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Human papillomavirus vaccination in Brazil: Universal health coverage or discriminatory practice?

By

Mariana Volpini Gattegno

Master of Public Health

Epidemiology

_____

Robert A. Bednarczyk, PhD

Committee Chair

_____

Dabney P. Evans, PhD, MPH

Committee Member

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Mariana Volpini Gattegno

Bachelor of Science

University of Mount Olive

2012

Thesis Committee Chair:

Robert A. Bednarczyk, PhD

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ABSTRACT

Human papillomavirus vaccination in Brazil: Universal health coverage or discriminatory practice?

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Mariana Volpini Gattegno

In 1988, Brazil's Unified Health System (SUS) established a right to health in the constitution granting all Brazilians universal access to health care. Brazil introduced human papillomavirus (HPV) vaccination into its vaccination program in 2014. Despite the universal nature of SUS, HPV vaccination was limited to females aged 9-13. The goal of this study was to evaluate parental knowledge and attitudes regarding HPV vaccination exclusion criteria. Data were collected from parents with children aged 9-17 in the municipality of Mauá (São Paulo, Brazil) through questionnaires. We documented high knowledge and positive parental attitudes regarding HPV vaccination safety and efficacy among the low-income population. Additionally, the majority of parents supported the inclusion of males and females over 13 into the vaccination program, and the demand for non-discriminatory HPV vaccination is high among parents. Exclusion of these populations violates the basic principle of non-discrimination as a part of universal health coverage (UHC), as well as Brazil's constitution. Worldwide, approximately 100 million individuals fall into poverty each year due to health care costs. Excluding these individuals from HPV vaccination perpetuates inequality in a health system that was created to provide UHC, as the majority of individuals cannot afford the cost of HPV vaccination.

Keywords: *Brazil, universal health coverage, human papillomavirus, vaccination, adolescent health, parental perceptions, human rights*

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TABLE OF CONTENTS

ACRONYM LIST

UHC	Universal Health Coverage
BRL	Brazilian Real
HPV	Human papillomavirus
PNI	Programa Nacional de Imunizações (National Immunization Program)
MOH	Ministry of Health
SUS	Sistema Único da Saúde (Unified Health System)
FMABC	Faculdade de Medicina do ABC (ABC Medical School)
LMIC	Low and middle income countries

CHAPTER 1: BACKGROUND

Introduction

Every year, approximately 100 million individuals around the world fall into poverty due to out-of-pocket (OOP) expenses because of health services (1). The goal of universal health coverage (UHC) is to implement a system in which all individuals can obtain health services without experiencing financial hardship (2). Worldwide, 58 countries have UHC that is considered all-inclusive (greater than 90% of the population covered), with coverage and quality differing between high-, middle-, and low-income countries (2). As with any system, challenges exist, primarily surrounding the healthcare costs and ineffective delivery of care.

After a drastic reform, Brazil's Unified Health System (SUS) established a Right to Health in 1988, granting all Brazilian citizens universal access to healthcare (3). Since then, financial burden due to health services has decreased in Brazil (4). In 2014, Brazil introduced the human papillomavirus (HPV) vaccine into the *Programa Nacional de Imunização* (National Immunization Program; PNI). Despite the universal nature of SUS, this program was constrictively limited to females between the ages of 9 and 13, although WHO's recommendation for routine HPV vaccination of females reaches up age 26 and for males up to age 21 (5). This exclusion violates the basic principle of UHC, as well as Brazil's constitution, and puts a large group of individuals at risk of contracting HPV.

Literature Review

Databases such as ScienceDirect, PubMed, WHO publications, and Google Scholar were searched for literature about universal health coverage, HPV and HPV vaccine, UHC in limited resource settings, UHC policies, and literature identifying

countries with successful UHC. Additionally, literature pertaining specifically to Brazil was gathered with regard to UHC, HPV vaccination, health care policies, and coverage of health services.

UHC and Human Rights

Article 12 of the International Covenant on Economic Social and Cultural Rights (1966) states that every person has the right to health (6). This includes protection of the wellbeing of children and efforts to reduce infant mortality, improving environmental and industrial hygiene, preventing diseases, and creating conditions to ensure equal and universal access to healthcare (7). UHC focuses primarily on achieving wide coverage of health services for all individuals with the protection from financial burden (2).

