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Examining the Association Between Cervical Cancer Screenings, Health Care Access, and Socio-Demographics Among Women of Urban/Rural Status in Kentucky

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Abstract

Background: This study focuses on cervical cancer screening rates (e.g., Pap testing) among women of urban/rural status in Kentucky. Specifically, this study's primary objective is to examine the association between cervical cancer screening rates and health care access among the women of interest. Secondarily, this study aims to identify which socio-demographic variables impact cervical cancer screening rates and health care access. The purpose of doing so is to better understand what disparities and barriers might be contributing to the suboptimal screening rates observed throughout Kentucky.

Methods: An empirical analysis utilizing secondary data from the 2020 Behavioral Risk Factor Surveillance Survey (BRFSS) was conducted for this study. Data was collected from January 2020 to December 2020. 1,623 female respondents were of interest and kept for the analysis. Variables of interest all fell within three categories: (1) socio-demographics, (2) health care access, and (3) cervical cancer screenings. Descriptive statistics, chi-square testing, and a correlation matrix were conducted to determine if there were associations between the variables of interest.

Results: This study suggests urban-rural disparities in terms of socio-demographics, cervical cancer screenings, and some health care access variables. Rural women were the ones to experience these disparities instead to their urban counterparts. Chi-square testing suggested significant relationships between urban/rural status and four socio-demographic variables of interest at an alpha of ≤ 0.05. Additionally, the correlation matrix suggested several significant relationships between the variables of interest at an alpha of ≤ 0.05 as well.

Implications/Conclusion: This study suggests that there may be an association between cervical cancer screening rates and specific health care access and socio-demographic variables. Future

efforts should focus on devising and improving policy and educational endeavors aimed at increasing cervical cancer and cervical cancer screening knowledge and access to screenings among the intended target populations throughout Kentucky.

Keywords: Cervical cancer, Human Papillomavirus (HPV), Preventative Health screenings, The Papanicolaou test (Pap test), and Behavioral Risk Factor Surveillance Survey (BRFSS)

I. Introduction

Cervical cancer incidence and mortality continue to be a pressing problem for women, both nationally and within the state of Kentucky. As of 2018, the United States (U.S.) observed 12,733 new cases of cervical cancer for an age-adjusted incidence rate of 7.5 per 100,000 women (USCS, 2018). In terms of mortality, the U.S. observed 4,138 cervical cancer deaths for an age-adjusted mortality rate of 2.2 per 100,000 women that same year (USCS, 2018). Compared to national rates, women residing in Kentucky observed higher cervical cancer incidence and mortality rates. As of 2018, Kentucky observed 210 new cases of cervical cancer for an age-adjusted incidence rate of 8.9 per 100,000 women (USCS, 2018). In terms of mortality, Kentucky observed 71 cervical cancer deaths for an age-adjusted death rate of 2.7 per 100,000 women that same year (USCS, 2018). There are also urban-rural disparities in incidence and mortality in Kentucky. A study conducted by Silva et al. found that in 2016-2017, cervical cancer incidence was 19.0% higher, and mortality was 79.0% greater among women residing in rural counties of Kentucky versus urban counties (Silva et al., 2020). Although overall cervical cancer rates have declined by over 70.0% since the 1950s, further improvements are needed (Safaeian et al., 2007).

To help prevent cervical cancer, the Papanicolaou test (e.g., Pap test) and primary HPV test were created for early detection. For this study, the Pap test will be the preventative health screening of focus. This preventative health screening was chosen due to how common it is and how much information is available on it. Developed in the 1940s, the Pap test has proven to be a highly effective screening tool for identifying precancerous lesions on the cervix (CDC, 2021). Throughout the U.S., it is recommended that all women aged 21 to 29 receive a Pap test every three years (CHFS, 2017). However, once a woman reaches the ages 30 to 65, it is recommended

that she still complete a Pap test every three years but add on a Primary HPV test every five years, or have both tests every five years (CHFS, 2017). According to America's Health Rankings, as of 2018, 79.9% of women in the U.S. aged 21 to 44 had received a Pap test within the past three years (AHR, 2018). Upon comparison, Kentucky observed a Pap test screening percentage of 83.8%; this was slightly higher than the national average in that same year (AHR, 2018). Although a significant majority of women throughout the state have received a Pap test, many still have not.

This is problematic, as the Pap test can significantly reduce incidence and mortality related to cervical cancer. Of the over 70.0% decline in cervical cancer rates previously mentioned, Pap testing has been the main attributer to that decline (Safaeian et al., 2007). However, barriers persist and prevent many women from receiving and benefitting from these screenings. Some common barriers include a lack of health care access (e.g., limited access to health care providers), being uninsured, and issues with affording the screening (e.g., if one must pay out-of-pocket) (Akinlotan et al., 2017). While many private insurance companies and federally administered programs (e.g., Medicare and Medicaid) cover routine cervical cancer screenings, women who are uninsured are easily missed (ACS, 2020). Additionally, geographic location (e.g., urban versus rural settings) can be another barrier for women completing this screening (Akinlotan et al., 2017). Women living in rural settings are less likely to be screened due to fewer health care provider visits and recommendations (Akinlotan et al., 2017).

