

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

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PREVIEW

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.

PREVIEW

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by

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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 FIBUSPAM 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 $H\text{-value}=17.02$ $df=3$, $p=0.001$.

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

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PREVIEW

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 it is 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 to the increase in 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 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 instability, 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