In 1948, the WHO Constitution declared health a fundamental human right, launching a change in healthcare and creating a base for universal coverage, and in 1978, the "Health for All" proclamation highlighted UHC as one of four key pillars of primary health care (8, 9). The right to health is comprehensive, and it should include efforts to improve education, housing, sanitation and potable water, build equitable gender and power relations, ensure adequate immunization against infectious diseases, and address specific health issues such as substance abuse and sexually transmitted diseases (10).

Financing UHC

There are many forms of international healthcare systems and different ways to finance UHC (11). Each requires trade-offs. Most commonly, health care systems are funded primarily through tax revenue (2). Initially, the country needs to develop policies and legal commitments to create a well-functioning UHC system (11). Pooled funds consisting of taxes and co-payments need to be organized, and a plan for dispersing said

funds must be implemented. These funds can and should be used to extend coverage to those who were previously excluded from health coverage (12). Additionally, mechanisms must be put in place to ensure that the country does not take on an unbearable financial burden. If the proper steps are not taken, the quality of healthcare will diminish and undo UHC's core policy of providing quality healthcare at a low cost (8).

To finance UHC, there must be a balance between private and public sector-focused care. Public financing, compared to private financing, reflects the true objective of UHC – to provide medical care based on need, rather than the individual's ability to pay for the services. If the country refuses a legal commitment in the beginning, the gradual expansion will leave individuals without coverage and vulnerable for an extended period of time (2).

To define whether residents contribute to healthcare costs through co-payments or taxes, various factors must be considered. The most pertinent of these considerations are the ability of the patient to pay copays and, if cost-free treatment is chosen, the source of the funds to cover these services. Moreover, mechanisms must be put in place to ensure that the country does not take on an unbearable financial burden. If the proper steps are not taken, the quality of healthcare will diminish and undo UHC's core policy of providing quality healthcare at a low cost (8).

As with any system, challenges exist, primarily surrounding the healthcare costs and ineffective delivery of care. Regardless of how it is being paid for, healthcare is costly to provide. However, the distribution of funds to cover these costs can prove to be successful if the country makes a commitment to the transition to UHC. Extension of

services requires reforms on all spectrums of the government in order to make funds available for expansion.

UHC Internationally

Worldwide, 75 countries have legislation mandating universal access to health services; yet, only 58 of these countries have health systems that meet the criteria to be considered "all-inclusive". UHC is considered all-inclusive when greater than 90% of the population has access to skilled birth attendance and insurance coverage, which serve as representative properties of UHC (2). For decades, high-income countries have helped their citizens to obtain health services, leading the world in the UHC revolution (13). However, this does not come easily. Countries such as the United Kingdom, Canada, and Germany struggled to sustain quality and cost-effective health services as the world's economy fell into recession, and the demand for quality healthcare continued to increase (13). The routes to UHC are very different when considering high-income compared to low- and middle-income countries (LMIC).

Challenges of UHC

While the implementation of UHC is already a challenge, this feat becomes particularly difficult in LMICs due to financial restrictions and governmental structure. Thailand, Mexico, and Brazil have served as models for developing countries striving for UHC (13). These countries are not embarking on this journey alone, but are supported by WHO and other international partners. In 2014, a global coalition of over 500 leading health and development organizations came together to demand further efforts to globalize UHC. This came shortly after over 70 countries requested support from WHO in achieving UHC as set forward by the UN General Assembly in 2010 (14).

Striving for worldwide universal access to healthcare as a human right has been an ongoing battle for decades. There are two primary challenges affecting the potential to move to UHC: healthcare costs are unmanageably high and the country's healthcare system is ineffective and cannot deliver appropriate care (2). Additionally, a country's government plays a very important role in the transition to all-inclusive care, and the implementation of UHC is a highly politicized process – leading to innumerable difficulties (15). A well-functioning health and state system is instrumental to the implementation and maintenance of UHC in LMICs.

Brazil

Brazil boasts the 6th largest population in the world, with approximately 204 million racially and ethnically diverse residents consisting of approximately 48% whites, 43% "mulatto" (mixed black and white), 8% black, and 1% Asian and indigenous. Composed of 26 states and 1 federal district, Brazil is the fifth largest country in the world and shares a border with 10 other South American countries (16). Approximately 9.7% of Brazil's USD 2.25 trillion GDP goes towards healthcare costs, placing it at 31st in health expenditure in the world (16, 17).