As a result of elevated rates and suboptimal screening regarding cervical cancer, information and data are needed to fill the gaps. For this study, cervical cancer screening rates among women residing in both urban and rural settings of Kentucky will be examined. Specifically, the association between those rates and health care access (e.g., percent covered by

health insurance and percent that have a health care provider) among the identified target populations. Furthermore, specific socio-demographic variables and their impact will be assessed for their effect on cervical cancer screening rates and health care access among women in both settings. An empirical analysis will be performed that utilizes secondary data from the 2020 Behavioral Risk Factor Surveillance Survey (BRFSS). By performing this study, the overarching goal is to provide a better understanding of the association between cervical cancer screenings and health care access in Kentucky and identify where barriers lie and among which subpopulation(s) of women. As a result, Public Health professionals can use that information to improve screening rates and barriers to access among women throughout Kentucky.

II. Literature Review

Throughout this section, a demographic profile of Kentucky will be provided, along with an overview of the current literature on cervical cancer prevalence, screenings, and health care access as a barrier within the state. National figures and estimates will be given when data on Kentucky is unavailable. The purpose of including these subheadings is to holistically explore the topics of interest among the intended target populations. Also, to ensure that the literature being surveyed is the most current, studies will be limited to those published since the year 2000; this is a 22-year timeframe.

Socio-Demographic Profile of Kentucky:

Table One: A Comparison of Socio-Demographic Characteristics of the U.S. & Kentucky:

	Kentucky	United States (U.S.)
Total Population	4,505,836	331,449,281
Sex	50.7% - Female 49.3% - Male	50.8% - Female 49.2% - Male
Age	6.1% - 5 years of age or less 22.4% - 18 years of age or less 16.8% - 65 years of age or older	6.0% - 5 years of age or less 22.3% - 18 years of age or less 16.5% - 65 years of age or older
Race/Ethnicity	87.5% - NH, White 8.5% - NH, Black 1.6% - NH, Asian 2.0% - Two or More Races 3.9% - Hispanic	76.3% - NH, White 13.4% - NH, Black 5.9% - NH, Asian 2.8% - Two or More Races 18.5% - Hispanic
Educational Attainment	86.3% - Graduated from high school 24.2% - Held a bachelor's degree or higher	88.5% - Graduated from high school 32.9% - Held a bachelor's degree or higher
Median Household Income	$50,589	$64,994
Percent in Poverty	14.9%	11.4%
Percent Uninsured	7.7%	10.2%

***Sources: U.S. Census 2021a, U.S. Census 2021b**
****NH = non-Hispanic**

As of 2021, the state of Kentucky had an estimated population of 4,509,394 residents (U.S. Census, 2021a). This was a growth of 3,558 individuals from the previous year, for a population percent change of just 0.1% (U.S. Census, 2021a). Of the over 4.5 million residents, there were slightly more females to males and most residents (54.7%) were older than 18 years of age but younger than 65 years of age (U.S. Census, 2021a). Additionally, Kentucky has a predominately Non-Hispanic, White population (U.S. Census, 2021a).

In terms of socioeconomic characteristics, most Kentuckians aged 25 and older obtained a high school diploma, while less than a quarter obtained a bachelor's degree or higher in 2015-2019 (U.S. Census, 2021a). These percentages were lower than the national averages of 88.5% and 32.9%, respectively (U.S. Census, 2021b). Median household income was lower and persons in poverty was significantly higher throughout Kentucky as compared to national averages (U.S. Census, 2021a). In fact, median household income was over $14,000 higher nationally at $64,994, and persons residing in poverty were slightly lower at 11.4% (U.S. Census, 2021b). In terms of uninsured individuals, Kentucky's had a lower percentage of residents who lacked insurance as opposed to the U.S. (U.S. Census, 2021a). The national average of uninsured individuals was 10.2% within the years 2015-2019 (U.S. Census, 2021b).

These socio-demographics indicate that while the state of Kentucky has experienced population increases, improves need to be made to promote diversity among its citizens, as well as enhancing the social environment in which they live. Specifically, improvements to education and literacy, financial and social status, and health services could help this state become more equivalent to the national averages observed above. Additionally, improvement made to health services (e.g., better promotion and quality of care) could help reduce morbidity and mortality-related to various chronic diseases and conditions throughout the state.

Prevalence of Cervical Cancer in Kentucky (Urban vs. Rural):

Subsequently, there are many socio-demographic characteristics where Kentucky performs below the national average or rates. The same can also be noted when comparing the incidence and mortality of various chronic diseases and conditions, like cancer. Although cancer, in general, continues to remain in the top 10 leading causes of morbidity and mortality throughout the U.S., its effects on Kentucky are far more pronounced and aggravated (Rodriguez et al., 2018). This is especially true with cervical cancer, specifically invasive cervical cancer. Davis defines *invasive cervical cancer* as abnormal cells that have spread from the surface of the cervix to deeper tissue within the cervix, or that have metastasized to nearby or distal parts of the body (Davis, 2021). According to Rodriguez et al. Kentucky has the eighth highest rates for invasive cervical cancer incidence and 10th highest related mortality out of the entire nation (Rodriguez et al., 2018). Rates are further intensified when comparing Kentuckians who live in Appalachian versus non-Appalachian regions of the state (Rodriguez et al., 2018).

