Examining Social Determinants Of Health And Cervical Cancer Risk And Outcomes In Ecuadorian Women

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EXAMINING SOCIAL DETERMINANTS OF HEALTH AND CERVICAL CANCER RISK
AND OUTCOMES IN ECUADORIAN WOMEN

POOJA TEWARI

Master’s Program in Public Health Sciences

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Dedication

This thesis is dedicated to my support network, from my family to my friends to my colleagues. I also dedicate this thesis to my partner. He has been with me every step of the way supporting me, from hearing me stress when I was pouring over hours and hours of literature review, to the excitement I found while running statistical analyses. Without this support network, I could not have done this thesis.
EXAMINING SOCIAL DETERMINANTS OF HEALTH AND CERVICAL CANCER RISK
AND OUTCOMES IN ECUADORIAN WOMEN

by

POOJA TEWARI, B.S.

THESIS

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Abstract

Background and Significance: The burden of cervical cancer in the Latin American region is high. The crude incidence rate and the crude mortality rate in Ecuador are significantly higher than that of South America and the World. Riobamba, Ecuador, where the Fundación Internacional Buen Samaritano Paul Martel (FIBUSPAM) hospital is located, has been found to be one of the cities most affected with cervical cancer in the country. Risk factors for cervical cancer that have been identified in Latin American women include chronological age, age of first sexual intercourse, number of sexual partners, number of pregnancies, use of oral contraceptives, smoking, and Sexually Transmitted Disease (STD) status. Barriers in accessibility to cervical cancer screening in Latin American women include health-system related, social, and cultural barriers.

Objective/Hypotheses: The purpose of the study is to identify factors associated with the risk of cervical cancer in Ecuadorian women. This study also seeks to identify the factors associated with preventing Ecuadorian women from accessing cervical cancer screening services. The first hypothesis is that in Ecuadorian women, risk factors of smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, and socioeconomic status, will be associated with a positive Visual Inspection with Acetic Acid (VIA) result. The second hypothesis is that in Ecuadorian women, VIA result, past healthcare services access, level of education received, socioeconomic status, and ethnicity will be associated with time taken to healthcare facility and type of transport used to reach the healthcare facility.

Methods: A secondary data analysis was executed on a cervical cancer dataset collected from February 2017 to May 2017 from the FIBUSPSAM cervical cancer program, which used a screen-and-treat method of screening 1000 Ecuadorian women with a VIA test and treating them with cryotherapy.

Results: There was a statistically significant difference in the percent of people who have ever used birth control and VIA result (p=0.006, $X^2=12.57$). There was a statistically significant difference in the percent of people by ethnicity and type of transport used to reach the clinic (p=0.000, $X^2=54.90$). Also, there was
a statistically significant difference in the percent of people by education and type of transport used to the health care facility ($p=0.000$, $X^2=71.83$). It was also found that age had a statistically significant impact on VIA result $F(3, 929)= 5.509$, $p=0.001$. Finally, the time taken to seek services at the healthcare facility differed significantly by ethnicity $H-value=17.02 \ df=3, p=0.001$.

**Conclusions/Recommendations:** Study findings indicate that birth control usage and age were significantly associated with VIA result. Additionally, ethnicity and highest education level received were significantly associated with type of transport used to reach the healthcare facility. Finally, ethnicity was significantly associated with time taken to healthcare facility. These findings advance literature related to cervical cancer risk and access to cervical cancer services and the health consequences for minority and medically-underserved communities globally. For priority communities, policies consistent with these results can be proposed to the Ministry of Public Health in Ecuador to increase cervical cancer screening programs that incorporate population/region specific risk factors and barriers.

**Key words:** Cervical Cancer, Screening, Global Health, Latin America, Ecuador, Accessibility, Barriers, VIA, Indigenous

**Word Count: 517**
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Introduction

Globally, cervical cancer is responsible for 300,000 deaths every year (Tsu et al., 2021). 90% of these deaths are concentrated in low- and middle-income countries (LMICs) (Tsu et al., 2021). From the Global Cancer Observatory, this disproportionate burden in LMICs can be seen with both cervical cancer incidence rates and mortality rates in Figure 1. Specifically, as Figure 1 illustrates, most LMICs are shaded darker blue and red to illustrate the higher rates of cervical cancer incidence and mortality, respectively. Additionally, according to the World Health Organization (WHO), the incidence of cervical cancer is twice as high and the death rates three times as high in LMICs as compared to high-income countries (WHO, 2020). This is particularly concerning because by 2030 is it expected that cervical cancer deaths globally, will increase by 50% (WHO, 2018). Finally, it is also expected by the end of the 21st century, globally, cancer will be the leading cause of death and the greatest barrier the increase life expectancy (Sohn, 2020).

Cervical cancer is unique because it is considered one of the most preventable and treatable types of cancer, only if it is efficiently detected and treated early (WHO, 2018). Additionally, cervical cancer is one of few cancers that could be diagnosed prior to a woman presenting with any symptoms (Valencia, 2021). When under-screened, women experience high incidence and mortality rates of cervical cancer as compared to women who are regularly screened (Perehudof et al., 2020). The primary cause of cervical cancer is the human papillomavirus (HPV) (Tsu et al., 2021). With cervical cancer, HPV is a necessary etiological cause for the development of a neoplasia, which is the abnormal growth of a clump of cells which could be benign or malignant (Valencia, 2021). With cervical cancer, screening is considered very beneficial because of the progression of the cancer. Cervical cancer has a long pre-symptomatic phase, in which preclinical cancer can be detected by pre-cancerous lesions,
like high grade cervical intraepithelial neoplasia (CIN 2-3), which can be become invasive cancer if not treated over a period of 1-4 decades (Sankaranarayanan, 2014). This step-wise progression between HPV infection and development of cervical cancer, gives the chance for multiple opportunities to intervene before the cancer becomes fatal (Bychkovsky, 2016).

HPV causes nearly 100% of cervical cancer cases (HPV Information Centre, 2019). One study found that in patients with cervical cancer, HPV was tested positive in 96.6% of the patients (Valencia, 2021). There is an estimated 291 million women who are carriers of HPV globally (Salazar-Torres et al., 2019). Women in developing countries experience a higher burden of HPV infection, than women in developed countries (Foster et al., 2020). Over 100 types of HPV have been identified and 40% of these types have the ability to infect the genitalia (Bychkovsky, 2016). There exist “high-risk” types of HPV, which include HPV 16, 18, 31, 45, 33, 35, 51, 52, 58, and 59 (Bychkovsky, 2016). Even when a woman is infected with a high-risk type of HPV, like HPV 16, it takes several years from the initial infection to development of cervical cancer, making early-screening critical in preventing a high incidence of the disease (Sankaranarayanan, 2014).

In the Latin American region, HPV 16/18 cause 70% of all cases, while HPV 45 causes 6% and HPV 31 and 33 cause 4% (Bychkovsky, 2016). HPV 16 and HPV 18 are the most frequent HPV types and are considered aggressive types (Basanes and Barahona, 2019). Specifically, in LMICs in Latin America, the prevalence of HPV in women is variable across regions and across countries. In the South American region as a whole, the prevalence of any type of HPV was 12.3% and in Central America 20.4%, both regions illustrating that these percentages are incredibly higher than worldwide prevalence estimates (Almonte et al., 2008). Across different countries in Latin America, the prevalence of HPV in women is that in Mexico it’s 3.4% and in Venezuela it’s 13.2% (Salazar-Torres et al., 2019). The prevalence % of HPV 16
and/or HPV 18 among Ecuadorian women with normal cytology is 5.8% while with Ecuadorian women with cervical cancer is 37.9% (HPV Information Centre, 2019). In Bolivia and Peru, cervical cancer ranks as the most common cancer, while in Brazil, Colombia, Ecuador, Mexico, Paraguay, The Guyanas, Surinam and Venezuela, it ranks as the second most common cancer (Bosch, 2016). Finally, cervical cancer has a relatively early age onset, as compared to other cancers. Therefore, cervical cancer is considered one of the three most common cancers in women under 45 years old in 82% of all countries irrespective of their cervical cancer screening practices (Bosch, 2016).

Latin America is a region of great importance when it comes to cervical prevalence because of its high incidence and mortality rates. In Latin America, out of all cancer-related deaths, cervical cancer is the second most common cause (Bychkovsky, 2016). The annual incidence of cervical cancer among Latin American women is 21.2 per 100,000 women with a mortality rate of 8.7 deaths per 100,000 (Bychkovsky, 2016). In this region, mortality is predicted to increase by 45% by the year 2030 (Bychkovsky, 2016). The distinction between Latin America and North America (which includes the US and Canada), is needed because women who live in Latin America and the Caribbean, have a 7-times greater risk of cervical cancer as compared to North American women (Liebermann et al., 2018). Despite this burden and the predictions that cervical cancer mortality will increase by 2030, cervical cancer is not explicitly mentioned in any of the targets of the 17 Goals of Sustainable Development from the United Nations, which encouraged progress by the year 2030 as well (United Nations, 2021).

The two main mechanisms of preventing cervical cancer are cervical cancer screening and HPV vaccination (Tsu et al., 2021). Specifically, to prevent the majority of cervical cancers from spreading, one must either prevent the premalignant lesions or treat them before they invade any further. Hence vaccination can help prevent premalignant lesions and screening can
help identify them for treatment (Valencia, 2021). Including these mechanisms, the WHO (2020) created 90-70-90 targets to achieve globally by 2030, which if successful, could prevent 62 million deaths from cervical cancer by 2120. Globally, these 3 targets hope to achieve 90% of girls fully vaccinated with the HPV vaccine by 15 years of age, 70% of women screened using a high-performance test by 35 years of age and again by 45 years of age, and 90% of women identified with cervical disease are treated (WHO, 2020). With the final target of 90% of women treated, there are sub targets that include 90% of women with precancer treated and 90% of women with invasive cancer managed (WHO, 2020). These ambitious targets may not be possible in some LMICs due to the lack of infrastructure to vaccinate, screen, and treat.

The WHO (2020) advises that strategic actions to achieve these cervical cancer targets be customized by each country in order to overcome such barriers such as structural deficiencies, level of readiness to implement, sociocultural/gender factors, myths and misconceptions about the disease, prevention, and treatment. In Latin America, the high mortality rates of cervical cancer can be attributed to a loss of follow-up after cervical cancer screening and lack of infrastructure to timely treat pre-cancerous cervical cancer lesions (Bychkovsky, 2016). Additionally, in LMICs there exists an absence of organized cervical cancer screening programs for women (Mezei et al., 2017). Screening looks for signs of a disease in people who are asymptomatic, and with cervical cancer in particular, it could include cervical pap smears and mammograms, infrastructure that some LMICs do not have the ability to execute (Sohn, 2020). This would explain the disparity of why in 2017, 445,000 women in LMICs developed cervical cancer as compared to women in high-income countries (Mezei et al., 2017). Combating cervical cancer is important, because it can impact women in other aspects of their well-being like work and economic and cultural production, and compromising family and social relationships (Riveria, 2016).
With the HPV Vaccine, it was first licensed for approval in 2006 as a 3-dose regime, but in 2014, the WHO recommended that girls between 9-14 years old could have the 2-dose regime (Tsu et al., 2021). HPV Vaccinations have been rapidly increasing in their execution globally, but implementation is slow in LMICs. This is because the HPV vaccine is targeted at young girls who have not begun to have sex yet, which would not help women already infected with HPV (Mezei et al., 2017). To help women already infected with HPV, screening for cervical cancer is key. Additionally, some women may not be reached by HPV vaccination programs or have access to them, which is again, why screening is needed (Bychkovsky, 2016). These mechanisms of prevention and early treatment are considered highly cost-effective (WHO, 2018).