Socioeconomic Classes in Brazil

The Brazilian Institute of Geography and Economics (IBGE) has developed socioeconomic status (SES) classifications for Brazilians based on various indicators. These classes, ranging from A-E with A representing the highest level and E the lowest, can be applied to income, education level and occupation, among other SES indicators (18).

More often than not, individuals in classes D and E are located in the favelas ("slums") of Brazil where running water and electricity are luxuries, rather than the baseline requirement. As of 2014, approximately 7.4% of Brazilians fall into the lowest classification (class E); however, this percentage has be steadily decreasing since 2009 as a result of the growth of the new middle class (4, 18).

Although geographic region plays an important role for the predominance of certain classes, it is in the densely populated cities such as São Paulo, Rio de Janeiro, and Brasilia, where all five classes reside, that the social inequality is most visible.

Healthcare in Brazil

Resulting from a major political reform, SUS established a Right to Health under the 1988 Constitution, which granted universal and equal access to health services to all Brazilians (3). SUS provides coverage to about 75% of the population through over 6,000 hospital facilities and more than 60,000 outpatient centers, reaching over 5,200 municipalities. This system grants Brazilians free access to medication, health technology, health checks, immunizations, and treatments, as well as performing epidemiologic surveillance and endemic disease control (19).

To provide adequate care to such a large population, SUS maintains community-based health posts that are all-inclusive medical units, hosting a variety of health services. Each health post is assigned to and responsible for specific areas, much like school districts. Care provided through SUS' health posts includes family health, such as general practitioners and pediatricians, oral health, pharmacy services, first aid, and vaccination (19). The Family Health Program, created in 1994, ensures that teams consisting of a physician, nurse, medical assistant, and four to six community agents will be on hand to

deliver care in each of these health posts and the adjacent community (20). Along with health posts, SUS also sponsors PNI, which establishes schedules for all vaccines offered by the Brazilian health system. In total, the PNI is responsible for scheduling and administering 26 different vaccines such as the influenza vaccine and the HPV vaccine (21).

Along with health posts, SUS also sponsors the Programa Nacional de Imunizações (National Immunization Program; PNI), which establishes schedules for all vaccines offered by the Brazilian health system. In total, the PNI is responsible for scheduling and administering 26 different vaccines such as the influenza shot and the HPV vaccine (21).

Private health insurance is also available to individuals that would like to pay for a supplementary health plan. These plans can be purchased individually or as a benefit through the individual's employer. The system is extensive and provides coverage to approximately 25% of the population. Individuals with private health insurance may also access healthcare through their SUS privileges; however, individuals with only SUS health plans may not have access to the benefits provided by the private sector unless the cost is paid for completely out of pocket (19).

SUS is funded through taxes on every level of government: federal, state, and municipal. The federal government distributes funds to the states, while the municipalities receive funding from both the state and federal governments (20). The government's commitment to funding SUS has ensured the country's success in healthcare.

Human Papillomavirus

Human papillomavirus (HPV) is a sexually transmitted infection with more than 150 different strains associated with genital warts and cancers of the vagina, penis, anus, vulva, cervix and oropharynx (22, 23). Affecting both males and females alike, HPV is the most common sexually transmitted infection in the United States and Brazil, and prevalence globally is close to 12% (23, 24). Infection by HPV is so common that an estimated 14 million individuals will become newly infected this year, and nearly all sexually active men and women will be infected at some point in their lifetime (25). Over 40 types of HPV affect the genital areas, and are divided into two subcategories: low-risk and high-risk. Low-risk HPV types generally cause genital warts, while high-risk types typically lead to different types of cancers (26). Cervical cancer, the most common outcome of high-risk HPV types, is the fourth most prevalent cancer among females worldwide (23). Death occurs in approximately 7% of the individuals diagnosed, and over 85% of these deaths occur in developing countries (27, 28).

In Brazil, cervical cancer is the second most common cancer among women, and mortality is exceptionally high in the country. Death occurs in approximately 8,400 of those diagnosed, making cervical cancer the fourth most common cause of cancer-related death among women in Brazil (29, 30). Cervical cancer is usually diagnosed through an abnormal Pap test; however, symptoms associated with cervical cancer usually only manifest once the disease is advanced, making the diagnosis incredibly difficult without regular screening (26). HPV types 16 and 18, the two main strains of HPV responsible for approximately 70% of cervical cancer cases can be prevented through vaccination (23).