According to the Kentucky Cancer Registry, both rural and Appalachian regions of Kentucky observe rates of invasive cervical cancer that are significantly higher than their urban and non-Appalachian counterparts. Of the 1,114 cases of invasive cervical cancer observed in the years 2014-2018, the rural population of Kentucky observed 517 of those cases, for an age-adjusted rate of 10.9 per 100,000 women (KCR, 2020a). As of that same timeframe, the urban population observed 597 cases but had an age-adjusted rate of 9.0 per 100,000 women living in those areas (KCR, 2020a). Women living in the Appalachian region of Kentucky observed 379 of the 1,114 cases, for an age-adjusted rate of 12.6 per 100,000 women (KCR, 2020b). However, women living in the non-Appalachian region of the state observed the remaining 735 cases but had an age-adjusted rate of just 8.8 per 100,000 women (KCR, 2020b).

HPV: A Direct Cause of Cervical Cancer:

The human papillomavirus (HPV) is one of the most common sexually transmitted infections (STIs) in the U.S. (Safaeian et al., 2007). Of the over 100 types identified, 40 types of HPV have been deemed sexually transmissible (Kitchen & Cox, 2021). During the years 2013-2014, approximately 42.5% of all adults in the U.S., aged 18 to 59 had a genital HPV infection (McQuillan et al., 2017). While many HPV infections are benign and resolve spontaneously within a couple of years, certain carcinogenic types can persist and elevate a woman's chances of developing precancerous lesions on her cervix (Safaeian et al., 2007). Carcinogenic or high-risk types of HPV can elevate a woman's chances because the virus interferes with cellular communication and can cause the cervix cells to divide uncontrollably (NCI, 2021). However, this is a lengthy process, as current research suggests it can take more than 10 to 20 years for infected cervical cells to exhibit cancerous properties (e.g., tumor growth) (NCI, 2021). According to Safaeian et al., approximately 15 carcinogenic types of HPV have been discovered through various epidemiologic studies and are directly linked to cervical cancer (2007). In terms of their prevalence, it was estimated that 22.7% of all adults in the U.S., aged 18 to 59 had a high-risk genital HPV infection as of 2013 to 2014 (McQuillan et al., 2017). Two high-risk HPV types (e.g.,16 or 18) are known to be very aggressive (Kitchen & Cox, 2021). In fact, these two subtypes are attributed to 70.0% of all cervical cancer cases nationally (Kitchen & Cox, 2021).

Economic Impact of Cervical Cancer:

Nationally, gynecologic cancers (e.g., ovarian, uterine, and cervical) are associated with medical expenditures of roughly $3.8 billion, for an average cost per patient of $6,293 annually (Yue et al., 2020). In terms of cervical cancer, average annual medical expenditures totaled

$2,312 per patient, for a total of $490.3 million from the years 2007 to 2014 (Yue et al., 2020). This was configured by multiplying the sample with cervical cancer from those years (e.g., 212,101 subjects) by the average annual medical expenditure for that sample (e.g., $2,312). From the low to high ends, these expenditures ranged from $1,894 to $2,730 per patient, for total costs ranging from $401.7 to $579.0 million (Yue et al., 2020). As of the years 2007-2014, most of the medical spending on these cancers went towards inpatient hospital stays (at 53.0%, for $2.03 billion), office visits (at 15.0%, for $559 million), as well as outpatient hospital visits (at 13.0%, for $487 million) (Yue et al., 2020). As can be seen, these totals are costly to the U.S. health care system, especially when many cases of cervical cancer can be prevented by receiving a regular screening (e.g., the Pap test).

Disparities in Cervical Cancer Screenings (Urban vs. Rural):

Although many cases of cervical cancer can be prevented by taking proper screening measures, certain groups of women observe lower rates of screening. In a comparison of women aged 18 and older living in urban (metro) and rural (nonmetro) areas of the U.S., women residing in the urban (metro) areas observed higher rates of pap test completion at 86.1% versus their rural (nonmetro) counterparts at 81.7% (Doescher & Jackson, 2009). This emphasizes that geographic variation can and does result in differences for women regarding Pap test screenings. Specific socio-demographic characteristics can result in women experiencing lower screening rates too.

Those of Hispanic descent have been found to have lower rates of Pap testing than their Non-Hispanic White and Black counterparts (Akinlotan et al., 2017). As of 2010, 9.9% of Hispanic women reported never having a Pap test compared to just 4.6% of Non-Hispanic White and 5.9% of Non-Hispanic Black women (Chen et al., 2012). Inadequate cervical cancer

screening rates among Hispanic women stem from barriers that include a lack of health insurance, a lack of knowledge surrounding cervical cancer and screenings, language barriers, and fears associated with immigration status (NLIRH, 2007). In terms of age, it was discovered that women in the 21–29-year-old age group were less likely to complete a Pap test than other age groups at 11.9%, respectively (Chen et al., 2012). This could be due to the rarity of cervical cancer among this age group, leading to women putting off the preventative screening (Roland et al., 2013). As for educational attainment, women with less than a high school education were less likely to participate in Pap testing at 10.7%, as opposed to those with a high school education or beyond (Chen et al., 2012). Lower health literacy surrounding cervical cancer, risk factors, and the importance of screening could be causing lower Pap test completion among this group (Akinlotan et al., 2017).