Specifically, with screening it is an effective strategy with “incremental cost-effectiveness ratios below the per capita gross domestic product (GDP) of LMICs per year of life saved”, which is a metric used to indicate a good value for money (Mezei et al., 2017). Additionally, the WHO currently recommends cervical screening as the only cancer to screen for in LMICs, since it is simple to detect and treatable if caught early on, which is not the same case for other cancers (Sohn, 2020).
Background and Significance

The burden of cervical cancer in the Latin American region is high. Specifically, in Latin America there exists an Andean region. The Andean region in Latin America include the countries of Bolivia, Chile, Columbia, Ecuador, and Peru (Nwandooi, 2017). Within this Latin American Andean region, Bolivia and Ecuador the highest standardized cervical cancer mortality rates of 21.0 per 100,000 women and 14.0 per 100,000 women, respectively (Nwandooi, 2017). Following this pattern, unfortunately in both Bolivia and Ecuador, there is a lack of literature in relation to attitudes and knowledge of HPV, HPV-related diseases, and HPV vaccines (Nwandooi, 2017). This lack of literature needs to be addressed in order to ensure that when it comes to addressing the disparities related to cervical cancer, it is representative of the uniqueness of the Andean region in term of local contexts/determinants of health. The Andean region of South America is important because while Latin American countries have a higher age-standardized mortality rates of cervical cancer as compared to the US and Canada, these high rates are particularly attributed to countries of the Andean region (Bermedo-Carrasco and Waldner, 2016).

Introduction to Ecuador

Ecuador is considered an upper-middle income country with high income inequity (Quizhpe et al., 2020). General population demographics include that as of 2020, the total population is 17,643,000 (IARC, 2020). Specifically, the female population is 8,819,000 people (IARC, 2020). With life expectancy for the total population, it is 78.5 years, while with women in particular, it is 76.2 years (IARC, 2020). Ethnically, the majority of the population are
mestizos, which is a mix between indigenous and Spanish people, 28% of the population are ethnic minorities of indigenous people, Afro-Ecuadorians, and Montubios (Quizhpe et al., 2020).

When it comes to health expenditure, the total per capita in US $ is 516.2, while the out of pocket (% of total expenditure on health) is 39.8% (IARC, 2020). With health expenditure in Ecuador, the country has had a tumultuous past. From 1993 to 2006, the eight different governments caused corruption, social violence and administrative in stability, in addition to slashing healthcare funding (Quizhpe et al., 2020). During this period, the government significantly reduced their role in healthcare, until 2007. From 2007-2017, new proposals to reduce socioeconomic inequalities and increase comprehensive social and health reforms to improve equity, were introduced (Quizhpe et al., 2020).

In Ecuador, the cancer incidence overall is 154.6 per 100,000 per year and the overall cancer mortality is 76.4 per 100,000 persons per year (IARC, 2020). With cervical cancer in particular, Table 1 provides a summary of key statistics. Ecuadorian women at risk are women older than and/or exactly 15 years old, which is 6.0 million people (HPV Information Centre, 2019). The median age of diagnosis is 54 years of age (Valencia, 2021). The annual number of cervical cancer cases is 1,612 cases, while the annual number of cervical cancer deaths is 838 deaths (HPV Information Centre, 2019). The crude incidence rate per 100,000 per year is 19.1 for cervical cancer (HPV Information Centre, 2019). Table 2 compares these incidence statistics across these same statistics in South America as a whole, and the World. The crude incidence rate and the age-standardized rate in Ecuador are all significantly higher than that of South America and the World. For the crude incidence rate in Ecuador, it is 19.1 as compared to 18.2 for South America and 15.1 for the World, and the age-standardized incidence rate is 17.8 in
Ecuador as compared to 15.2 in South America and 13.1 for the World (HPV Information Centre, 2019).

Table 3 illustrates the cervical cancer incidence rates across five different cities in Ecuador. In Ecuador, cervical cancer ranks as the second leading cause of female cancer and the third most common female cancer in women aged 15 to 44 years old (HPV Information Centre, 2019). Table 4 compares Ecuadorian cervical cancer mortality statistics across South America as a whole, and the World. The crude mortality rate and the age-standardized rate in Ecuador are all significantly higher than that of South America and the World. For the crude mortality rate in Ecuador, it is 9.9 as compared to 8.9 for South America and 8.2 for the World, and the age-standardized incidence rate is 9.0 in Ecuador as compared to 7.1 in South America and 6.9 for the World (HPV Information Centre, 2019). Cervical cancer ranks as the second leading cause of female deaths in Ecuador and the first leading cause of deaths in women aged 15 to 44 years old (HPV Information Centre, 2019). The Sociedad de Lucha Contra el Cáncer (SOLCA) is an Ecuadorian-based organization which researched the odds of Ecuadorian women contracting cervical cancer by age. The odds are 2% at 39 years, 9% at 50 years, and 23% at 79 years (Salazar-Torres et al., 2019).

In Ecuador, the highest prevalence rates of women with cervical cancer were found to be in women close to the end of adolescence and those over 30 years of age (Valencia, 2021). One study of 164 Ecuadorian women, found that 86.1% of them were HPV positive, with HPV16 (41.8%) and HPV58 (30.5%), being the most common types (Mejia, 2016). In the capital of Ecuador, two studies found a high HPV prevalence at 67.7% and 86% (Aguilar, 2017). In one study in Santo Domingo, Ecuador, found that 24.1% of the participants tested positive for HPV infection, of the high-risk types (Foster et al., 2020). Another city of Cuenca, found out of 500
women, there was an HPV prevalence of 25.6% in both high and low risk HPV types, which was similar to the HPV prevalence in another city of Santa Elena, Ecuador (Aguilar, 2017). A final city in Ecuador, Riobamba, where this present study primarily takes place, has been found to be one of the cities most affected with cervical cancer in the country (Carlos et al., 2021).

**Riobamba, Ecuador**

One study specifically conducted in Riobamba, found when it came to HPV infection, women aged 25-35 years old had 57% prevalence of HPV infection and women aged 36-45 years old had a 43% prevalence of HPV infection (Basanes and Barahona, 2019). The results of this study suggested that HPV prevalence is more likely in to occur in young adult women in Riobamba. It presents a contrast to data which will be presented about higher incidence and mortality rates of cervical cancer in women above the age of 65. Another study conducted in Riobamba in 2016, found that most of the women had unsatisfactory general knowledge about cervical cancer (66.7%), and most women had unsatisfactory knowledge of timely prevention of cervical cancer and risk factor dimensions, which include most frequent symptoms (82.1%), knowledge about the pap smear (55.1%), and pap smear frequency and requirements (58.9%) (Riveria, 2016). A more recent study conducted in 2021 in Riobamba, found that 80% of study participants had incorrect beliefs about cervical cancer, like that cancer only affects older people, teenage girls cannot get cervical cancer, and that the causes of cervical cancer are poor diet and poor genital hygiene (Carlos et al., 2021). This same study classified 93% study participants as having a low-level knowledge about cervical cancer because they could not discern social or economic repercussions from become ill with cervical cancer (Carlos et al., 2021). The results of these studies suggest that women in Riobamba lack knowledge of cervical cancer, which could
lead to high mortality rates of cervical cancer, especially if women do not have the knowledge to get screened early on, before the cancer becomes fatal.

**Risk Factors for Cervical Cancer**

Risk factors for Cervical Cancer that have been found in Latin American women include: age in general, age of first sexual intercourse, # of sexual partners, # of pregnancies, use of oral contraceptives, smoking, HIV, and Chlamydia trachomatis/herpes simplex virus type 2.

When it comes to age in general, it has been seen that in Latin American women, cervical cancer rates remain the highest in women over the age of 65 in all Latin American countries and territories (Nugus et al., 2018). Women under 20 years old are unlikely to contract cervical cancer, while women over 40 years are at risk and women over 65 years old are at high risk (Basanes and Barahona, 2019). In Ecuador, 96% of the diagnoses of cervical cancer occur in women after the age 30 (Logrono et al., 2018). With cervical cancer in general, between 40% to 50% of women over the age of 65 die from it (Valencia, 2021). Reasons which contribute to this high incidence in older women are that women over the age of 65 are no longer targeted by conventional cervical cancer screening programs. Additionally, older women have anatomical changes of the cervix which can complicate cervical cancer management, as well as high comorbidities and lower performance status, which leads to older women receiving suboptimal treatment as compared to younger women (Nugus et al., 2018). Another study found an explanation to explain this risk factor by explaining the development of squamous epithelium. When a woman is at reproductive age, the maturation and desquamation of the squamous epithelium occurs, but as a woman gets older and menopause occurs, changes occur (Basanes and Barahona, 2019). Post-menopause, the squamous epithelium atrophies, wastes away, and decreases in thickness, losing its protective function against infections like HPV (Basanes and
Barahona, 2019). Finally, older women who develop cervical cancer are more likely to also be diagnosed with an advanced stage disease, contributing to higher mortality rates in this age group too. As the population growth is expected to increase in older women in the Latin American region, it is critical to have cervical cancer screening programs and policies that are specifically tailored to women of this age group (Nugus et al., 2018).

When it comes to HPV infection, it is affected by the age of onset of sexual activity. One study found that in a cohort of 1,610 Columbian women, the prevalence of HPV infection was 42.5% between young girls aged 15-19 (Almonte et al., 2008). In Quito, Ecuador, another study was conducted in 2017 which found that there was a risk factor for cervical cancer of women who started sexual activity between the ages of 13 and 18 (Valencia, 2021). In another study conducted in Cuenca, Ecuador, women who started sexual activities before the age of 18 had four times higher a risk of having cervical cancer lesions (Valencia, 2021). One reason which could account for this is that when a younger woman engages in sexual intercourse, she could have an immature cervix that could develop a malignant neoplasm because there is immunological immaturity of the cervical epithelium (Valencia, 2021).

With number of sexual partners, several studies have shown that there is an association between acquisition of HPV infection and number of sexual partners (Valencia, 2021). In one study that included Latin American women from Argentina, Chile, Mexico and Columbia, it found that there was a significant increased risk for HPV positivity (low and high-risk HPV types) for women that had two lifetime sexual partners or more vs. women with only one lifetime sexual partner (Almonte et al., 2008).

With number of pregnancies, Latin American women with seven or more full-time pregnancies had a higher risk of developing cervical carcinoma than women who had only one or
two full-time pregnancies (Almonte et al., 2008). Therefore, it has been concluded that there is strong evidence that as the number of full-time pregnancies increases for a woman, so does her risk of cervical cancer. One reason which could account for this is the greater number of children a woman has, leads to a greater transformation zone in the ectocervix, which makes the chance of HPV infection greater (Valencia, 2021). Other factors which could have an impact include hormonal factors associated with pregnancy or cervical trauma attributed to childbirth (Basanes and Barahona, 2019). Additionally with full-time pregnancies, young age at first full-time pregnancy influenced risk of cervical cancer. For example, women who had their full-time pregnancy at age 17 as compared to at age 25, were found to have a higher risk of cervical cancer (Almonte et al., 2008).

When it comes to usage of oral contraceptives, there has also been an association with cervical cancer. Latin American women who used oral contraceptives for five years or more, as compared to women who never used it, had their risk of cervical cancer increase with use (Almonte et al., 2008). One study found that women who had been taking oral contraceptives for five years or less had a 10% risk of cervical cancer, but the risk increased to 60% with five to nine years of use, and then doubled risk with ten or more years of usage (Valencia, 2021). Once the women stopped taking oral contraceptives, their risk declined once they hit the 10-year mark of stopping use, and their risk became the same of that of women who never used oral contraceptives (Almonte et al., 2008). One reason which could account for this association is that women who use oral contraceptives are more likely to be exposed to HPV infection, than those who use other birth control methods like barriers or abstinence (Almonte et al., 2008). In fact, women who use barrier methods have been seen to have a moderate reduction in risk of having high grade squamous intraepithelial lesions (HSILs) and cancer (Almonte et al., 2008).
With smoking, Latin American women who are smokers have been found to have an increased risk of cervical cancer (Almonte et al., 2008). One reason which accounts for the association between smoking and cervical cancer is that smoking can have “in vivo effects of prolonged exposure to nicotine affect[ing] persistent cell proliferation, inhibition of apoptosis, and stimulation of vascular endothelial growth factor” (Valencia, 2021). When it comes to cancer cells, if they are allowed to continue to proliferate, then that allows them to grow and continue to cause severe damage to the cervix, which would need treatment. Women who smoke, are two-four times more likely to contract precancerous lesions and cervical cancer, as compared to non-smokers (Basanes and Barahona, 2019).