HPV Vaccine

The HPV vaccine, first developed in 2006, is intended to protect from infection by the virus, and WHO recommends HPV vaccination to be part of routine vaccination in all countries. Currently, there are three available HPV vaccines: HPV2 (Cevarix), HPV4 (Gardasil) and Gardasil-9. Cervarix protects against HPV types 16 and 18, Garadasil against HPV types 6, 11, 16, and 18, Gardasil-9 against HPV types 6, 11, 16, 18, 31, 33, 45, 52, 58. Regardless of the type of HPV vaccine, all three were directed toward oncogenic genotypes. The Gardasil and Gardasil-9 are recommended for both males (ages 9-21) and females (ages 9-26) in the United States, while the Cevarix is only recommended for females (22).

Given the prophylactic nature of these vaccines, the recommended age for vaccination is between 9 and 13, prior to sexual debut; although, males can be routinely vaccinated up to age 21 and females up to age 26 (25). Since its availability in 2006, over 170 million doses have been administered worldwide. Infections by the HPV types included in the vaccine have declined significantly, and studies have shown a reduction in precancerous cervical cancer lesions in vaccinated women (31).

WHO recommends HPV vaccines to be part of routine vaccination in all countries, including the United States. Given the prophylactic nature of these vaccines, the recommended age for vaccination is between 9 and 13, prior to exposure to the virus; although, males can be vaccinated up to 21 years of age and females up to 26 years of age (25, 31, 32). In 2014, 58 countries had introduced the HPV vaccine into their national immunization program (2, 13).

In Brazil, the vaccination campaign that began in 2014 has shown to be incredibly successful with some states nearing 100% coverage of the eligible population. Brazil has chosen to administer the quadrivalent vaccine Gardasil at 0, 6, and 60 months, and SUS covers the vaccine at no cost for females aged 9-13. Merck currently supplies the HPV vaccine; however, the country will begin producing its own vaccine in 2019, after a 5-year contract is over with the supplier. Brazil regularly produces its medications domestically, such as antiretroviral medications for HIV positive individuals. Given Brazil's willingness to negotiate, it pays one of the lowest global prices for the HPV vaccine over the 5-year agreement with Merck (33).

Since HPV vaccines became available in 2006, over 86 million doses have been administered worldwide (34). Infections by the HPV types included in the vaccine have declined significantly, and studies have shown a reduction in precancerous cervical cancer lesions in vaccinated women (31).

Expansion of Health Services in Brazil

Since the health reform in 1988, Brazil has consistently expanded and improved its healthcare system through a series of initiatives. An example of one such undertaking is the creation and implementation of the Family Health Program, which, as mentioned above, helped address chronic disease trends and led to a significant decline in unnecessary hospitalizations (20). Brazil's initiative is notable particularly with their approach in improving primary health care and delegating policy interventions, such as excise taxes on tobacco and alcohol, restrictions and bans on smoking locations, strategic action plans for obesity and diabetes, and national vaccination campaigns (20).

Most recently, Brazil's PNI implemented a school-based vaccination program that provides nationwide immunization against HPV for females aged 9-13, free of cost to the eligible individual (35). Brazil chose to administer the quadrivalent vaccine, Gardasil, at 0, 6, and 60 months, and country-wide vaccination began in March 2014. The vaccination campaign has shown to be incredibly successful with some states nearing 100% coverage of the eligible population (21).

This expansion of services was revolutionary in the battle against cervical cancer in Brazil; however this program was constrictively limited to females between the designated age range. The exclusion of females over 13 years and all males raises the question of what effect the expansion of services has had on the general population, and this effect was explored through a study in the municipality of Mauá.

Municipality of Mauá

The project site, *Unidade de Atencão Básica de Saúde* (primary health posts; UBS) Kennedy, is located in the city of Mauá, a municipality in the state of São Paulo on Brazil's east coast. Mauá holds the 11th largest population in the state of São Paulo and consists of a diverse population (36). The Public Health Department, through the over 45 UBS clinics in the city, aims to promote health through the prioritization of preventative care and actions, and the dissemination of information to the public. Despite public outreach efforts, large disparities exist, particularly concerning income and access to healthcare. UBS Kennedy operates with four Family Health teams, consisting of a physician, a nurse, a medical assistant, and six community agents. Together, all four physician teams see approximately 120 patients per day from various backgrounds and socioeconomic statuses.