Moreover, women earning an annual household income of less than $15,000 and who identified as being uninsured were also less likely to participate in Pap testing at 10.7% and 11.2%, respectively (Chen et al., 2012). Likely reasons for this could be due to these women lacking health insurance and health care providers to make screening recommendations (Akinlotan et al., 2017). Lastly, women who identified as never being married were also a less likely subpopulation to have received a Pap test at 21.9%, respectively (Chen et al., 2012). This could be due to more unmarried women lacking adequate health care access and social support as opposed to married women (El Ibrahimi, 2013). These findings are consistent with what has been found regarding the limited data on Kentucky's specific cervical cancer screening disparities.

Knowledge and Perceived Barriers surrounding Cervical Cancer Screenings:

Many studies regarding cervical cancer screenings examine the knowledge, attitudes, and behaviors among rural and Appalachian women in Kentucky. Specifically, they examined knowledge pertaining to risk factors, adherence to screening guidelines, and perceived barriers to screenings. It was found that many of these women had knowledge surrounding cervical cancer risk factors and understood the importance of screening (Akinlotan et al., 2017). However, gaps in knowledge surrounding certain risk factors were identified, and the authors suggest that more education is needed. These specific risk factors include HPV, having an early sexual debut, cigarette smoking, prolonged use of birth control, and having multiple births (Akinlotan et al., 2017). Some women were less likely to understand the impact these risk factors have on the development of cervical cancer (Akinlotan et al., 2017).

Moreover, another study found that rural and Appalachian women typically have limited or mixed knowledge, attitudes, and behaviors regarding Pap test screening guidelines and adherence (Cohen et al., 2016). Common reasons for limited or mixed knowledge, attitudes, and behaviors include not knowing the updated screening guidelines, not understanding the details of those guidelines, feelings of uncertainty surrounding the recommendations, and a lack of understanding regarding some general screening knowledge (e.g., what age should Pap test screening cease?) (Cohen et al., 2016). Additionally, several studies indicated that increased personal and community-wide fatalism were significant predictors of decreased adherence to Pap test screening guidelines (Mark et al., 2018). Each of these factors contributed to a woman's perception of screening and adherence, either positively or negatively (Cohen et al., 2016).

Subsequently, many studies assessed perceived barriers to Pap test screenings among these women. As many rural and Appalachian regions of Kentucky tend to host medically

underserved and vulnerable populations, several barriers were identified to cervical cancer screenings (Ely et al., 2014). These barriers can be divided into representing either personal or environmental/structural factors. Personal factors are those that are made of personal reasons for being unable to participate in Pap test screenings. Some of the most common personal barriers include being fearful of finding cancer, having to be seen by a male provider, lacking health care access and insurance, a lack of acceptance or understanding for the need to screen, lower educational attainment and health literacy to understand screening guidelines, and lack of a consistent health care provider (Ely et al., 2014).

Environmental/structural factors are those that are made up of environmental or system barriers that prevent women from participating in Pap test screenings. Some of the most common environmental/structural barriers include the inability to afford screenings, the inability to take time off work, difficulties finding childcare, and a lack of transportation to reach a screening location (Akinlotan et al., 2017). Conclusively, each of these sections and sub-sections provide reason for further exploration into this topic, especially for Kentucky. Many gaps in research and knowledge persist for this state and are aimed to be investigated by this study.

III. Methodology

Data Collection:

Data from the 2020 Behavioral Risk Factor Surveillance Survey (BRFSS) was used to conduct the statistical analysis. BRFSS is a cross-sectional study that has been performed annually since it began in 1984. It is a collective effort that integrates data from all 50 U.S. states, participating U.S. territories, and the Centers for Disease Control and Prevention (CDC) on various risky behaviors, diseases/conditions, and preventative health services that affect health and well-being (BRFSS, 2021). Facilitated by the CDC's Population Health Surveillance Branch, BRFSS collects data through ongoing telephone (e.g., landline or cellular device) interviews (BRFSS, 2021). These interviews are administered by state health departments and include a three-part questionnaire with core, optional, and state-added modules (BRFSS, 2021).

The core module consists of socio-demographic and health-related (e.g., current perceptions, conditions, and behaviors) questions asked by all states/territories (BRFSS, 2021). The optional modules consist of questions centered around specific health-related topics (e.g., diabetes, HPV vaccination, cancer survivorship, etc.), and each state has the option of including these (BRFSS, 2021). However, they are not required to include them. Lastly, the state-added module(s) consists of questions developed or acquired by the individual states/territories to use in their questionnaire (BRFSS, 2021). It should be noted that these questions are not edited or evaluated by the CDC (BRFSS, 2021). Each of the modules (e.g., core, optional, or state-added) is then used to sample noninstitutionalized adults (e.g., individuals 18-years-of-age or older) throughout the U.S. (BRFSS, 2021). The purpose of collecting this self-reported data on the multiple health-related variables is to determine their relation to the leading causes of morbidity and mortality observed within the U.S. (BRFSS, 2021).