With HIV, one difference between infections in the Latin American region vs. the sub-Saharan Africa region is that the infections in the Latin American region occur primarily in men (Almonte et al., 2008). However, Latin American women who have HIV are still at elevated risk of cervical cancer because both HPV and HIV are transmitted sexually, and immunosuppressed women (due to the HIV infection), are more likely to contract HPV (Almonte et al., 2008). Specifically, women living with HIV are six times more likely to develop cervical cancer as compared to women who are HIV negative (WHO, 2020). Additionally, globally, one type of cervical cancer lesion CIN2, is found to exist in 10% of HIV positive women, as compared to 1-2% of HIV negative women (WHO, 2013). Cervical cancer is the most common cancer among women living with HIV (WHO, 2020).

Chlamydia trachomatis and herpes simplex virus Type 2, have been associated with an increased risk of cervical cancer among HPV positive Latin American women (Almonte et al., 2008). One reason which could account for this association is that the women who have Chlamydia trachomatis and herpes simplex virus Type 2, could have induction of inflammation
at the cervix, which could lead to genotoxic damage via reactive oxidative metabolites, making it more likely women could be infected with HPV (Almonte et al., 2008).

Protective factors for cervical cancer include well-organized cervical cancer screening programs and good-quality cytology testing (Almonte et al., 2008). These factors can reduce the incidence and mortality of cervical cancer. Additionally, when it comes to screening programs in Latin American countries, they should use affordable, sustainable, and reliable approaches to reduce the burden of cervical cancer (Almonte et al., 2008). In some Latin American countries there has been a decrease in incidence of cervical cancer rates. Factors which can be attributed to this decline are lower fertility rates, lower parity, improvements in socioeconomic status and education levels, and structured screening/treatment programs with high screening coverage (Nugus et al., 2018).

**Co-Factors (or Other Factors Associated) with Cervical Cancer**

Additionally, another study considered certain factors mentioned in the Risk Factors section to be co-factors. Here, co-factors which help progress cervical HPV infection to cancer include: tobacco smoking, high parity, long-term hormonal contraceptive use, and co-infection with HIV (HPV Information Centre, 2019). Some probable co-factors defined here are infection with Chlamydia trachomatis and herpes simplex virus type-2, immunosuppression, and certain dietary deficiencies (HPV Information Centre, 2019).

Other studies have found different factors that impact the ability of Ecuadorian women to access cervical screening such as: place of residence, ethnicity, education, and wealth (Quizhpe et al., 2020). One study used the Slope of Index Inequality, which is a “weighted measure of inequality that represents the absolute difference in the estimated values of a health indicator
between the most advantaged and the most disadvantaged, while taking into consideration the size of all the other subgroups” (Quizhpe et al., 2020). This study found that when it came to education and occupation class there were significant increases in inequality with a Slope of Index Inequality of 6.69 and 3.37, respectively, which influenced whether Ecuadorian women were able to access cervical cancer screening services (Quizhpe et al., 2020). Another study identified both ecological and individual-based studies as having markers of socio-economic status, like education level, being related to cervical cancer incidence and mortality; specifically, women with a lower socioeconomic status have a higher risk of developing and dying from the cancer (Pereira-Scalabrino et al., 2013). Reasons which could account for this are that women with low socioeconomic status may partake in risky sexual behavior, which would increase their risk of contracting an HPV infection, and they are likely to have poor access to healthcare services of early detection, diagnostic and treatment facilities (Pereira-Scalabrino et al., 2013). Women who are least likely to access cervical cancer screening have found to be women of low socioeconomic status belong to either a Black, Hispanic, and/or indigenous identity (Basanes and Barahona, 2019). Also, women with lower incomes are at higher risk of being unable to do a follow-up or treatment procedure, as compared to women with higher incomes (Miles et al., 2021).

Additionally, women who have a higher smoking prevalence and higher parity are at an increased risk of HPV persistence and progression to pre-invasive lesions (Pereira-Scalabrino et al., 2013). In general, Latin American countries with a young age-structure, low degree of urbanization, lowest socioeconomic status development, and poorest health indicators, had the highest cervical cancer mortality rates (Pereira-Scalabrino et al., 2013). Additionally, factors found to be the best independent predictors of cervical cancer mortality in Latin American
countries include: mortality rate under 5 years of age, per capita total expenditure on health, and proportion of the population with access to improved sanitation (Pereira-Scalabrino et al., 2013). From 2006 to 2014, it was found that the proportion of Ecuadorian women screened for cervical cancer was low in all socioeconomic groups (Quizhpe et al., 2020). High inequalities which attributed to these low screening numbers include place of residence, ethnicity, and level of education received (Quizhpe et al., 2020).

**Barriers in accessing Cervical Cancer screening**

It has been seen that the burden of cervical cancer lies in the world’s LMICs. Globally, 85% of the women affected with cervical cancer are young, uneducated women, who live in the world’s poorest countries (WHO, 2020). The higher rates in LMICs of cervical cancer are not due to differences in the types of HPV. Instead, these higher rates are due to health-system barriers such as the lack of high-quality cervical cancer screening and lack of high-quality treatment of invasive cervical cancer in these countries (WHO, 2020). Only 30% of low-income countries have stated they have pathology services, cancer surgery, chemotherapy, and radiotherapy available in the public sector as compared to more than 90% of high-income countries having these services (WHO, 2020). A lack of ability to be screened for cervical cancer has also been found to be a risk factor (Valencia, 2021). Additionally, when it comes to health-system barriers, countries with National Cervical Cancer Screenings programs have overlooked women with a low SES and women marginalized by their age, ethnicity, disability, language, place of residence, and/or immigration status (Perehudof et al., 2020). These inequalities hurt women in multiple ways because not only would having one of these marginalized identities make them more susceptible to HPV infection, but also, if they choose to seek screening
services, then they might not even have access to screenings which could prevent cervical cancer incidence and mortality (Perehudof et al., 2020).

Guiding Framework:

Demographic variables in particular, have been seen as barriers to women in Latin American countries in accessing cervical cancer screenings. These demographic variables include: age, education, income/socioeconomic status (SES), race/ethnicity, rural versus urban residence, marital status, parity/number of children, visits to health care providers, and insurance coverage (Liebermann et al., 2018). With these barriers, the specific populations impacted are women of lower socioeconomic status, have lower levels of education, non-White race, or indigenous ethnicity, were significantly less likely to access cervical cancer screening as compared to women of higher socioeconomic status, high levels of education, White race, and non-indigenous ethnicity (Liebermann et al., 2018). Some of these barriers such as age and parity, are also consider risk factors for cervical cancer. Finally, the barrier of education can fit into multiple categories of barriers, like for example as a demographic barrier or a social barrier.

Another category of barriers is social barriers, which include: target age of screening, knowledge and education, sources of information, and lack of culture of preventative health. With these barriers in Latin America, the variability of the target age of cervical cancer screenings, multiple and conflicting sources of information, and a lack of a culture of preventative health, contributed to barriers in women accessing cervical cancer screenings (Liebermann et al., 2018). A final category of barriers is cultural barriers, which includes embarrassment and fear about screening, fatalism, and gender roles. Women who have a perceived fear or embarrassment for screening, beliefs that their health was in God’s will, or men’s negative attitudes toward screening, have impacted whether women will have accessibility
to screening (Liebermann et al., 2018). See **Figure 4** for an overview of health-system, demographic, social, and cultural barriers.

Additionally, **Figure 5** illustrates how these barriers are aligned into the socioecological framework guiding this study design (CDC, 2021). Specifically, there are 4 levels of influencing factors in the socioecological framework: Individual, Relationship, Community, and Societal. See **Figure 5**. At the individual level of the framework, it is inclusive of the demographic variables of age, SES. Under the relationship level, it is inclusive of a combination of social barriers & cultural barriers, which is inclusive of sources of information and gender roles. Under the community level, it is inclusive of intersecting social and cultural barriers, specifically of a lack of culture of preventative health. Additionally, mobility such as internal and international migration can play a role in shaping behavior and access to care. Finally at the societal level, health-system and other organizational barriers, such as the availability and access for cervical cancer screening and linkage to treatment shape risk and health outcomes. The factors in each level /domain may intersect within and between domains to shape health risks and outcomes (Healthy People, 2022)

It has been seen in Latin American countries that the impact of cervical cancer screening programs is influenced by suboptimal coverage and follow-up of patients, unequal access to healthcare and low adherence to the screening program (Nugus et al, 2018). Specifically, in Latin America the incidence of cervical cancer is among the highest, globally (Nugus et al., 2018). This disparity can be attributed to structural and sociocultural barriers that prevent Latin American women from accessing existing screening and preventative services like pap smears (Nugus et al., 2018). Some of these barriers include lack of knowledge, education, lack of health care provider training, and economic and sociocultural barriers (Liebermann et al., 2018). Other
barriers which impact accessibility of cervical cancer screening include: poor roads, a lack of hospitals in rural areas, prohibitive costs of healthcare, insufficient medical equipment, shortage of healthcare workers, and a reluctance to get tested (Sohn, 2020).

In one South American country, Brazil, a health-system barrier of a lack of accessibility of screenings services in remote and rural areas has been identified, which is similar to other countries in the Latin American region (Perehudof et al., 2020). In another South American country, Peru, a study was conducted that found that women avoided cervical cancer screening because they had fears that pap smear screening is painful and could cause infertility, as well as they felt as though the healthcare professions were disrespectful to them (Miles et al., 2021). Additionally, these women feared a positive test result, potential treatments, and if they could have the ability to pay for these treatment options (Miles et al., 2021). Other barriers include discomfort with the test, fear, shame, embarrassment, and stigma (Miles et al., 2021). The results from this study found that civil status, district/city of residence, and having 1–3 children were significantly associated with premenopausal women receiving a Pap smear in the past year, and, education, civil status, and district were highly associated with premenopausal women receiving a Pap smear in the past year (Miles et al., 2021). The authors stated that these results are consistent with accepted literature.

Additionally, in another Latin American country of Columbia, lack of education about preventing disease, accessing healthcare, and practicing individual’s healthcare rights, have been identified as barriers to preventing women from accessing cervical cancer screenings (Bermedo-Carrasco and Waldner, 2016). Additionally, more barriers include distance to health care centers, lack of cultural appropriate healthcare services, political inefficiency, and administrative inability (Bermedo-Carrasco and Waldner, 2016). In Latin American cultures, lack of knowledge
continues to remain one the biggest barriers in cervical cancer screening, along with fear and anxiety about testing and results (Liebermann et al., 2018).

In Ecuador while a pap smear test, which is a form of cytology test, is available in all public health facilities, it is not utilized due to poor execution of health promotion polices and continuous barriers to screening (Quizhpe et al., 2020). The cervical cancer screening coverage in Ecuador % (age and screening interval) is 23.6% (all women aged 15-49 screened every 1y) (HPV Information Centre, 2019). This low screening percentage is surprising in a country where as of 2020, there exist free cervical cancer screenings in public healthcare facilities; however, the incidence of cervical cancer continues to remain high at 19 women per 100,000 (Perehudof et al., 2020). In the country, the screening ages are typically from age 35-age 64 and the frequency of screening is every 5 years (HPV Information Centre, 2019). Some of these barriers to screening include feelings of shame getting tested, negative perceptions of healthcare workers, concerns about the results of test, the physical procedure of the test, and previous negative experiences (Quizhpe et al., 2020). Other barriers to screening in South America in particular, are low education, poverty, and lack of access to health insurance (Quizhpe et al., 2020). Additionally, Ecuador does not have a quality assurance structure or mandate to supervise and monitor the cervical cancer screening process (HPV Information Centre, 2019). Health-system barriers of a lack of understanding one’s entitlement to care and the cost and inconvenience of travelling to or the screening services themselves, are particularly relevant in Ecuador (Perehudof et al., 2020). Additionally, “hard to reach women” are defined as women aged 30 to 65, sexually active, and are not reached by screening services and consequently, making them at higher risk for cervical cancer (Perehudof et al., 2020). This is particularly applicable for the Chimborazo Region of
Ecuador, which is why the FIBUSPAM cervical cancer screening program was decided to be implemented in this region in 2017.