Vaccination Success

According to the PNI Database, the number of eligible girls in the municipality who received the first and second dose of the HPV vaccine in 2014 was 10,955 (102.6%) and 10,680 (70.2%), respectively. The uptake surpassing 100% for 2014's first dose is due to the municipality's original estimate of the number of eligible girls not accounting for those that were unregistered in the SUS system. In 2015, 77.61% (8,188) of the eligible population of girls in the municipality received the first dose of the vaccine, while 6,119 (56.73%) girls received the second dose (21).

Overall, the first and second doses of the vaccine after PNI implementation (March and September 2014) had incredibly high coverage rates (85% uptake) throughout the country, suggesting success for the program (21). However, the current guidelines limit access for the vaccine to females within the designated age range, and even girls within the appropriate age range are falling through the cracks. Additionally, the exclusion of males from vaccination through SUS is troubling as males are the primary carriers of HPV. Proper vaccination of males can contribute significantly to decreased transmission. Approximately 50% of males between the age of 18 and 70 have some form of the virus, suggesting vaccination for males is imperative for the well-being of both populations (37).

CHAPTER 2: MANUSCRIPT

Human papillomavirus vaccination in Brazil: Universal health coverage or discriminatory practice?

Mariana V. Gattegno, Maria A. Vertamatti MD, MSc, Robert A. Bednarczyk PhD, Dabney P. Evans PhD, MPH

Mariana Gattegno, is an MPH candidate at the Rollins School of Public Health, Emory University, Atlanta, GA, USA

Maria A. Vertamatti, MD, MSc, is an Assistant professor, physician, and researcher at the Instituto Idéia Fértil de Saúde Reprodutiva in the Department of Reproductive Health at the Faculdade de Medicina do ABC – School of Medicine, Santo André, SP, BRA

Robert A. Bednarczyk, PhD is an Assistant Professor at the Hubert Department of Global Health and Department of Epidemiology at the Rollins School of Public Health and Winship Cancer Institute, Emory University, Atlanta, USA

Dabney P. Evans, PhD, MPH, is Director of the Institute of Human Rights and an Assistant Professor at the Hubert Department of Global Health and Department of Behavioral Sciences and Health Education at the Rollins School of Public Health, Emory University, Atlanta, GA, USA.

Introduction

Annually, approximately 100 million individuals worldwide fall into poverty due to out-of-pocket (OOP) expenses from health services (1). The goal of universal health coverage (UHC) is to implement a system whereby all individuals can obtain health services without experiencing financial hardship (2). In 1988, Brazil's Constitution established a right to health, granting all Brazilian citizens universal access to health care (3). Since then, financial burden due to health services has decreased (4). In 2014, Brazil introduced the human papillomavirus (HPV) vaccine into the *Programa Nacional de Imunização* (National Immunization Program; PNI). Despite the universal nature of the Unified Health System (SUS), this program was limited to females between the ages of 9 and 13, despite the World Health Organization's (WHO) recommendation for routine HPV vaccination of females to age 26 and for males to age 21 (5). This exclusion violates the basic human rights principle of non-discrimination under riding UHC, as well as Brazil's constitution, and puts a large group of individuals at risk of contracting HPV.

In 1948, the WHO Constitution first declared health a fundamental human right creating a base for universal coverage (9). Article 12 of the International Covenant on Economic Social and Cultural Rights (ICESCR) (1966) further enumerated the right (6). The right to health is comprehensive and includes protection of the wellbeing of children, efforts to adequately immunize against infectious diseases, address specific health issues such as sexually transmitted diseases, and the creation of conditions to ensure equal and universal access to health care (10, 38).

Striving for worldwide universal access to health care as a human right has been an ongoing battle, with two primary challenges affecting the potential to move to UHC:

unmanageably high health care costs and ineffective country-level health care systems (2). Additionally, a country's government plays an important role in the transition to all-inclusive care, and the implementation of UHC is a highly politicized process–leading to innumerable difficulties (15). A well-functioning health and state system is instrumental to implementing and maintaining UHC in LMICs. Thailand, Mexico, and Brazil have served as models for developing countries working toward UHC (13).