Lastly, to control for instances of potential bias (e.g., selection bias), the BRFSS employs design or data weighting. Weighting the data acts as a blanket adjustment for noncoverage and nonresponses (BRFSS, 2020). It also ensures that the total number of cases equals population estimates for a geographic region (BRFSS, 2020). Additionally, weighting is necessary to ensure that the analysis and its results are generalizable to the population as a whole (BRFSS, 2020).

Data Analysis:

An empirical analysis utilizing secondary data from the 2020 BRFSS was conducted for this project. This data was collected from January 2020 to December 2020, and Kentucky observed 3,934 responses during this timeframe. Variables of interest all fell within three categories: (1) socio-demographics, (2) health care access, and (3) cervical cancer screenings (e.g., Pap testing). Socio-demographic variables included sex (explicitly looking at females only), age, race/ethnicity, educational attainment, income levels, marital status, and urban/rural status. Health care access variables included the proportions of women with health care insurance, a health care provider(s), and who could not see a health care provider due to cost in the past 12 months. The cervical cancer screening variable consisted of a computed variable that looked at female respondents, aged 21-65, with intact cervix, and who had a Pap test in the past three years.

Descriptive statistics for each variable were generated and stratified by urban versus rural status. Chi-square tests (e.g., with an alpha of ≤ 0.05) were then conducted to determine if there were associations between the variables of interest. A correlation matrix (e.g., with an alpha of ≤ 0.05) was then used to investigate the magnitude and strength of association between the variables of interest.

IV: Results

There were 2,091 female respondents to the 2020 BRFSS throughout Kentucky. However, after removing "Don't Know/Not Sure" and "Refused" responses, 1,623 female respondents remained. These respondents were included and further categorized by urban versus rural status. There were roughly three times more urban respondents (e.g., 1,213) versus rural respondents (e.g., 410). To explore additional, potential differences among these women descriptive statistics were generated and encompass tables two and three listed below.

Table Two: Descriptive Statistics of Urban vs. Rural by Socio-Demographic Variables

Variables	Urban Women	Rural Women
Age Groups:		
18 to 64	823 (67.85%)	266 (64.88%)
65 or Older	390 (32.15%)	144 (35.12%)
Race/Ethnicity:		
White	1038 (85.57%)	387 (94.39%)
Non-White	175 (14.43%)	23 (5.61%)
Education:		
No High School	75 (6.18%)	52 (12.68%)
Graduated High School	305 (25.14%)	119 (29.02%)
Some College	369 (30.42%)	114 (27.80%)
Graduated College	464 (38.25%)	125 (30.49%)
Income:		
Less than $15,000	114 (9.40%)	86 (20.98%)
$15,000 to less than $25,000	261 (21.52%)	103 (25.12%)
$25,000 to less than $35,000	128 (10.55%)	42 (10.24%)
$35,000 to less than $50,000	159 (13.11%)	49 (11.95%)
$50,000 or More	551 (45.42%)	130 (31.71%)
Marital Status:		
Married	574 (47.32%)	213 (51.95%)
Not Married	639 (52.68%)	197 (48.05%)
Total	1213	410

***468 "Don't Know/Not Sure and Refused" responses removed from the data**
****Unweighted Data**
*****Non-White includes Blacks, Other races, Multiracial, and Hispanic persons**
******Not Married includes Divorced, Widowed, Separated, Never Married, and persons part of an Unmarried Couple**
*******Source: BRFSS 2020**

Table two displays socio-demographic variables stratified by urban/rural status. Urban women observed a slightly younger population by 2.9 percentage points, whereas rural women observed a slightly older population by 2.9 percentage points. Both urban and rural women had predominately White, Non-Hispanic populations; however, this race/ethnicity was more pronounced by 8.8 percentage points among rural women. Racial diversity was lacking in both settings; however, more diversity was observed among women in urban settings.

A 6.5 percentage point difference among non-high school graduates and a 7.7 percentage point difference among college graduates was observed in terms of education. Rural women observed lower levels of educational attainment as opposed to their urban counterparts. As for income, there was an 11.5 percentage point difference among women earning less than $15,000 and a 13.7 percentage point difference among women earning $50,000 or more annually. Rural women were more likely to earn a lower income than urban women. Lastly, in terms of marital status, there was a 4.6 percentage point difference between married and not married. Overall, rural women were more likely to be married and urban women were more likely to be unmarried.

Table Three: Descriptive Statistics of Urban vs. Rural status by Cervical Cancer Screenings and Health Care Access

Variables	Urban Women	Rural Women
Cervical Cancer Screenings		
Had a Pap Test in Last Three Years:		
Yes	482 (80.20%)	149 (75.25%)
No	119 (19.80%)	49 (24.75%)
Total	601	198
Health Care Access		
Health Care Insurance:		
Yes	1167 (96.21%)	394 (96.10%)
No	46 (3.79%)	16 (3.90%)
Health Care Provider:		
Yes	1080 (89.04%)	365 (89.02%)
No	133 (10.96%)	45 (10.98%)
Could Not See Due to Cost:		
Yes	102 (8.41%)	42 (10.24%)
No	1111 (91.59%)	368 (89.76%)
Total	1213	410

