Did Not Graduate High School	1,560 (6.4%)	686 (8.1%)	REFERENCE
Graduated High School	8,046 (18.0%)	3,039 (20.6%)	0.91 (0.77-1.11)
Attended College/Technical School	14,020 (30.9%)	5,107 (36.1%)	0.93 (0.77-1.11)
Graduated College/Technical School	30,990 (44.6%)	8,118 (35.2%)	0.63 (0.52-0.75)
Employment Status			
Employed	37,868 (69.1%)	10,134 (62.5%)	REFERENCE
Unemployed	16,748 (30.9%)	6,816 (37.5%)	1.34 (1.24-1.45)
Annual Household Income			
<$25,000	4,976 (10.2%)	2,369 (15.1%)	REFERENCE
$25,000-$49,999	9,071 (17.6%)	3,532 (21.2%)	0.81 (0.71-0.92)
$50,000-$99,999	15,628 (26.9%)	4,725 (25.1%)	0.63 (0.56-0.71)
$100,000 or more	18,173 (32.6%)	4,180 (25.5%)	0.53 (0.46-0.60)
Declined	6,768 (12.7%)	2,144 (13.1%)	0.69 (0.60-0.80)
Insurance Status Aged 18-64			
Insured	46,008 (86.9%)	11,880 (75.4%)	REFERENCE
Uninsured	1,691 (4.6%)	1,185 (9.6%)	2.41 (2.05-2.83)
Declined	6,917 (8.6%)	3,885 (15.1%)	2.03 (1.83-2.25)
Location of Respondent			
Urban	48,623 (94.8%)	14,709 (93.2%)	REFERENCE
Rural	5,993 (5.2%)	2,241 (6.8%)	1.34 (1.20-1.50)
Language of Respondent			
English	53,225 (94.9%)	16,607 (96.1%)	REFERENCE
Spanish	1,391 (5.1%)	342 (3.9%)	0.76 (0.61-0.94)
Lack of Transportation			
Yes	1,785 (6.3%)	951 (11.3%)	1.89 (1.57-2.27)
No	30,895 (93.7%)	9,665 (88.7%)	REFERENCE
Primary Care Provider			
Yes	50,651 (90.8%)	14,433 (82.1%)	REFERENCE
No	3,965 (9.2%)	2,517 (17.9%)	2.15 (1.93-2.39)
Poor Mental Health Days Per Month			
0 Days	26,204 (46.2%)	7,975 (45.2%)	REFERENCE
1-13 Days	19,444 (35.9%)	5,576 (33.1%)	0.95 (0.87-1.03)
14+ Days	8,968 (17.9%)	3,399 (21.7%)	1.24 (1.13-1.37)

N (%) = Estimated Weighted Frequency, POR= prevalence odds ratio, CI = 95% confidence interval
Note: Reference category for outcome = "Up to Date". The bivariate analysis did not include any observations with missing data. The total sample size for the bivariate analysis was N= 71,566.
*** Up to Date N= 54,616**
† Not up to Date N = 16,950

Table 3: Adjusted relationship between cervical cancer screening status and sample characteristics.

Variable	Crude POR (CI)	aPOR (CI)
Avoided Doctor Due to Cost		
Yes	1.82 (1.63-2.03)	1.57 (1.34-1.84)
No	REFERENCE	REFERENCE
Age in Years		
18-29	REFERENCE	REFERENCE
30-39	2.24 (1.95-2.58)	2.73 (2.21-3.37)
40-49	2.06 (1.78-2.39)	2.64 (2.12-3.29)
50-59	2.30 (1.99-2.65)	3.10 (2.50-3.85)
60-69	3.50 (3.05-4.00)	4.02 (3.16-5.11)
Race/Ethnicity		
White Only, non-Hispanic	REFERENCE	REFERENCE
Black Only, non-Hispanic	0.70 (0.61-0.81)	0.64 (0.51-0.80)
Other Race Only, non-Hispanic	0.85 (0.68-1.07)	1.25 (0.92-1.70)
Multiracial, non-Hispanic	1.13(0.92-1.39)	1.02 (0.74-1.40)
Hispanic	0.85 (0.68-1.07)	0.99 (0.81-1.20)
Education Level		
Did Not Graduate High School	REFERENCE	REFERENCE
Graduated High School	0.91 (0.77-1.11)	0.84 (0.64-1.09)
Attended College/Technical School	0.93 (0.77-1.11)	0.88 (0.68-1.14)
Graduated College/Technical School	0.63 (0.52-0.75)	0.68 (0.53-0.87)
Annual Household Income		
<$25,000	REFERENCE	REFERENCE
$25,000-$49,999	0.81 (0.71-0.92)	0.96 (0.80-1.16)
$50,000-$99,999	0.63 (0.56-0.71)	0.89 (0.74-1.07)
$100,000 or more	0.53 (0.46-0.60)	0.72 (0.58-0.89)
Declined	0.69 (0.60-0.80)	0.85 (0.69-1.05)
Insurance Status Aged 18-64		
Insured	REFERENCE	REFERENCE
Uninsured	2.41 (2.05-2.83)	1.72 (1.34-2.22)
Declined	2.03 (1.83-2.25)	1.65 (1.30-2.09)
Location of Respondent		
Urban	REFERENCE	REFERENCE
Rural	1.34 (1.20-1.50)	1.20 (1.02-1.40)
Language of Respondent		
English	REFERENCE	REFERENCE
Spanish	0.76 (0.61-0.94)	0.72 (0.58-0.89)
Lack of Transportation		
Yes	1.89 (1.57-2.27)	1.52 (1.26-1.84)
No	REFERENCE	REFERENCE
Primary Care Provider		
Yes	REFERENCE	REFERENCE
No	2.15 (1.93-2.39)	2.23 (1.90-2.62)