Specifically in Ecuador, indigenous women disproportionately are affected by barriers in accessing cervical cancer screening, as compared to non-indigenous women (Nugus et al., 2018). Indigenous people in Ecuador comprise 1.1 million of the 16.4 million in Ecuador, but they remained marginalized in the healthcare system (Perehudof et al., 2020). Specifically, in the Chimborazo region of Ecuador, where Riobamba is located, the indigenous population comprises nearly 40% of the population, the highest percentage of all provinces in Ecuador (Quichuas de Chimborazo, n.d.). Indigenous Ecuadorian women’s ability to receive cervical cancer services is dependent on their ability to access transportation, overcome racial discrimination, sociocultural influences, and modern medicine distrust. With transportation, some indigenous Ecuadorian women could not have gone to the hospital to access cervical cancer services, without government social assistance services or unless they had their husband’s permission. One study found that Ecuadorian indigenous women have a higher prevalence of cervical cancer than non-indigenous women. They found that in a sample of 396 indigenous women, there was a 13.8% prevalence of intraepithelial lesions that cause cervical cancer, which was higher than 10% prevalence as reported in other studies (Salazar-Torres et al., 2019).

Additionally, for indigenous women, there exists racial discrimination of indigenous Ecuadorians by non-indigenous Ecuadorians, especially in the clinical setting, which makes indigenous Ecuadorians hesitant to access these services (Perehudof et al., 2020; Nugus et al., 2018). In addition to this discrimination, indigenous Ecuadorians face a language barrier when accessing healthcare services because most modern healthcare professionals do not speak the indigenous languages that many indigenous Ecuadorians speak (Perehudof et al., 2020; Nugus et
al., 2018). Overall, in Ecuador, there exists of lack of information about cervical cancer screenings, which are sensitive to cultural, ethnic, and linguistic barriers (Perehudof et al., 2020). Other specific barriers include a lack of culturally competent sexual education for indigenous Ecuadorian women. High ethnic disparities in Ecuador have been found between indigenous and mestizo women when it comes to preventative knowledge about breast and cervical cancer and sexually transmitted infections in general (Quizhpe et al., 2020). It has also been found that with sexual education for Ecuadorian women, there is lack of knowledge about the causes of cervical cancer, the reasons for undertaking Pap tests, the etiology of different gynecological diseases, and rumors and fears about the pap smear in relation to privacy and intimacy (Nugus et al., 2018). Additionally individual barriers for Ecuadorian indigenous women include: gender norms, cultural customs, and a mistrust of Western medicine, making them less likely to have the ability to access cervical cancer screening programs (Perehudof et al., 2020).

One recent mechanism the Ecuadorian government has implemented in response to the high cervical cancer burden in the country, is that in 2017 the Ministry of Health created a national strategy for care to ensure equitable access to cancer care (Quizhpe et al., 2020). This was in hopes of addressing the weak comprehensive cancer management and the fragmented preventative and curative portions of the healthcare system (Quizhpe et al., 2020). The key goals of the strategy include: improving preventive measures, increasing screening and early detection, and promoting evidence-based treatment, rehabilitation and palliative care (The Economist, 2017). Finally, the hope with this national strategy was that Ecuadorians would have more access to cancer services, which would reduce inequalities in the future.

**Screening for Cervical Cancer**
When it comes to the general idea of prevention for cervical cancer, there exist three levels of prevention, as shown in **Figure 2**. As **Figure 2** describes, the first level of prevention is for young girls 9-14 years old and the major component is HPV vaccination (WHO, 2020). The second level of prevention, secondary prevention, in **Figure 2** is screening and treating women who are over 30 years of age (WHO, 2020). The WHO recommends screening women between the ages of 30-49 for cervical cancer, but women aged 20-29 can be screened as well (Gatti et al., 2020). In **Figure 2**, the third level of prevention, tertiary prevention is inclusive of all women and includes treatment with surgery, radiotherapy, chemotherapy, and palliative care (WHO, 2020). For the purposes of this proposed study, secondary prevention of screen-and-treat was used.

When it comes to screening for cervical cancer, it is not enough just to offer the screening test to a group of people. There must also be “diagnostic investigations for those with a positive test, confirming or excluding the disease, treatment and follow-up care of those diagnosed with disease, quality assurance of program inputs and documentation of data pertaining to the program information systems, and ongoing monitoring and evaluation” (Sankaranarayanan, 2014). A test that is considered suitable for cervical cancer screening, is one which is easy to apply, noninvasive, safe, acceptable, affordable, and accurate in identifying people with a high probability of having the disease (Sankaranarayanan, 2014). How screening can impact cervical cancer incidence and mortality is in different manners. If a precancerous lesion is detected, then a reduction in incidence of cervical cancer occurs; however, if early invasive cancer is detected, then a reduction in morality instead of incidence occurs (Sankaranarayanan, 2014).

Cervical cancer screening aims to identify pre-cancerous/cancerous lesions in the cervix. Cervical intraepithelial neoplasia (CIN) is a pre-malignant lesion which consists of 3 stages:
CIN1, CIN2, and CIN3 (WHO, 2013). CIN2 and CIN3 are of particular concern because if untreated, they progress to cervical cancer, and it’s estimated that globally, 1-2% of women have CIN2 lesions (WHO, 2013).

The three most common cervical cancer screening procedures include cytology, HPV-testing, and Visual Inspection with Acetic Acid (VIA). When it comes to cytology-based screening, it is very successful in places where it’s integrated as part of a national program and there exist resources for patient follow-up, more diagnostic testing (colposcopy and pathology), and disease management (WHO, 2020). However, in LMICs, it has been difficult to implement cytology-based screening and the few places it has been implemented, screening coverage is low (WHO, 2020). This can be attributed to cytology-based screening programs in middle-income countries, like in Latin America, which have poor organization, coverage, and lack of quality assurance, for Papanicolaou programs, for example (Sankaranarayanan, 2014, Bychkovsky, 2016). Cytology programs have long wait times to receive results, due to the infrastructure needed to process the tests (WHO, 2013). Additionally, cytology programs in Latin America, are underfunded, not comprehensive, and have delayed follow-up care (Bychkovsky, 2016). For example, one study in Brazil found that 86% of eligible women participated in their cervical cancer screening program, but the incidence of cervical cancer remained high because the women who had abnormal results, did not receive timely follow-up care (Bychkovsky, 2016).

HPV testing is testing for the presence of viral DNA from human papillomavirus (Sohn, 2020). HPV testing and VIA have both been found effective as alternatives to cytology-based screening, because they both have been found to be effective in preventing cervical neoplasia and deaths caused by cervical cancer in clinical trials (Sankaranarayanan, 2014). However, issues with HPV testing include that it is a two-visit approach, instead of one-visit approach like
with VIA. Additionally, HPV testing has a need for high-volume testing and requires significant time for processing (Sankaranarayanan, 2014). Additionally, with HPV testing, the HPV testing market is not standardized nor regulated because there exist 200 commercially available tests, but not validated to internationally approved diagnostic standards (Cubie and Campbell, 2020). Finally, HPV testing is expensive and requires infrastructure and lab personnel and expertise in order to execute this test (Bychkovsky, 2016). When comparing HPV testing and VIA testing, while HPV testing was more effective, it cost significantly more than VIA testing (Mezei et al., 2017).

Visual inspection with acetic acid (VIA) works by adding acetic acid (vinegar solution) directly to the cervix, and if there are any abnormal cervical cells, they’d turn white, indicating a positive VIA test (Cubie and Campbell, 2020). VIA is a procedure that identifies cervical abnormalities, without needing magnification (Cubie and Campbell, 2020). A positive VIA test indicates that these abnormal cells, could either be pre-cancerous or have progressed to a more invasive cancer, which would need treatment. VIA is considered a screen-and-treat method, because after screening, women who are positive can be immediately treated as Figure 3 illustrates. Women can be treated with a variety of methods, but the WHO recommends that cryotherapy be the primary choice for women who test positive in a “screen-and-treat”, especially if they are eligible for this procedure (Cubie and Campbell, 2020). Cryotherapy uses nitrous oxide or carbon dioxide to freeze cells at -90 Celsius degrees, and this procedure has seen cure rates for CIN 2-3 lesions at 85%-92% (Cubie and Campbell, 2020). To be eligible for cryotherapy, women who are positive after screening must have the entire lesion and squamocolumnar junction visible, while the lesion does not cover more than 75% of the ectocervix (Cubie and Campbell, 2020). As Figure 3 shows, if a woman is found ineligible, then
she may be given other treats like Loop electrosurgical excision procedure (LEEP) or referred out for another treatment (WHO, 2013).

VIA is commonly used as an approach to secondary prevention in resource-constrained places (WHO, 2020). VIA requires less staff to execute and this particular method is inexpensive, as compared to cytology-based testing (Bychkovsky, 2016). VIA also does not need laboratories to analyze the results and both screening and treatment can be conducted in one-visit (Cubie and Campbell, 2020). It is relatively easily to set-up VIA screening, but the quality of the test is subjective and dependent on the healthcare provider and the sensitivity can be variable (WHO, 2020). Additionally, since VIA is subjective test, one problem which occurs is that some healthcare providers may have false-positives, which could lead to overtreatment (WHO, 2013).

Between HPV testing and VIA testing, HPV testing is conditionally recommended as the first choice by the WHO; however, since HPV testing has barriers, the WHO recommends VIA testing as the first choice in resource restrictive countries (WHO, 2013). VIA is best used in women under 50 because the transformation zone of the cervix, where most precancerous lesions occur, is best visible because after menopause, the transformation zone recedes in the endocervical canal, making it difficult to identify precancerous lesions (WHO, 2013). With VIA, if the skills are appropriately taught and quality assurance occurs, then VIA can achieve high coverage, be cost-efficient, and could be implemented in national screening programs (Cubie and Campbell, 2020). In fact, the WHO states that women who are even screened with another test like HPV testing and test positive, should be also be screened with VIA to identify large lesions and see if these women could be eligible for cryotherapy (Cubie and Campbell, 2020).

The cost-effectiveness of VIA in one Latin American country, Honduras, found that VIA testing would save $3,198 per cancer case as compared to $36,802 per cancer case for cytology-
testing (Bychkovsky, 2016). VIA testing is highly attractive for LMICs, and has been widely implemented in multiple countries in Asia and Africa because it uses a single-visit approach, and provides immediate test results (Sankaranarayanan, 2014). VIA testing is best used in remote/rural areas where there exist barriers in accessing cytology-screening programs (Bychkovsky, 2016). In 2016, one study found that in Ecuador, VIA tested was not yet available in the public nor private sector (Bychkovsky, 2016). The data collected for this current study was collected from a VIA screening program in the private sector of Ecuador in 2017.
Study Aims

Purpose:

This study served to provide a descriptive look at this population of Ecuadorian women and identified measures of association between variables that could be associated with cervical cancer risk. This study also served to identify what factors are associated with Ecuadorian women from accessing cervical cancer screening services. From the background section it has been identified that there exist many risk factors for Latin American women in general, when it comes to cervical cancer. However, there exists a gap of knowledge of the specific risk factors for Ecuadorian women, like birth control usage, ethnicity, and age, especially for women from the Chimborazo Province, where the FIBUSPAM hospital is located. Additionally, when it comes to accessibility of cervical cancer services, from the background section, there have been factors identified associated with Latin American women having the ability to access cervical cancer screenings, but again, there exists a gap of knowledge in the literature of the specific factors, such as travel to healthcare facility, which impact Ecuadorian women, especially Chimborazo women, in accessing these services. This study is, to the best of the thesis author’s knowledge, the first study on risk factors and screening barriers associated with cervical cancer in this population of women from the Chimborazo province, Ecuador.

Aims:

1. Identify if there is an association between VIA result and sociodemographic, socioeconomic, and sexual and reproductive factors.
   a. Sociodemographic factors include: age, ethnicity
b. Socioeconomic factors include: socioeconomic status, smoking status, number of children, and education level attained

c. Sexual and Reproductive factors include: oral contraception use, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs

2. Identify if there is an association between travel to healthcare facility and social determinants of health and VIA result.
   a. The social determinants of health to be assessed are: past healthcare services access, level of education received, socioeconomic status, and ethnicity.

Hypotheses:

1. In Ecuadorian women, risk factors of smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, and socioeconomic status, will be associated with a positive VIA result.