***There were 824 missing responses for the variable Had Pap test in last three years**
****Unweighted Data**
*****Source: BRFSS 2020**

Table three displays cervical cancer screening and health care access variables stratified by urban/rural status. It should be noted that the cervical cancer screening variable used had 824 missing responses and this lowered the sample size able to be used by roughly 50.0%. Only 601 urban and 198 rural women were able to be used in any analysis with this variable, however, some differences were still able to be observed. There was a 4.9 percentage point difference among women who had received a Pap test within the past three years and those who had not. Rural women were less likely to have received a Pap test than their urban counterparts. Regarding health care access, no noteworthy differences were observed among a woman's health insurance or health care provider status. However, a 1.8 percentage point difference was observed among women who could not see a provider due to cost in the past 12 months. It was

observed that rural women were slightly more likely to not see a provider due to cost than urban women.

Table Four: Chi-Square tests of Urban vs. Rural Status by Socio-Demographic, Cervical Cancer Screening, and Health Care Access Variables

Variables	p-Value (≤0.05)
Age	0.0079
Race/Ethnicity	<0.0001
Education	<0.0001
Income	<0.0001
Marital Status	0.2284
Cervical Cancer Screenings	0.1466
Health Insurance Status	0.3828
Health Provider Status	0.5260
Could Not See Due to Cost	0.3330

***Weighted Data**
****Source: BRFSS 2020**

Table four displays the chi-square tests conducted between women of urban/rural status, the socio-demographic, cervical cancer screening, and health care access variables. Nine chi-square tests were performed, and four were significant at the ≤ 0.05 level. The tests to reach significance were between urban/rural status and age, race/ethnicity, education, and income levels. The chi-square test between urban/rural status and age observed a p-Value of 0.0079, whereas the tests between urban/rural status and race/ethnicity, education, and income levels all observed a p-Value of <0.0001. The chi-square test between urban/rural status and marital status, cervical cancer screenings, and all health care access variables were not found to be significant at the ≤0.05 level.

Table Five: Correlation Matrix between Cervical Cancer Screenings and Variables of Interest

	Urban/Rural Status	Cervical Cancer Screening	Health Insurance Status	Health Provider Status	Could Not See Due to Cost	Age	White	Non-White	Education	Income	Married	Not Married
Urban/Rural Status	.	0.052	0.0025	0.00015	-0.028	0.027	0.12**	-0.12**	-0.11**	-0.16**	0.040	-0.040
Cervical Cancer Screen	0.052	.	0.04	0.14**	-0.026	0.044	0.034	-0.034	-0.085**	-0.13**	-0.088**	0.088**
Health Insurance Status	0.0025	0.04	.	0.13**	-0.14**	-0.11**	-0.034	0.034	-0.052**	-0.078**	-0.039	-0.039
Health Provider Status	0.00015	0.14**	0.13**	.	-0.064**	-0.19**	-0.10**	0.10**	-0.021	-0.088**	-0.099**	0.099**
Could Not See Due to Cost	-0.028	-0.026	-0.16**	-0.064**	.	0.13**	0.076**	-0.076**	0.029	0.11**	0.043	-0.043
Age	0.027	0.044	-0.11**	-0.19**	0.13**	.	-0.011	0.011	-0.13**	-0.11**	-0.11**	0.11**
White	0.12**	0.034	-0.034	-0.10**	0.076**	-0.011	.	-1.00**	0.045	0.12**	0.12**	-0.12**
Non-White	-0.12**	-0.034	0.034	0.10**	-0.076**	0.011	-1.00**	.	-0.045	-0.12**	-0.12**	0.12**
Education	-0.11**	-0.085**	-0.052**	-0.021	0.029	-0.13**	0.045	-0.045	.	0.49**	0.21**	-0.21**
Income	-0.16**	-0.13**	-0.078**	-0.088**	0.11**	-0.11**	0.12**	-0.12**	0.49**	.	0.46**	-0.46**
Married	0.040	-0.088**	-0.039	-0.099**	0.043**	-0.11**	0.12**	-0.12**	0.21**	0.46**	.	-1.00**
Not Married	-0.040	0.088**	0.039	0.099**	-0.043**	0.11**	-0.12**	0.12**	-0.21**	-0.46**	-1.00**	.

Note. ** Correlation is significant at the 0.05 level
***Source: BRFSS 2020**
****Unweighted Data**

Table five displays the correlation matrix conducted between cervical cancer screening, health care access, and socio-demographic variables among women of urban/rural status. Many significant relationships were observed between the variables of interest, and most of those relationships yielded weak to moderate correlation coefficients. Highlighted in yellow were the significant relationships of primary interest to this study and highlighted in blue were the significant relationships of secondary interest to this study. Cervical cancer screenings were shown to have significant relationships with health provider status, education, income-levels, and

marital status. These relationships produced correlation coefficients of 0.14, -0.085, -0.13, -0.088 (e.g., married), and 0.088 (e.g., not married), respectively.