Brazil boasts the sixth largest population in the world, with approximately 204 million racially and ethnically diverse residents, living in 26 states and 1 federal district. Approximately 9.7% of its US$2.25 trillion GDP goes toward health care costs, placing it 31st in health expenditure in the world (17, 39). Social stratification in Brazil shows a disproportionate gap between the upper and lower classes, with very small working and middle classes (40). As of 2014, approximately 7.4% of Brazilians had a monthly income less than US$263 (4).

SUS provides coverage to about 75% of the population through over 6,000 hospital facilities and more than 60,000 outpatient centers, reaching over 5,200 municipalities. This system grants Brazilians free access to medication, health technology, health checks, immunizations, and treatments, and also performs epidemiologic surveillance and endemic disease control (19). To provide adequate care to such a large population, SUS maintains community-based health posts that are all-inclusive medical units, which include family health, oral health, pharmacy services, first aid, and vaccination (19). Each health post is responsible for specific geographic areas. The Family Health Program, created in 1994, ensures that teams consisting of a physician, nurse, medical assistant, and four to six community agents will be on hand to

deliver care in each health post and adjacent community (20). Along with health posts, SUS also sponsors the PNI, which establishes schedules for all vaccines offered by the Brazilian health system. In total, the PNI is responsible for scheduling and administering 26 different vaccines, including the HPV vaccine (21).

HPV is a sexually transmitted infection with more than 150 different strains associated with genital warts and cancers of the vagina, penis, anus, vulva, cervix and oropharynx (22). Affecting both males and females alike, HPV is the most common sexually transmitted infection in Brazil, and prevalence globally is close to 12% (24, 30). Infection by HPV is so common that nearly all sexually active men and women will be infected at some point in their lifetime (5). Over 40 types of HPV affect the genital areas, and are divided into two subcategories: low-risk and high-risk. Low-risk HPV types can cause genital warts, while high-risk types can lead to development of cancers (26). Cervical cancer, the most common outcome of high-risk HPV types, is the fourth most prevalent cancer among females worldwide (30). Death occurs in approximately 7% of the individuals diagnosed, and over 85% of these deaths occur in developing countries (27, 28).

In Brazil, cervical cancer is the second most common cancer among women, and mortality is exceptionally high in the country. Approximately 8,400 women in Brazil die from cervical cancer annually, making it the fourth most common cause of cancer-related death among Brazilian women (29, 30). Infection with HPV types 16 and 18, which are responsible for approximately 70% of cervical cancer cases, can be prevented through vaccination (30).

The HPV vaccine, first developed in 2006, prevents infection by the most pathogenic virus types, and WHO recommends HPV vaccination to be part of routine vaccination in all countries. Given the prophylactic nature of these vaccines, the recommended age for vaccination is between 9 and 13, prior to sexual debut; additionally, males can be routinely vaccinated up to age 21 and females up to age 26 (5). Between 2006 and 2014, over 170 million HPV vaccine doses have been administered worldwide. Infections by the HPV types included in the vaccine have declined significantly, and studies have shown a reduction in precancerous cervical cancer lesions in vaccinated women (41).

Since the 1988 health reform, Brazil has consistently expanded and improved its health care system. Brazil's initiative is notable particularly with their approach in improving primary health care and delegating policy interventions (20). Most recently, Brazil's PNI implemented a school-based vaccination program that provides nationwide immunization against HPV for females aged 9-13, free of cost to the eligible individual (35). Brazil chose to administer the quadrivalent vaccine, Gardasil, at 0, 6, and 60 months, and countrywide vaccination began in March 2014. The vaccination campaign has shown to be incredibly successful with some states nearing 100% coverage of the eligible population for the first dose (21).

However, this program was constrictively limited to females within the designated age range. The exclusion of females over 13 years and all males raises the question of what effect the expansion of services has had on the general population, and this effect was explored through a study in the municipality of Mauá.

The project site, *Unidade de Atencão Básica de Saúde* (primary health post; UBS) Kennedy, is located in the city of Mauá, a municipality in the state of São Paulo on Brazil's east coast (36). Despite public outreach efforts, large disparities exist in this community, particularly concerning income and access to health care. UBS Kennedy operates with four Family Health teams, which see approximately 120 patients per day from various backgrounds and socioeconomic statuses.

According to the PNI Database, the percentage of eligible girls in the municipality who received the first and second dose of the HPV vaccine in 2014 reached 85%. In 2015, 77.61% of the eligible population of girls in the municipality received the first dose of the vaccine, while 56.73% girls received the second dose(21).