2. In Ecuadorian women, VIA result, past healthcare services access, level of education received, socioeconomic status, and ethnicity, will be associated with travel to healthcare facility.
Methods

Study Participants

A total of 1000 participants were recruited to take part in a cervical cancer screening program in which an in-person survey was distributed. This screening program was executed by the Fundación Internacional Buen Samaritano Paul Martel (FIBUSPAM) clinic during February 2017 to May 2017 in Ecuador. The patients that were included in this study were women between the ages of 21-65.

Parent Study Design

The FIBUSPAM Clinic Cervical Cancer Screening and Treatment Form is a clinic intake form that was collected in cross-sectional manner that collected demographic information such as age, residence, ethnicity, and SES. The dependent/outcome variables of documented VIA result and travel to healthcare facility were also collected. By specifically looking at the association of risk factors of cervical cancer with the VIA test results, factors that are associated with the risk of cervical cancer in Ecuadorian women will be identified. Factors of interest include: smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, socioeconomic status, past healthcare access, and level of education received. HPV Vaccination status was not collected as a variable because during the time the data was collected in 2017, according to the staff at FIBUSPAM, the vaccine was not easily available in that area and they believed that their target population would not have received the vaccine yet.

Procedure of Parent Study

The clinic intake form was distributed in conjunction with a FIBUSPAM cervical cancer screening initiative conducting at the FIBUSPAM clinic in Riobamba and in different
communities in Ecuador as part of Caravans in the cities of Cumanda, Santa Isabel Cayambe, Cayambe, Guayaquil, Santa Lucia, Licto, and Cebadas. For each participant, the form was filled out by the doctors and nurses that participated in the VIA training program. The staff were also given a training on how to fill out the intake form before it was rolled out into the field. The form was piloted among 5-6 women at the clinic, before the start of screening program. The data from the survey was then inputted into excel by a front office staff member, Ruth Pomaquero. This process was overseen by an intern working with FIBUSPAM, Emma Boey.

The form was distributed in Spanish, and the results were translated from Spanish to English for the purposes of this study. Participants heard about the program through flyers, word-of-mouth, their community President, television, radio, and referrals. Additionally, participants were also made aware of the screening program via the FIBUSPAM clinic, municipal meetings, World Vision Volunteers, church, Instituto Carlos Garbay, Club de los Leones, Mensaje Militar, Reina de Riobamba, Ing. Copa Minga, Subcentro de salud, Perifoneo, Fundacion Blanca House, Escuela Monte Carmelo Internet, and friends/relatives. When advertising the program, the screening program was looking for women based on the following inclusion criteria: women between the ages of 30 and 50 and who had not received cervical cancer screening in the past three years. It is important to note that the screening was opportunistic. Women attending the FIBUSPAM clinic for any reason, were invited to participate in the screening program. Each participant signed a physical consent form prior to getting screened. The purpose of the consent form was for them to participate in the screening and possible treatment, and have their information collected via the intake form.

The intake form begins by asking demographic questions such as age, residence, ethnicity. Then, it progressed to collect the participant’s history of sexual activity, previous pregnancies, oral contraception use, smoking status, STD status, and previous cervical cancer
history (if any). Finally, the intake form collected VIA test status, type of treatment recommended (if given), patient satisfaction with the procedure, and whether the patient needed to follow-up.

**Measures for Current Study**

*Dependent/Outcome variable-VIA Result.* To collect VIA result, Question C3 of “VIA Results”, with answers of “1: Not done; 2: Positive; 3: Negative; 4: Suspicious for cancer”, will be collected.

*Dependent/Outcome variable-Travel to healthcare facility.* To measure travel to healthcare facility, Question A8 of “How long did it take you to get there from when you left home and until the moment you arrived at the clinic” collected in minutes, and Question A9 of “What means of transportation did you take to get to the clinic today:” with answers of “1: Car; 2: Clinic bus; 3: On foot; 4: Other” will be collected.

*Sociodemographic factors.* For ethnicity, it is measured by Question B3 “What is your ethnicity?” with answer choices “1: Mestizo; 2: African; 3: Indigenous; 4: Other”. Age will be measured by Question A5 “Date of Birth” as written in as “dd/mm/yy”. Education will be measured by Question B2 “What is the highest level of education you have completed” with answer choices “1: None; 2: Elementary School; 3: High School; 4: College or higher; 5: Other”.

*Socioeconomic factors:* Formal employment is used as a proxy to measure SES. Formal employment will be measured by Question B11a “Do you have formal employment?” with answer choices “1: Yes; 2: No”. For smoking, Question B10a “Have you ever smoked in your
life” with answers of “1: Yes; 2: No”, and Question B10b “If the answer was yes, do you currently smoke” with answers of “1: Yes; 2: No” will be collected. For number of children, Question B7 “How many children do you have” with a number as an answer in the format of XX will be collected. For past healthcare access, Question A14 “How many times have you come to this clinic or another clinic for care in the last 12 months” with a number as an answer in XX will be collected.

Sexual and reproductive factors: For oral contraception use, Question B12a “Have you ever used birth control” with answers of “1: Yes; 2: No”, Question B12b “You are currently using birth control methods” with answers of “1: Yes; 2: No”, and Question B12c “If yes, what methods are you currently using” with answers of “1: Condoms; 2: Sterilization; 3: Injection; 4: Family planning natural; 5: Contraceptive pill; 6: Other” will be collected. For age of first sexual intercourse, Question B8 “How old were you the first time you had sexual intercourse” with an answer of age in double digits XX, will be collected. For number of sexual partners, Question B9 “How many sexual partners have you had in your life” with an answer in the format of XX will be collected. For previous positive test of an STD, Question 5b “If yes, you have been told that you have a positive result” in response to Question 5a “Have you ever had a test for sexually transmitted diseases”, will be collected with answers of “1: Yes, positive result; 2: No positive result”. For previous diagnosis of a STD, Question 5c “If yes, what disease have you been told you have” in response to Question 5b of “Have you every had a test for sexually transmitted diseases” with answers of “1: HIV; 2: syphilis; 3: chlamydia; 4: gonorrhea; 5: HPV; 6: genital warts; 7: herpes; 8: Other” will be collected.

These measures can also be organized to fit into the socioecological framework in public health (CDC, 2021). Table 5 illustrates how each of these measures can fit into one of the four levels of the framework. At the individual level the measures include: VIA result, ethnicity, age,
education, smoking status, number of children, oral contraceptive use, and socioeconomic status (SES). At the relationship level, it is inclusive of the measures of age of first sexual intercourse, number of sexual partners, previous positive test for an STD, and previous diagnosis of a STD. At the community level, there were no measures that fit into this level. Finally, at the societal level it is include of the measures of travel to healthcare facility and past healthcare access.

**Statistical Analysis Plan**

All variables were checked for normality assumptions using a univariate analysis. Descriptive statistics including frequencies and means were computed to describe the sample. Univariate and bivariate analyses were then conducted. To test the proposed hypotheses, the statistical software SPSS was used. If the variables were found to be not normally distributed, then the non-parametric tests as described in Table 6 were ran. If the variables are normally distributed, the following parametric tests ran as illustrated in Table 6.

For the first research question, VIA result and cervical cancer screening, VIA result and smoking, VIA result and ethnicity, and VIA result and socioeconomic status were run with a Likelihood ratio test. VIA result and oral contraception use were run with an ANOVA. VIA result and age, VIA result and age of first sexual intercourse, and VIA result and number of children were run with ANOVA. VIA result and number of sexual partners will be run with ANOVA. VIA result and positive STD test and VIA result and previous STD diagnosis were run with a Likelihood ratio test.

For the second research question, travel to healthcare facility and past healthcare access were run with a Spearman correlation and Kruskal-Wallis test, respectively. Travel to healthcare facility and SES were run with a Mann-Whitney test and a Pearson Chi-Squared test. Travel to healthcare facility and ethnicity, were run using a Kruskal-Wallis test and a likelihood ratio test. Travel to healthcare facility and education were run with a Kruskal-Wallis test and a likelihood
ratio test. Travel to healthcare facility and VIA result, were run using a Kruskal-Wallis test and a
likelihood ratio test.

**IRB Approval**

The intake form which collected the data from the cervical cancer screening program was
not initiated for research purposes but for clinical purposes only, and therefore no IRB approval
was sought or needed in 2017. This current study, which is for research purposes, sought
approval from the University of Texas Institutional Review Board in January 2022. This study
was declared exempt from review under the following federal guidelines: [45 CFR 46.104(b)(4)].
Results

Descriptive Statistics

Descriptive statistics in this study include age, number of children, age of first sexual encounter, number of sexual partners, time to healthcare facility, visits to a healthcare facility in the past 12 months, methods of transportation used, highest educational level received, ethnicity, previous STD diagnosis, formal employment, having ever used birth control, current method of birth control, and VIA result. After removed patients that did not fit the eligibility criteria based on the identified age range of 21-65 years old, 934 participants were included in the data analysis. Missing values were appropriately classified using the SPSS software. According to Table 7, the mean age for the total population (N=934), was 41.09 with a standard deviation of 7.89 years. For number of children (N=929), the mean was 3.83 children with a standard deviation of 7.28 children. For age of first sexual encounter (N=933), the age of first sexual encounter was 19.49 years with a standard deviation of 11.21. For number of sexual partners (N=924), the mean was 1.67 partners with a standard deviation of 1.17. For time taken to healthcare facility (N=932), the mean was 30.70 minutes with a standard deviation of 32.63 minutes. For past 12-month visits to a healthcare facility (N=659), the mean was 2.67 visits with a standard deviation of 2.18 visits.

From Table 8, the top methods of transportation (N=932) used to the healthcare facility were by car (47.4%) and by foot (31.5%). For highest education level received (N=933), most of the participants had up to an elementary school education (46.4%). For ethnicity, most participants were mestizo (56.0%) and indigenous (42.2%). For participants with a previous STD diagnosis (N=48), the majority had a diagnosis of HPV (79.2%). For formal employment (N=905), most participants did not have formal employment (70.8%). As for ever using birth control (N=932) most participants had used them before (71.1%), with 61.5% of participants (N=709) currently
using birth control. Out of the birth control methods (N=428), the three most common were tubal ligation (36.0%), injection (18.2%), and an implant (12.9%). Finally, as for VIA Result (N=933), 89.0% of the participants were VIA negative and 8.9% of the participants were VIA positive. For the following sections of results, only the statistically significant results have been reported.

Crosstabulation and test of independence

Crosstabulation was used to examine proportions of reported VIA result across levels of smoking, birth control usage, previous STD test/diagnosis, and demographic characteristics. Additionally, to examine the relationship between the proportions for each independent variable and dependent variable, a chi square test of independence was performed, with an alpha = .05 criterion for significance.

**Hypothesis 1**: In Ecuadorian women, risk factors of smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, and socioeconomic status, will be associated with a positive VIA result.

It was found that among 931 participants, there was a statistically significant difference in the percent of people who have ever used birth control and VIA result (p=0.006, X²=12.57). Specifically, among 931 participants who tested VIA positive, the percent for those who have ever used birth control (9.8%) was higher compared to those who have never used birth control (6.1%). Also, among 931 participants who tested VIA negative, the percent of those who have ever used birth control (89.0%) was about the same as those who have never used birth control (88.8%).

**Hypothesis 2**: In Ecuadorian women, VIA result, past healthcare services access, level of education received, socioeconomic status, and ethnicity, will be associated with travel to healthcare facility.
Among 899 participants, there is a statistically significant difference in the percent of people by ethnicity and type of transport used to the clinic (p=0.000, $X^2=54.90$). Specifically, among 899 participants who traveled by foot to the clinic, the percent of those who were indigenous (38.5%) was higher as compared to other ethnic groups of Mestizo (25.4%) or African (20.0%). Additionally, among 899 participants who traveled by public bus, the percent of those who were indigenous (17.2%) was higher as compared to other ethnic groups of Mestizo (14.5%) or African (6.7%). Finally, among 899 participants who traveled by car, the percent of those who were indigenous (35.9%) was lower as compared to other ethnic groups of Mestizo (55.8%) or African (66.7%).