In terms of the health care access variables, health insurance status showed to have significant relationships with health provider status, could not see a provider due to cost, age, education, and income-levels. These relationships produced correlation coefficients of 0.13, -0.14, -0.11, -0.052, and -0.078, respectively. Apart from cervical cancer screenings and health insurance status, health provider status showed to have significant relationships with could not see a provider due to cost, age, race/ethnicity, income-levels, and marital status. These relationships produced correlation coefficients of -0.064, -0.19, -0.10 (e.g., white), 0.10 (non-white), -0.088, -0.099 (e.g., married), and 0.099 (e.g., not married), respectively. Lastly, apart from health insurance and health provider status, the variable could not see a provider due to cost showed to have significant relationships with age, race/ethnicity, and income-levels. These relationships produced correlation coefficients of 0.13, 0.076 (e.g., white), -0.076 (e.g., non-white), and 0.11, respectively.

V. Discussion

This study suggests that barriers and disparities may exist among the women being studied and might be contributing to the suboptimal screening rates observed throughout the state. Rural women tended to suffer more socio-demographic disparities than their urban counterparts. This is supported by previously published literature and supports the hypothesis developed for this study. Results suggested that rural women experienced socio-demographic disparities regarding age, race/ethnicity, education, and income levels. This could be due to rural areas hosting older, more vulnerable, and underserved populations that lack resources and opportunities as opposed to urban areas.

Several studies have indicated that women of rural status tend to be more disadvantaged and face more disparities than their urban counterparts. For example, a study conducted by Horner-Johnson et al. emphasized that rural women, in general, faced more geographic and socioeconomic barriers (e.g., education and income) (Horner-Johnson et al., 2015). The authors state that this is especially true when it comes to obtaining preventative health services (Horner-Johnson et al., 2015).

Furthermore, the results suggested minimal differences between urban/rural status and the cervical cancer screening and health care access variables being examined. It was expected that rural women would have lower cervical cancer screening rates and health care access than their urban counterparts. Results suggested that rural women did have slightly lower cervical cancer screening rates than urban women. Some likely reasons for this could be more rural women being medically underserved, lacking transportation and access to screening facilities, and lacking knowledge surrounding screening guidelines and the importance of screening. Many studies have indicated that women residing in rural areas face more disparities in cervical cancer

screenings and health care access. For example, Yu et al. highlighted this when examining racial and socioeconomic disparities in cervical cancer rates and screenings (Yu et al., 2019). The authors found that the different stages of cervical cancer and cervical cancer screenings were impacted by a woman's geographic location (e.g., urban vs. rural), race/ethnicity, and specific socioeconomic characteristics (e.g., income) (Yu et al., 2019). Another study emphasized that rural residents tend to lack access to care, were less likely to be insured, and have fewer health care visits, all of which affect screening rates (Caldwell et al., 2016). While findings from this study partially support those from the previous literature, some did not.

Results did not support that there would be notable differences in health care access among rural women. Findings suggested that urban and rural women were similar when it came to measures of health care access (e.g., percent with health insurance, a health care provider, and who could not see due to cost). This could be due to more utilization and the expansion of Medicaid to encompass more low-income and uninsured women. Many studies have emphasized that Medicaid expansion is responsible for increasing low-income and uninsured women's access to and affordability of care (Leighton & Brantley, 2021). Even throughout the COVID-19 pandemic, Medicaid coverage increased by roughly 17.0% and protected those most affected by the recession it caused (e.g., low-income workers) (Williams & Rudowitz, 2022).

Chi-square testing was performed to explore potential significant relationships between the descriptive statistics previously discussed. Results suggested significant relationships among women of urban/rural status and certain socio-demographic variables (e.g., age, race/ethnicity, education, and income levels). However, no significant relationships were observed among women of urban/rural status and the utilized cervical cancer screening and healthcare access

variables. These findings were somewhat expected and partially supported the hypotheses developed for this study.

To better understand the relationships between the variables of interest, a correlation matrix was developed. It was expected that cervical cancer screening rates would be positively and significantly correlated with the health care access and socio-demographic variables based on findings from the previous literature. Results suggested that cervical cancer screenings had a weak yet positive linear correlation with the variable health provider status that yielded a significant relationship. This is likely due to the influence that having a health provider has on making screening recommendations, as previous literature has indicated that health provider status is strongly linked with receiving screenings on time (Selvin & Brett, 2003). However, results did not support that cervical cancer screening rates would be positively correlated with the socio-demographic variables of interest. Findings suggested that cervical cancer screenings had weak and negative linear correlations with several socio-demographic variables (e.g., education, income levels, and marital status) that yielded significant relationships.

These inverse relationships suggested that as cervical cancer screenings increased, education, income levels, and marital status decreased. These findings are counterintuitive to the previous literature, as many studies have indicated that higher education and income levels are typically protective factors of timely cervical cancer screenings (Selvin & Brett, 2003). In many cases, being married has also shown to be a protective factor in receiving timely cervical cancer screenings (Hanske et al., 2016). A few reasons these inverse relationships might exist could be the pandemics impact on healthcare service utilization, more affluent individuals altering their normal screening behaviors to follow pandemic guidelines, and the potential presence of an unintentional confounder affecting screening rates on the high-end. Secondarily, results

suggested that health care access variables were positively and negatively correlated with many socio-demographic variables and produced many significant relationships. These findings were somewhat expected and partially supported this portion's previously developed hypotheses.