While first and second dose HPV vaccine coverage is high throughout Brazil, it is not at optimal levels, and girls within the appropriate age range are falling through the cracks (21). Excluding males from vaccination through SUS is troubling as males are the primary carriers of HPV. Proper vaccination of males can contribute significantly to decreased transmission. Approximately 50% of males in Brazil between the ages of 18 and 70 have some form of the virus, suggesting vaccination for males is imperative for the well-being of both populations (37).

The goal of this study is to address the human rights issues associated with the exclusions imposed by the Brazilian government for HPV vaccination. Parents and guardians (hereafter, "parent") of children aged 9-17 were surveyed in the municipality of Mauá to understand public knowledge and attitudes regarding HPV vaccination for these excluded populations. Universal and equal access should include all eligible

individuals in the population, and the current vaccination policy does not support the basic components UHC and the Brazilian constitution are based on.

Methods

In this study of parents of adolescents aged 9-17 years regarding HPV vaccination and its eligibility guidelines in Brazil, we focused on the analysis of gaps in knowledge and parental perceptions and attitudes regarding HPV, using an original survey instrument. The lower age range was selected following SUS guidelines recommending HPV vaccination for girls aged 9-13 years, while the upper age range was selected due to parents still being legally responsible for their children until age 18. Participants were recruited in health posts in the city of Mauá.

The survey instrument was developed after an extensive review of current related studies through literature searches for: parental decision making, knowledge and attitudes, vaccination implementation, and parental acceptance, all related to HPV vaccination implementation and analysis. Three articles were selected for use in adapting survey questions (42, 43, 44). The instrument contained 29 quantitative questions and two free response questions, grouped into five sections. Original questions, as well as questions adapted from existing surveys, comprised the survey.

The first section (demographics) consisted of questions about the participant (age, sex, marital status, income), as well as their child's age and sex, how many doses of the HPV vaccine the child received, and the location (school or health post) where the vaccine was administered. The second section (HPV and HPV vaccine knowledge) examined whether the participant had knowledge about HPV transmission, and who is presently eligible to receive the HPV vaccine through SUS. The third section (attitudes)

utilized Likert scale measurement, with parents specifying their level of agreement regarding the safety of the vaccine, the importance of vaccinating adolescents, and whether adult women and men should get the vaccine. The fourth section (excluded populations), included questions specifically about females above age 13 and all males, who are currently ineligible for vaccination through SUS. Additionally, this section included questions on whether the parent would pay OOP for their child to be vaccinated, and any apprehensions surrounding the HPV vaccine. The last section (open-ended questions) provided the participant with the opportunity to express ideas for changes in the vaccination policy, and to discuss their opinions as to why there are excluded populations in the vaccination policy. These date were not included in this analysis.

Of approximately 100 patients who visit the clinic per day, our observations showed that about 10 to 15 individuals fit the criteria for participation in the study. During the data collection period, approximately 8 to 10 of these were captured for interviewing per day. Individuals were approached by the researcher as they entered the health post and invited to participate in the study. If the individual fit the criteria, the researcher would briefly explain the study and if the individual provided consent, data collection began. Due to low literacy levels in the population, the researcher administered the survey verbally, following instructions exactly as written on the questionnaire and recording participant's responses on the survey instrument. Between June 1, 2015 and August 1, 2015, a total of 230 surveys were collected.

Consent documents and questionnaires were filed separately from one another in a locked filing folder to ensure confidentiality. Survey data were entered into Excel and stored in a password-protected folder on a password-protected laptop. Paper surveys were

provided to the Brazilian partner organization (FMABC) in accordance with the requirements of the Mauá Institutional Review Board (IRB).

For analysis, parents were divided into two categories: “HPV eligible” and “HPV ineligible.” For this analysis, “HPV eligible” parents had one or more female child aged 9-15 years between March 2014 and August 2015. These dates were chosen given the implementation of the HPV vaccine into the PNI and the end of the study. While the current HPV vaccination policy only includes girls aged 9 and 13, girls who were in this age range in 2014 (but no longer eligible for vaccination) may presently be up to age 15, and therefore their parents would be included in the “HPV eligible” category. All other parents were considered “HPV ineligible”.