Finally, among 931 participants, there is a difference in the percent of people by education and type of transport used to the clinic (p=0.000, $X^2=71.83$). Specifically, among 899 participants who traveled by foot to the clinic, the percent of those who did not have formal education (37.5%) or had an elementary high school education (37.0%), was higher as compared to those with a high school education (27.9%) or college or higher (15.4%). Among 899 participants who traveled by car to the clinic, the percent of those who did not have formal education (42.7%) or had an elementary high school education (38.9%) was lower as compared to those with a high school education (53.6%) or college or higher (66.7%). Among 899 participants who traveled by the clinic bus to the clinic, the percent of those who did not have formal education (10.4%) or had an elementary high school education (5.8%) was higher as compared to those with a high school education (2.9%) or college or higher (1.6%). Finally, among 899 participants who traveled by public bus to the clinic, the percent of those who had an elementary high school education (18.1%) was higher as compared to those with college or higher education (15.4%), a high school education (13.8%), and did not have formal education (5.2%).
ANOVA

**Hypothesis 1:** In Ecuadorian women, risk factors of smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, and socioeconomic status, will be associated with a positive VIA result.

A one-way ANOVA was conducted to compare the effect of age on VIA result. It was found that age had a statistically significant impact on VIA result $F(3, 929) = 5.509, p=0.001$. Among 933 participants, there are significant differences in mean age between people with VIA results of not done ($m=46.13$), positive ($m=38.74$), negative ($m=41.19$), and suspicious for cancer ($m=46.42$) ($p=0.001$). A Bonferroni post hoc test did not find any significant pairwise comparisons that were $p<0.0083$.

**Kruskal-Wallis**

**Hypothesis 2:** In Ecuadorian women, VIA result, past healthcare services access, level of education received, socioeconomic status, and ethnicity, will be associated with travel to healthcare facility.

The Kruskal-Wallis Test was conducted to examine the differences on time taken to healthcare facility according to ethnicity $H$-value=$17.02$, $df=3$, $p=0.001$. Among 899 participants, mean ranks differed for Mestizo (420.01), Indigenous (485.30), African (550.17), and Other (682.00). Mestizos took less time to get to the healthcare facility as compared to Indigenous, African, and Other ethnic groups.
Discussion

This study served to provide a descriptive look at this population of Ecuadorian women and identify measures of association between variables that could be associated with cervical cancer risk. This study also served to identify what factors are associated with Ecuadorian women from accessing cervical cancer screening services. It was hypothesized that in Ecuadorian women, risk factors of smoking, oral contraception use, age, age of first sexual encounter, number of sexual partners, previous positive STD test, previous diagnosis of specific STDs, number of children, ethnicity, and socioeconomic status via the proxy of formal employment, will be associated with a positive VIA result. Additionally, it was also hypothesized that in Ecuadorian women, VIA result, past healthcare services access, level of education received, socioeconomic status, and ethnicity, will be associated with travel to healthcare facility.

Out of the proposed hypotheses, a few associations were found to be significant. There was a statistically significant difference in the percent of people who have ever used birth control and VIA result (p=0.006, X2=12.57). There was a statistically significant difference in the percent of people by ethnicity and type of transport used to get to the clinic (p=0.000, X2=54.90). Also, there was a statistically significant difference in the percent of people by education and type of transport used to the clinic (p=0.000, X2=71.83). It was also found that age had a statistically significant impact on VIA result F(3, 929)= 5.509, p=0.001. Finally, the differences on time taken to healthcare facility according ethnicity were also found to be statistically significant H-value=17.02 df=3, p=0.001.

Hypothesis 1
With mean age of VIA result, it was found that women who were VIA positive had a mean age of 38.74 years. The youngest mean age of 38.74 years was found to be for VIA positive women as compared to women who were VIA negative, suspicious for cancer, or test not done. This aligns with Torres-Roman et al. (2022) who describe how cervical cancer is still one of main cancers that impacts younger women under the age of 45. Additionally, in low-and-middle income countries, they continue to have an increase in cervical cancer cases and deaths in women under the age of 45 (Torres-Roman et al., 2022). As this study found that both the average woman diagnosed with a VIA result and the average woman in this study was under the age of 45, it is important that women are screened and receive treatment for cervical cancer early, so they do not succumb to the cancer.

With women who had a positive VIA result, the percent of women who had ever used birth control was higher than women who had never used birth control. This is unsurprising as the literature has described how women who have ever taken oral contraceptives, are more likely to be susceptible to cervical cancer (Almonte et al., 2008, Valencia, 2021). Specifically, it was found that the cervical cancer risk for women who used oral contraceptives increased to 60% with five to nine years of use, from 10% with five years (Valencia, 2021). This is important to note as one study in the US found that few women knew that birth control use increases risk for cervical cancer (Akinlotan et al., 2017). With this present study, it was found that women who ever used birth control (N=932) most participants had used it before (71.1%), with 61.5% of participants (N=709) currently using birth control. Therefore, it is important that these Ecuadorian women are communicated about cervical cancer risk as this population may be susceptible to cervical cancer due to oral contraceptive use, in addition to other potential reasons.
identified in the background section, such as sexual activeness, number of children had, and previous STD diagnosis.

**Hypothesis 2**

When it came to examining highest education level received, by type of transport, it was found that the majority of women with no formal education or elementary school education, did not take cars. Instead, these women traveled by foot or used public transportation. The majority of women with a high school level education or college level or higher, were the ones who took a car to the clinic. Fang et al. (2016) found that there was an association between limited education and transportation as a barrier to screening. Therefore, the authors created a multicomponent intervention which combined cervical cancer education and navigation services to increase uptake of cervical cancer screening (Fang et al., 2016). In interpreting the findings of this study, further analyses would need to be done to explore the association between these two variables to understand why women with no formal education or level of highest education received at the elementary school were more likely to travel by foot or use public transportation, as compared to women with higher levels of education, who took cars.

When it came to differences in ethnicity by type of transport, indigenous women were found to be the least likely to take a car to the clinic. Instead, the majority of the indigenous women travelled by foot and public transportation, as compared to other ethnic groups of Mestizos and Africans. This finding is important to note because indigenous Ecuadorian women have been observed to have many barriers in accessing healthcare services, as compared to Mestiza women (Quizhpe et al., 2020). One reason which accounts for the ability of indigenous women in accessing healthcare services is transportation, so it expresses concerns that these
women may not have been able to access these services if this temporary screening program was hosted outside of their community.

**Strengths and Limitations**

One strength of this study is that it examined the association of factors related to cervical cancer risk specific to Chimborazo women living in Ecuador. Few studies in the past years have examined the association between cervical cancer risk and outcomes and this population of Ecuadorian women. The few studies that have, looked at HPV infection or knowledge about cervical cancer and prevention (Basanes and Barahona, 2019, Riveria, 2016, Carlos et al., 2021). Additionally, this study also not only looked at cervical cancer but also at what factors could be associated with preventing women from access cervical cancer services. These results can serve in the creation of future studies and programs to eliminate these barriers for Chimborazo women to ensure they have access to cervical cancer screening and treatment services.

Limitations of this study include that the original data for this study was collected in 2017, almost 5 years ago. The needs of the study participants may have changed since this time, so while the results can help inform what was needed in 2017, an updated study should be conducted to see if Chimborazo women have the similar needs as this study, or if they have slightly changed. Additionally, one of the variables of this study, time it took to healthcare facility, may not be as reliable as the other variables. This is attributed to the dataset owner communicating that one of the data entry individuals had begun entering the time taken to healthcare facility in hours instead of minutes. While the majority of study participants had corrected times in minutes inputted, there could have been participants whose time taken to the healthcare facility was left in hours, therefore some of the results with the time variable could have been off.
Another limitation of this study is in relation to generalizability of these results to all populations in Ecuador. As the women who were included in this screening program, and therefore the dataset, was done opportunistically, these results cannot be generalized to all populations in Ecuador. If the women recruited for this study could have been done via probability sampling, then the study participants could have been generalized to be representative of the different communities in Ecuador. While there is still much we can learn from this current study and the results, we cannot generalize saying that the results in this study are what all populations of Ecuadorian women are facing.

**Future Directions**

As this intake form was conducted in 2017, more research should be conducted in future to examine what the current cervical cancer risk and potential barriers to accessing cervical cancer services are. Additionally, an updated screening program could be designed and implemented in this same region for Chimborazo because as Ecuador’s National Strategy for Cervical Cancer Prevention includes screening women between the ages 21-65 every 3-years for cervical cancer, it has been 5-years since this initial screening program by FIBUSPAM took place. Since then, there was no formal cervical cancer screening program in the province that took place during that time frame. Therefore, there are potentially 1000 women who need to be screened again, and many more women who may not have been screened during the initial screening program who should be screened now. Especially, younger women who did not qualify to get screened the first time, but now have surpassed the age of 21 and are eligible for cervical cancer screening now.

Additionally, the 2017 FIBUSPAM cervical cancer screening program did not collect HPV vaccination as a variable. At the time this program was being rolled out in the Chimborazo
region, local staff believed none of the population for screening would have received the vaccine yet, so it was not collected. This data should be collected in future studies/screening programs. As HPV vaccination is an effective primary prevention mechanism for cervical cancer, promotion of dual cervical cancer screening/vaccination programs would be the best effective measure in providing better health outcomes for Ecuadorian women.

**Implications**

The implications are that the findings from this study quantified what variables are linked to the outcome variables of VIA result and travel to healthcare facility. Birth control usage and age were associated with VIA result. Under travel to healthcare facility, ethnicity and highest education level received were associated with type of transport used to the clinic. Under travel to healthcare facility, ethnicity was also found to be associated with time taken to healthcare facility. These results can help inform future studies with complex analyses on these variables, to further identify the scope of the relationship between the variables. Additionally, the implications of this research on cervical cancer are while learning about global health and global borders, the knowledge gained from studying a similar predominately Hispanic population, it can help inform minority health disparity research.

In reference to the strategic framework of the CDC (2021) socioecological model, there exist implications in public health research. Specifically, while there were individual variables which impacted the participants in this study, there was also one societal variable of transport taken to clinic, which was found to be significantly significant in this population. This is important to note because for the individual variables like birth control usage and its risk for cervical cancer, they can be addressed via health education for the targeted population. However, when it comes to addressing the societal variables, they cannot be easily addressed with health education.
Within these levels of the socioecological framework, the measures which were assessed through this study are also tied to social determinants of health. According to Health People 2030, there exist 5 domains for social determinants of health, these include: economic stability, education access and quality, healthcare access and quality, neighborhood and built environment, and social and community context (Healthy People, 2022). Under economic stability, the measures of formal employment as a proxy for SES is a social determinant of health. Under education access and quality, the measure of highest education level received is a social determinant of health. Under healthcare access and quality, VIA result, previous positive for an STD, smoking status, previous diagnosis of a STD, and past healthcare access are social determinants of health. Under neighborhood and built environment, the measure of travel to healthcare facility is a social determinant of health. Finally, under social and community context, discussions about the measures of age of first sexual intercourse, number of sexual partners, number of children, ethnicity, age, and oral contraceptive use can be social determinants of health. When it comes to addressing the social determinants of health that were found to be significant in this study such as under healthcare access and quality of VIA result, under neighborhood and built environment of travel to healthcare facility, and under social and community context of age and ethnicity, policy interventions are needed to address the impact of these social determinants of health on the population.

Specifically, policy interventions to help address the barriers disadvantaged groups like the indigenous population in this study faced, like by needing to get to the clinic by foot, which took hours for some women. Cervical cancer screening and treatment services must be more accessible to indigenous communities in Ecuador. Both public health professionals and policymakers must work in conjunction to bring these programs directly into the communities of these disadvantaged groups to minimize the cervical cancer disparities they face.
Additionally, as this community in Ecuador is a medical underserved predominately minority community, the findings can be implicated in global health research for similar medically underserved and/or predominately minority communities. One example, is the US-Mexico Border Region which is both a medically underserved region and with a predominately Latinx population. As this cervical cancer screening intervention was cost-effective for the community in Ecuador, this intervention could be adapted in similar low-resource communities here in the US, in which residents cannot access cervical cancer screening/treatment services.

Finally, there are further implications for policy from study findings. Since the VIA test is subjective, a proposal of a policy to make VIA testing more advanced, like used in conjunction with HPV testing, for example, would increase its effectiveness as a testing mechanism. This would give the ability for Ecuadorian women to receive advanced technology screening with cervical cancer, even with the limited resources available in Ecuador. Additionally in conjunction with the Ministry of Public Health in Ecuador, policies can be proposed to increase cervical cancer screenings program in Ecuador, which are specific to the risk factors and barriers, as found in this current study for Ecuadorian women. Finally, while working with the local community health organization of FIBUSPAM, a new cervical cancer screening program can be proposed, building on the results of this study, to address the current burden of cervical cancer in the region, as of 2022.