Early data suggests that the pandemic impacted healthcare utilization and preventative health services. This could be a potential explanation for these correlations and relationships observed above. Changes in healthcare delivery and delays in elective procedures throughout the pandemic affected the typical screening environment and behaviors (TRACIE, 2021). A study by Moynihan et al. emphasized that healthcare utilization decreased by roughly 33.3% at the height of the pandemic (Moynihan et al., 2021). Another study conducted by Laing & Johnston emphasized that the pandemic decreased the number of patients screened for cervical cancer in Canada by about 7.5% (Laing & Johnston, 2021). These authors also estimated that there were approximately 288,000 overdue cervical cancer screenings among their study population (Laing & Johnston, 2021).

Overall, this study and its findings reflect the previous literature in some ways while also highlighting differences. This study adds to the previous literature regarding cervical cancer screening rates in Kentucky by creating a more holistic profile of urban and rural women that was not previously there. Also, it has helped identify some of the primary health care access and socio-demographic variables that might be affecting screening rates throughout the state.

Limitations:

Although this study was able to add to the existing literature surrounding this issue, there are limitations. Some of the shortcomings experienced in this study include utilizing data solely from a COVID-19 year, the potential for bias (e.g., self-report bias), the use of multiple calculated variables, and the use of a calculated variable that had many missing responses.

The COVID-19 pandemic disrupted many facets of the healthcare system in its beginnings. One such disruption being the mandatory halt of elective health services like cervical cancer screenings. Wentzensen et al., estimates that after the national emergency was declared and stay-at-home orders were enforced that cervical cancer screening rates plummeted by roughly 94.0%, and even after restrictions were lifted, rates remained 35.0% lower than they ever had before (Wentzensen et al., 2021). This could have potentially led to a decrease in screening rates among categories in which they were typically higher. So, caution must be given when using the findings from this study to make interpretations about cervical cancer screening rates in Kentucky, as they may have been greatly affected by the pandemic and not an accurate representation of what rates truly are. However, an offsetting strength of using data from this year would be that the findings might paint a stark picture of what screening rates are, but those rates will likely increase to pre-COVID-19 levels again.

To continue, the potential for self-report bias could be present in this study, as it is always a possibility when relying on self-reported data. There can be a tendency to under- or over-report, or falsely report on measures of interest, so this bias must be taken into consideration. The use of multiple calculated variables could also be a slight limitation because multiple categories are condensed within these variables, and that could make it difficult to see were important differences within variables lie.

Lastly, the missing responses from the dependent, cervical cancer screening variable ("_RFPAP35") is a limitation that must be considered. This variable had a total of 824 missing responses, eliminating roughly 49.5% of the urban sample and 48.3% of the rural sample that could have been used in analyses. This could be due to low response rates to portions of this variable, as it is a calculated variable that encompasses multiple part (e.g., female respondents,

aged 21-65, with intact cervix, and who had reported screening in the last three years). Regardless, this could be problematic, as there could be an unintentional confounder within this variable that are causing screening rates to be lower than they truly are.

Implication(s)/Conclusion:

While a few limitations are present within this study, its findings are not without merit. This study suggests that there may be a relationship between cervical cancer screening rates and specific health care access and socio-demographic variables. This information could be used to help inform potential policies and interventions that could be targeted among women with lower cervical cancer screening rates. As the previous literature dictates and this study suggests, cervical cancer screening rates are affected by health provider status, education, income levels, and marital status.

With this knowledge, policy could be used to strengthen measures of health care access, such as by increasing the number of women eligible to be covered by health insurance which could increase utilization of preventative health services in Kentucky. Also, policy could be devised that would improve the provision of free or subsidized Pap testing, as well as transportation to screening facilities throughout the state (Tapera et al., 2021). This could greatly help women who are of low-income status or who are uninsured, as well as women in rural/remote settings (Tapera et al., 2021).

Additionally, this knowledge could be used to identify and strengthen educational efforts surrounding cervical cancer and cervical cancer screenings throughout Kentucky. This could be done through multi-step interventions that increase preventative health knowledge, provide more in-depth training to health care professionals on the importance of promoting preventative health services, and providing all communities with a means to access these screenings (Tapera et al.,

2021). By enhancing knowledge surrounding cervical cancer and cervical cancer screenings, as well as by increasing access, self-efficacy among the women could be greatly improved. This improved self-efficacy could then result in improvements in cervical cancer screening rates.

Conclusively, future research should compare multiple years of cervical cancer screening data and the health care access and socio-demographic variables of interest from a Pre- to Post-COVID-19 climate. Doing so could help identify more accurate trends in cervical cancer screenings and could help to see how the pandemic affected them. Additionally, interrelationships between cervical cancer screening rates, health care access, and socio-demographic variables should be examined more closely. This could help make more meaningful interpretations than what this study was able to do. Lastly, cervical cancer screening rates and healthcare access could be explored differently, such as by examining the spatial impact of healthcare access (e.g., number of screening facilities, proximity to screening facilities, and means of transportation) on cervical cancer screening rates among urban and rural women in Kentucky. This could help explore other potential barriers contributing to suboptimal screening rates throughout the state.

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