aPOR = adjusted prevalence odds ratio, CI= 95% Confidence Interval

Appendix

Biography

Sarah Johnson is an online Master of Public Health student with a concentration in epidemiology at the University of Nebraska Medical Center, Center College of Public Health. Her research interests include vaccine-preventable infectious diseases and cancer prevention, especially for cancers affecting women. Sarah holds a Bachelor of Arts in Biology from Hastings College and a Postbaccalaureate Certificate in Cytotechnology from the University of Nebraska Medical Center, College of Allied Health Professions. She works as a board-certified cytotechnologist at Methodist Hospital in Omaha, NE.

Resume

SARAH MARCELLA JOHNSON

402-469-3953 | sarahmjohnson@charter.net

EDUCATION

Master of Public Health—Epidemiology **Aug. 2021-present**
University of Nebraska Medical Center, Omaha, Nebraska

Postbaccalaureate Certificate-- Cytotechnology **Aug. 2019—July 2020**
University of Nebraska Medical Center, Omaha, Nebraska

Bachelor of Arts-- Biology **Aug. 2015 –May 2019**
Minor: English
Hastings College, Hastings, Nebraska

PROFESSIONAL EXPERIENCE

Student Researcher, University of Nebraska Medical Center, Omaha, NE Present

- Designed a cross sectional study using the 2022 Behavioral Risk Factor Surveillance System to understand the relationship between cervical cancer screening rates and avoiding medical care due to cost
- Conducted statistical analysis using SAS Studio coding software
- Produced a research paper and scientific poster to present results

Public Health Intern, Nebraska Cures, Omaha, NE May-July 2023

- Conducted a program evaluation of how well the Nebraska Women in STEM initiative met its goals in its first year by surveying initiative participants
- Created a final report of data from the survey that will be used to make improvements to the program
- Researched resources for women in STEM careers to access on the initiative website

Student Researcher, University of Nebraska Medical Center, Omaha, NE Nov. 2022

- Analyzed case data from the measles outbreak in New York State from 2018-2019 in the context of vaccine hesitancy
- Created a line listing and epidemic curve using reports of cases from the New York State Department of Health

Cytotechnologist, Nebraska Methodist Health System, Omaha, NE July 2021-present

- Screen and diagnose ThinPrep Pap smears
- Screen and interpret non-gynecological samples including thyroid, urine, cerebrospinal fluid, and body fluids
- Report cytology results using the laboratory information system Cerner
- Accession, process, and stain non-gynecological samples including ThinPrep, cell block, cytospin, and direct smears

- Assist with fine needle aspiration procedures including bronchoscopies, endobronchial ultrasound, endoscopies, CT-guided core biopsies, and ultrasound-guided head and neck biopsies
- Perform ROSE assessments on bronchoscopies, endobronchial ultrasound, and thyroid
- Assist with quality control and quality assurance activities including Pap rescreens, stain quality assessments, and reviews of written cytology procedures

Cytotechnologist, CHI Health Creighton University Medical Center Bergan Mercy, Omaha, NE
Sept. 2020 – July 2021

- Screen and diagnose ThinPrep Pap smears utilizing the ThinPrep imaging system
- Screen and interpret non-gynecological samples including thyroid, urine, cerebrospinal fluid, and body fluids
- Report Pap smear results using the laboratory information system Cerner
- Accession, process, stain, and image pap smear samples
- Process and stain Pap smear rerun samples
- Trained to accession, process, and stain non-gynecological samples including ThinPrep, cell block, cytospin, and direct smears

Student Researcher, University of Nebraska Medical Center, Omaha, NE May 2020

- Analyzed the cytology of Pap smears of transgender male patients at UNMC
- Captured images of cells with the microscope camera to describe and present the unique cytology of transgender male Pap smears

Microbiology Research Lab Intern, U.S. Meat Animal Research Center, Clay Center, NE
May-July 2018

- Characterized 10 strains of probiotic *Escherichia coli* to determine if they could be used as contamination control surrogates in the meat packing line
- Plotted data points on graphs and presented my findings to a group of scientists from M.A.R.C.

LICENSES AND CERTIFICATIONS

- Cytotechnologist, CT(ASCP) — Certified July 2020
- ThinPrep Morphology — Certified October 2020

SKILLS

- Screen and interpret gynecologic and non-gynecologic samples; Pap, Diff Quik, cell blocks, and special stains
- Assist on FNA procedures and perform ROSE assessments
- Perform cytology preparatory techniques, including SurePath, ThinPrep, cytospins, and cell blocks
- Cerner laboratory computer system
- SAS programming