Conclusions

In conclusion, this study found that birth control usage and age were significantly associated with VIA result. Additionally, ethnicity and highest education level received were significantly associated with type of transport used to the healthcare facility. Finally, ethnicity was significantly associated with time taken to healthcare facility. These findings contribute to
the literature on the association of different factors in relation to cervical cancer risk and access
to cervical cancer services with minority and medically-underserved communities globally.
Strategic Frameworks

   a. Goal 1
      i. End poverty in all its forms everywhere.
   b. Goal 3
      i. Ensure healthy lives and promote well-being for all at all ages:
         ii. Goal 3, target 3.4: By 2030, reduce by one third premature mortality from noncommunicable diseases through prevention and treatment and promote mental health and well-being.
         iii. Goal 3, target 3.7: By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs.
         iv. Goal 3, target 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
   c. Goal 5
      i. Achieve gender equality and empower all women and girls.
   d. Goal 10
      i. Reduce inequality within and among countries.

   a. Objective 1.

      i. To raise the priority accorded to the prevention and control of noncommunicable diseases in global, regional and national agendas and internationally agreed development goals, through strengthened international cooperation and advocacy.

         1. Strengthen international cooperation for resource mobilization, capacity-building, health workforce training and exchange of information on lessons learnt and best practices.

   b. Objective 4.

      i. To strengthen and orient health systems to address the prevention and control of noncommunicable diseases and the underlying social determinants through people-centered primary health care and universal health coverage.

         1. Scale up early detection and coverage, prioritizing very cost-effective high-impact interventions including cost-effective interventions to address behavioral risk factors

      2. **Cancer**

         a. Prevention of cervical cancer through screening (visual inspection with acetic acid [VIA] (or Pap smear (cervical cytology), if very cost-effective), linked with timely treatment of pre-cancerous lesions.
b. Vaccination against human papillomavirus, as appropriate if cost-effective and affordable, according to national programs and policies.


3. PAHO: PLAN OF ACTION FOR CERVICAL CANCER PREVENTION AND CONTROL 2018-2030 (PAHO, 2018)

   a. 1. Improve cervical cancer program organization and governance, information systems, and cancer registries

      i. A.) Formulation/review and alignment of national cervical cancer program strategies and plans, with targets and milestones for 2030 in line with regional and global objectives for cervical and other HPV-related cancers, sexual and reproductive health, HIV/STIs, and health system plans.

      ii. B.) Development/review of national cervical cancer policies based on the most up-to-date scientific evidence, with specific mention of HPV vaccination delivery strategies and target groups; screening method(s), including target groups and frequency; and referral mechanisms for diagnosis, treatment, and palliative care—all tailored to the needs of priority populations based on the local situation.

   b. 2. Strengthen primary prevention through information, education, and HPV vaccination

   c. 3. Improve cervical cancer screening and precancer treatment through innovative strategies
i. **A.)** Review/update national screening and precancer treatment protocols to ensure that they are based on the most recent scientific evidence, adhere to WHO recommendations and ethical standards, and are tailored to the needs of priority populations, including those living with HIV who need more frequent screening. The target age may vary in different settings and should be determined based on the likelihood of reaching the largest group of women, focusing on those between the ages of 30 and 49 and expanding to younger and older age groups as resources permit with a view to attaining maximal coverage.

ii. **B.)** Assess health service capacity and needs with a view to increasing equitable access, screening coverage, and treatment rates through clinical outreach services as well as static health services, while tailoring the service delivery model to the needs of women living in vulnerable and disadvantaged communities. Consider ways to deliver screening and treatment services in fewer health service visits so as to reduce loss in follow-up care and maximize impact on cervical cancer mortality. Ensure that cervical cancer services are part of the essential benefits offered by health systems and services at the first level of care with a definite strategy for referrals to secondary and tertiary care.

d. **4.** Improve access to services for cancer diagnosis, treatment, rehabilitation, and palliative care.

i. **A.)** Develop/update and implement evidence-based protocols for cervical cancer treatment and palliative care based on current scientific evidence.

a. #3 Organize and implement a timely response for screening, detection, specialized diagnosis to improve the prognosis and life of cancer patients.

i. Organize and carry out an intensive campaign screening for prioritized neoplasms, of according to detailed directions in national regulations.

1. Uterine Cervical Cancer: Screen Women 21 to 65 Years Old with Pap smear every 3 years. In women between 30 and 65 years old and if possible, perform screening with cytology and molecular tests to HPV DNA every 5 years; (51–55) for other ages and cases specific, refer to the normative documents issued by the entity rector.

ii. Carry out the diagnosis cancer opportunities for providing a treatment adequate, continuous and successful and a follow-up specialized in all the stages of cancer.

1. Guarantee access to histopathological diagnosis and staging with await no longer than 45 days. Refer patients with positive screening to the level of health and complexity established in the national regulations to carry out the diagnosis and treatment plan defined in clinical practice guidelines and MSP protocols. Promote the identification of cancer lesions in clinical stages with the best sanitary technology available, in order to increase healing and survival. Strengthen the second and third level of health to
guarantee the diagnosis and treatment of patients identified by screening.

b. #4 Implement interventions based on the best available evidence for the cancer treatment and monitoring based on disease staging in the various levels of care and complexity of health services.

i. Guarantee access priority, with quality and warmth for treatment and follow-up of patients with cancer.

ii. Carry out multidisciplinary and standardized cancer treatment according to the Clinical Practice Guidelines and the documents issued by the National Health Authority, or in the absence of such, the best available scientific evidence appropriate to the national context.

1. Ensure that the start of treatment is carried out for a maximum of 30 days after confirmatory cancer diagnosis.

2. Ensure access and opportunity for comprehensive treatment to patients with diagnoses identified with ICD code 10: C00-D48.

c. #8 Epidemiological Surveillance and Research for the generation of information for national strategy.

i. Promote Cancer Research in Ecuador

1. Promote cancer research in Ecuador, guaranteeing the generation of strategic information with emphasis on the investigation of related risk factors with the appearance of cancer in individuals.
2. Encourage the generation of scientific research for the cancer prevention, diagnosis, treatment and care palliative according to the research priorities of the MSP.

ii. Strengthen epidemiological surveillance systems about cancer in the country with the purpose of obtaining data reliable and representative of the real situation of risk factors and cancer in Ecuador.

d. #9 Social and Intersectoral participation

i. Promote community, health sector, and other stakeholders to get involved and participate actively in the fight for prevention, treatment and cancer monitoring.

1. Identify the social and community organizations that perform interventions in cancer.
MPH Program Foundational Competencies

A. Evidence-based Approaches to Public Health
   1. Select quantitative and qualitative data collection methods appropriate for a given public health context
   2. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate
   3. Interpret results of data analysis for public health research, policy or practice

B. Public Health and Health Care Systems
   4. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings
   5. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels

C. Planning and Management to Promote Health
   6. Assess population needs, assets and capacities that affect communities’ health

D. Policy in Public Health
   7. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence
   8. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes
   9. Advocate for political, social or economic policies and programs that will improve health in diverse populations

E. Leadership
10. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making

11. Apply negotiation and mediation skills to address organizational or community challenges

F. Communication

12. Communicate audience-appropriate public health content, both in writing and through oral presentation

13. Describe the importance of cultural competence in communicating public health content

G. Inter-professional Practice

14. Perform effectively on inter-professional teams

H. Systems Thinking

15. Apply systems thinking tools to a public health issue

Through the design of this quantitative-based thesis, the organization and structure of healthcare was compared between the US and Ecuador. The impact of social inequities and racism was discussed, which was specific to the indigenous population of Ecuador, to assess the population needs of this local community. Additionally, implications of this research, specific to policy in public health, were discussed and communicated. Finally, through collaboration on an inter-professional team, a systems thinking approach was used in proposing this study and analyzing the findings.
MPH Program Hispanic and Border Health Concentration Competencies

1. State the principles of prevention and control of disease, and discuss how these can be modified to accommodate cultural values and practices in Hispanic and border communities.

2. Develop prevention strategies for the different stages of the major communicable and non-communicable diseases in Hispanic and US/Mexico border communities.

3. Differentiate quantitative health indicators in major communicable and non-communicable diseases in US/Mexico border vs non-border communities.

With these Hispanic and Border Health Concentration Competencies, my proposed study is in Ecuador but I'm looking at Hispanic and Border Health in a global context, and learning from the phenomena of similar medically underserved communities, which can be applicable in minority and low-access communities globally, like on the US-Mexico border region. Prevention and control of disease was found with cervical cancer in Ecuador, as well as, identifying how these Hispanic/Latinx women were able to access services related to this disease. Quantitative health indicators for cervical cancer, such as previous access to healthcare, number of children, previous STD diagnosis, level of education, and birth control usage, were identified in this non-border community, but have been seen with similar minority populations on the US-Mexico border.
References


Figure 1

*Global Burden of Cervical Cancer Incidence and Mortality Rates*

*Note:* LMICs have higher cervical cancer incidence and mortality rates as can be seen with these countries shaded darker blues and reds, respectively. From: The Global Cancer Observatory. (2021). *Cervix uteri.*
Figure 2

Primary, Secondary, and Tertiary Prevention of Cervical Cancer

Note: There exist three types of prevention for cervical cancer, depending on the age of a woman. For the purposes of this particular study, secondary prevention was used. From: World Health Organization. (2020). Global strategy to accelerate the elimination of cervical cancer as a public health problem.
Figure 3

Screen-and-Treat VIA

Figure 4

4 Categories of Barriers

Note: 4 categories of barriers in accessing cervical cancer services. From: Graphic made by Pooja Tewari. Information pulled from: (Perehudof et al., 2020; Valencia, 2021; WHO, 2020; Liebermann et al., 2018; Nugus et al., 2018).
Figure 5

*Socioecological Framework in Public Health*

*Note:* 4 levels of barriers inputted into the CDC’s Socioecological framework. From: Pooja Tewari.
Table 1

**Key Statistics about Cervical Cancer in Ecuador**

*Note:* These cervical cancer statistics are specific to the county of Ecuador. They were compiled in 2019. From: HPV Information Centre. (2019). *Human papillomavirus and related diseases report -Ecuador*.

<table>
<thead>
<tr>
<th>Population</th>
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<tbody>
<tr>
<td>Women at risk for cervical cancer (Female population aged &gt;=15 years)</td>
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<table>
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<tr>
<th>Burden of cervical cancer and other HPV-related cancers</th>
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<tbody>
<tr>
<td>Annual number of cervical cancer cases</td>
<td>1,612</td>
<td></td>
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<tr>
<td>Annual number of cervical cancer deaths</td>
<td>838</td>
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<td>Crude incidence rates per 100,000 and year:</td>
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<tr>
<td>Cervical cancer</td>
<td>Male: 19.1</td>
<td>Female: 0.7</td>
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<td>Anal cancer</td>
<td>Male: 0.0-0.2</td>
<td>Female: 0.6-1.1</td>
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<td>Vulvar cancer</td>
<td>Male: 0.4-0.9</td>
<td>Female: 0.0-0.5</td>
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<th>Burden of cervical HPV infection</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence (%) of HPV 16 and/or HPV 18 among women with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal cytology</td>
<td>5.8†</td>
<td></td>
</tr>
<tr>
<td>Low-grade cervical lesions (LSIL/CIN-1)</td>
<td>34.5</td>
<td></td>
</tr>
<tr>
<td>High-grade cervical lesions (HSIL/CIN-2/CIN-3/CIS)</td>
<td>37.6</td>
<td></td>
</tr>
<tr>
<td>Cervical cancer</td>
<td>37.9</td>
<td></td>
</tr>
</tbody>
</table>

| Other factors contributing to cervical cancer |          |          |
| Smoking prevalence (%), women             | 3.5 [1.7-5.6] |
| Total fertility rate (live births per women) | 2.6    |
| Oral contraceptive use (% among women)    | 11.1     |
| HIV prevalence (%), adults (15-49 years)   | 0.3 [0.2 - 0.3] |

| Sexual behaviour |          |          |
| Percentage of 15-year-old who have had sexual intercourse (men/women) | - / - |
| Range of median age at first sexual intercourse (men/women) | - / 18.3-19.0 |

| Cervical screening practices and recommendations |          |          |
| Cervical cancer screening coverage, % (age and screening interval, reference) | 23.6% (All women aged 15-49 screened every 1y, ENSANUT 2012 Ecuador) |
| Screening ages (years) | 35-64      |
| Screening interval (years) or frequency of screens | 5 years    |

| HPV vaccine |          |          |
| HPV vaccine introduction |          |          |
| HPV vaccination programme | National program |
| Date of HPV vaccination routine immunization programme start | 2015       |

†Please see the specific sections for more information.
Table 2

Statistics about Cervical Cancer Incidence in Ecuador vs. South America vs. the World

Note: These statistics compare cervical cancer incidence in comparison to South America as a whole, and the World. Across the board, Ecuador has higher rates as compared to both South America and the World. From: HPV Information Centre. (2019). *Human papillomavirus and related diseases report -Ecuador.*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Ecuador</th>
<th>South America</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual number of new cancer cases</td>
<td>1,612</td>
<td>39,581</td>
<td>569,847</td>
</tr>
<tr>
<td>Crude incidence rate[8]</td>
<td>19.1</td>
<td>18.2</td>
<td>15.1</td>
</tr>
<tr>
<td>Age-standardized incidence rate[9]</td>
<td>17.8</td>
<td>15.2</td>
<td>13.1</td>
</tr>
<tr>
<td>Cumulative risk (%) at 75 years old[6]</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Data accessed on 05 Oct 2018.

[8] Cumulative risk (incidence) is the probability or risk of individuals getting from the disease during ages 0-74 years. For cancer, it is expressed as the % of new born children who would be expected to develop from a particular cancer before the age of 75 if they had the rates of cancer observed in the period in the absence of competing causes.

[6] Data sources:

Table 3

Statistics about Cervical Cancer in different cities in Ecuador

Table 4

Statistics about Cervical Cancer Mortality in Ecuador vs. South America vs. the World

Note: These statistics compare cervical cancer mortality in comparison to South America as a whole, and the World. Across the board, Ecuador has higher rates as compared to both South America and the World. From: HPV Information Centre. (2019). Human papillomavirus and related diseases report -Ecuador.
Table 5
Measures as Categorized into the Socioecological Framework

Note: These four tables illustrate how the measures for this study fit into the socioecological framework in public health. All the measures are able to fit into the individual level, relationship level, and societal level. In this study, there were no variables that fit into the community level. From: Pooja Tewari

<table>
<thead>
<tr>
<th>Individual Variables</th>
<th>Question</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIA Result</td>
<td>Question C3 of “VIA Results”</td>
<td>1: Not done; 2: Positive; 3: Negative; 4: Suspicious for cancer</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Question B3 “What is your ethnicity”?</td>
<td>1: Mestizo; 2: African; 3: Indigenous; 4: Other</td>
</tr>
<tr>
<td>Age</td>
<td>Question A5 “Date of Birth”</td>
<td>Written in the format of “dd/mm/yy”</td>
</tr>
<tr>
<td>Education</td>
<td>Question B2 “What is the highest level of education you have completed”</td>
<td>1: None; 2: Elementary School; 3: High School; 4: College or higher; 5: Other</td>
</tr>
<tr>
<td>Smoking Status</td>
<td>Question B10a “Have you ever smoked in your life”</td>
<td>B10a: 1: Yes; 2: No</td>
</tr>
<tr>
<td></td>
<td>Question B10b “If the answer was yes, do you currently smoke”</td>
<td>B10b: 1: Yes; 2: No</td>
</tr>
<tr>
<td>Number of Children</td>
<td>Question B7 “How many children do you have”</td>
<td>A number as an answer in the format of XX</td>
</tr>
<tr>
<td>Oral Contraceptive Use</td>
<td>Question B12a “Have you ever used birth control” with answers of “</td>
<td>Q12a: 1: Yes; 2: No</td>
</tr>
<tr>
<td>Socioeconomic status (SES)</td>
<td>Question B12b “You are currently using birth control methods”</td>
<td>Q12b: 1: Yes; 2: No</td>
</tr>
<tr>
<td></td>
<td>Question B12c “If yes, what methods are you currently using”</td>
<td>Q12c: 1: Condoms; 2: Sterilization; 3: Injection; 4: Family planning natural; 5: Contraceptive pill; 6: Other</td>
</tr>
<tr>
<td></td>
<td>Question B11a “Do you have formal employment?”</td>
<td>1: Yes; 2: No</td>
</tr>
<tr>
<td>Relationship Variables</td>
<td>Question</td>
<td>Measure</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Age of first sexual intercourse</td>
<td>Question B8 “How old were you the first time you had sexual intercourse”</td>
<td>An answer of age in double digits XX</td>
</tr>
<tr>
<td>Number of Sexual Partners</td>
<td>Question B9 “How many sexual partners have you had in your life”</td>
<td>A number as an answer in the format of XX</td>
</tr>
<tr>
<td>Previous Postive Test for an STD</td>
<td>Question 5b “If yes, you have been told that you have a positive result”</td>
<td>1: Yes, positive result; 2: No positive result</td>
</tr>
<tr>
<td></td>
<td>(in response to -&gt; Question 5a “Have you ever had a test for sexually</td>
<td></td>
</tr>
<tr>
<td></td>
<td>transmitted diseases”)</td>
<td></td>
</tr>
<tr>
<td>Previous Diagnosis of a STD</td>
<td>Question 5c “If yes, what disease have you been told you have”</td>
<td>1: HIV; 2: syphilis; 3: chlamydia; 4: gonorrhea; 5: HPV; 6: genital</td>
</tr>
<tr>
<td></td>
<td>(in response to -&gt; Question 5b of “Have you every had a test for sexually</td>
<td>warts; 7: herpes; 8: Other</td>
</tr>
<tr>
<td></td>
<td>transmitted diseases”)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Community Variables</th>
<th>Question</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Societal Variables</th>
<th>Question</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel to healthcare facility</td>
<td>Question A8 of “How long did it take you to get there from when you left</td>
<td>A8- Collected in minutes</td>
</tr>
<tr>
<td></td>
<td>home and until the moment you arrived at the clinic”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question A9 of “What means of transportation did you take to get to the</td>
<td>A9-1: Car; 2: Clinic bus; 3: On foot; 4: Other</td>
</tr>
<tr>
<td></td>
<td>clinic today:”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question A14 “How many times have you come to this clinic or another</td>
<td>A number as an answer in the format of XX</td>
</tr>
<tr>
<td></td>
<td>clinic for care in the last 12 months”</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6

Proposed Statistical Analysis Plan

Note: This chart is the proposed statistical analyses plan (for both parametric and non-parametric tests) for all the variables. In the outcome measures and the factors of interest columns, the numbers listed in paratheses correspond to the question pulled from the data coding guide. From: Pooja Tewari.
Table 7

*Screening characteristics of Continuous Variables*

*Note:* This table is the descriptive analyses for the continuous variables in this study. From: Pooja Tewari.

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (N=934)</td>
<td>41.09</td>
<td>7.89</td>
</tr>
<tr>
<td>Number of children (N=929)</td>
<td>3.83</td>
<td>7.28</td>
</tr>
<tr>
<td>Age of first sexual encounter (N=933)</td>
<td>19.49</td>
<td>11.21</td>
</tr>
<tr>
<td>Number of sexual partners (N=924)</td>
<td>1.67</td>
<td>1.17</td>
</tr>
<tr>
<td>Time Taken to Clinic (N=932)</td>
<td>30.70</td>
<td>32.63</td>
</tr>
<tr>
<td>Past 12-month visits to a healthcare facility (N=659)</td>
<td>2.67</td>
<td>2.18</td>
</tr>
</tbody>
</table>
### Table 8

**Screening characteristics of Categorical Variables**

*Note: This table is the descriptive analyses for the selected categorical variables in this study. From: Pooja Tewari.*

<table>
<thead>
<tr>
<th><strong>Variable</strong></th>
<th><strong>%</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method of Transportation (N=932)</strong></td>
<td></td>
</tr>
<tr>
<td>Car</td>
<td>47.4</td>
</tr>
<tr>
<td>By foot</td>
<td>31.5</td>
</tr>
<tr>
<td>Public Bus</td>
<td>15.0</td>
</tr>
<tr>
<td>Clinic Bus</td>
<td>4.8</td>
</tr>
<tr>
<td>Other (Taxi, Motorcycle)</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Highest level of education completed (N=933)</strong></td>
<td></td>
</tr>
<tr>
<td>Elementary School</td>
<td>46.4</td>
</tr>
<tr>
<td>High School</td>
<td>29.7</td>
</tr>
<tr>
<td>College or Higher</td>
<td>13.2</td>
</tr>
<tr>
<td>None</td>
<td>10.3</td>
</tr>
<tr>
<td><strong>Ethnicity (N=901)</strong></td>
<td></td>
</tr>
<tr>
<td>Mestiza</td>
<td>56.0</td>
</tr>
<tr>
<td>Indigenous</td>
<td>42.2</td>
</tr>
<tr>
<td>African</td>
<td>1.7</td>
</tr>
<tr>
<td>Other</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Previous STD Diagnosis (N=48)</strong></td>
<td></td>
</tr>
<tr>
<td>HPV</td>
<td>79.2</td>
</tr>
<tr>
<td>Other</td>
<td>14.6</td>
</tr>
<tr>
<td>Syphilis</td>
<td>4.2</td>
</tr>
<tr>
<td>Herpes</td>
<td>2.1</td>
</tr>
<tr>
<td><strong>Formal employment (N=905)</strong></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>70.8</td>
</tr>
<tr>
<td>Yes</td>
<td>29.2</td>
</tr>
<tr>
<td><strong>Ever Used Birth Control (N=932)</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>71.1</td>
</tr>
<tr>
<td>No</td>
<td>28.9</td>
</tr>
<tr>
<td><strong>Type of Current Birth Control Method (N=428)</strong></td>
<td></td>
</tr>
<tr>
<td>Tubal Ligation</td>
<td>36.0</td>
</tr>
<tr>
<td>Injection</td>
<td>18.2</td>
</tr>
<tr>
<td>Implant</td>
<td>12.9</td>
</tr>
<tr>
<td>Condoms</td>
<td>7.0</td>
</tr>
<tr>
<td>Family Planning</td>
<td>6.8</td>
</tr>
<tr>
<td>Contraceptive Pill</td>
<td>6.5</td>
</tr>
<tr>
<td>Sterilization</td>
<td>6.5</td>
</tr>
<tr>
<td>Other</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>VIA Result (N=933)</strong></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>89.0</td>
</tr>
<tr>
<td>Positive</td>
<td>8.9</td>
</tr>
<tr>
<td>Suspicious for Cancer</td>
<td>1.3</td>
</tr>
<tr>
<td>Not Done</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Vita

Pooja Tewari received her Bachelor of Science in Biological Sciences and her Bachelor of Science in Health & Society from Southern Methodist University in May 2020. She then continued her education and received her Master of Public Health Sciences with a concentration in Hispanic and Border Health from the University of Texas at El Paso in August 2022. During her Graduate School career, Pooja served as a Graduate Research Assistant for UTEP’s College of Health Sciences, in the Department of Public Health Sciences. She worked closely with Dr. Thenral Mangadu since Fall 2020 on projects related to global health. She also worked with Dr. Gabriel Ibarra during Spring 2022 on launching a project about environmental workplace stressors on Central American migrants who currently live in Ciudad Juarez. For her Master of Public Health thesis, Pooja worked with her faculty mentor Dr. Mangadu from the Department of Public Health sciences.

Post-graduation from the MPH, Pooja intends to continue work in the field of public health, specifically in global/international health. After entering the workforce for a few years, she intends to further her education and pursue a doctorate degree in the field. Pooja is grateful for the mentorship she received not only from Dr. Mangadu but also from her professors like Dr. Jeannie Concha, for their advice both in-and-out of the classroom. Pooja is very thankful for her time at UTEP, as it, and her MPH cohort, will always hold a place in her heart. If you need to contact Pooja, you may email her at poojtewari@gmail.com.