Data were cleaned and analyzed with SAS version 9.4. The number of children the parent was responsible for was categorized into three categories: 1-2, 3-4, and 5 or more. The ages of the children were grouped into five categories focusing specifically on having a category designated for girls aged 9-15 years. Likert scale questions in the attitudes section of the survey were collapsed from five levels to three levels (agree, neutral and disagree). Income was converted from Brazilian reals to US dollars based on the average December 2015 exchange rate of US$3.8764 (45). For income, a median was determined most appropriate after preliminary analysis showed many outliers for both the low and high ends of the monthly income scale.

Descriptive statistics were computed and are reported in frequencies and percentages, stratified by HPV parent eligibility (Table 1). We conducted bivariate analyses with chi-square tests (or Fisher’s Exact tests (FET), where appropriate) for each

table. Significance was assessed at $\alpha = 0.05$ level. Willingness to vaccinate all individuals age 9-26 was examined by parent's demographic, knowledge, and attitude variables.

Approval for the study was obtained from the Emory University institutional review board (Atlanta, GA, USA) and the Municipality of Mauá (São Paulo, SP, Brazil) ethics committee. The project was found exempt by both bodies, as it did not meet the definition of research with human subjects.

Results

Demographics

Among those visiting health posts, 230 individuals agreed to participate in the study. Of these, eleven were excluded; therefore, 219 surveys were analyzed. Overall, the study population, aged 25-64 years, consisted of 87.2% females. Monthly income ranged from unemployed to US$1,548, with a median of US$258. Approximately 30% of parents were either unemployed or making less than minimum wage (US$203 monthly). Most parents (62%) indicated they were responsible for health-related decisions regarding the children in the house (Table 1).

Most parents (93.6%) had between 1 and 4 children; the largest family size reported was 7 children. Children's ages ranged from newborns (age calculated in months) to 21 years of age or older, with the majority aged 9-15 years (n=251) and 51.5% being female. Overall, the number of eligible children for HPV vaccination through SUS was 163, denoted by an asterisk (Table 1). The number of HPV eligible and ineligible parents were split approximately even among those included in the analysis (n=115 vs n=104, respectively). The stratification of parent groups mirrored those of the overall

population, with no significant difference in demographics between the two (p>0.05) (Table 1).

Knowledge

Approximately 82% of parents correctly identified that HPV is transmitted through sexual contact, and the majority of parents (71.4%) correctly identified that both males and females should be vaccinated against HPV. There was no statistically significant difference between the two parent groups (p>0.05) (Table 2).

Approximately 66% of parents could identify the correct group currently eligible for vaccination through SUS. Knowledge of maximum age to vaccinate girls was low, with 47% of parents identifying the correct answer. The rate of choosing the incorrect answer to this question was higher in comparison to other knowledge questions (33.3%), and parents chose "I don't know" more frequently than the previous questions. Again, there was no statistically significant difference in knowledge between the two parent groups (p>0.05) (Table 2).

Attitudes regarding vaccination

Overall, parents had positive attitudes regarding the HPV vaccine. Both groups agreed that vaccination in general and HPV vaccination for adolescents is important (over 96% agreement for both questions). HPV eligible and ineligible parents agreed that HPV vaccination is beneficial for girls aged 9-13 (approximately 94% agreement) and beneficial for women over 13 years (approximately 83% agreement). Parent groups differed slightly in attitudes regarding vaccine efficacy in preventing cervical cancer (90.7% and 96.0%, respectively), vaccine safety (90.1% vs 83.7%, respectively), men being vaccinated against HPV (74.9% vs. 84.2%, respectively), and

vaccine efficacy for men (62.3% vs. 64.6%, respectively). There was no statistically significant difference in attitudes between parent groups ($p>0.05$) (Table 3).

Attitudes regarding excluded populations

As with attitudes regarding vaccination, parents had overall positive attitudes regarding the HPV vaccine and excluded populations. Ninety-four percent of parents would pay to have their children vaccinated if the child did not qualify for vaccination through SUS, on the stipulation that the parent could afford the vaccine. Approximately 89% of parents also said that they would have all their children, regardless of sex and age, vaccinated against HPV if the cost of the vaccine was covered through SUS. Most notably, over 86% of parents expressed that they had no hesitations in regards to the HPV vaccine. There was no statistically significant difference in attitudes between parent groups ($p>0.05$) (Table 4).

Discussion

For most of the world, universal health coverage (UHC) is a distant aspiration that is regularly stalled due to ongoing economic crises. Yet, UHC is a broad concept that has limitless options in terms of implementation, depending on the country, government, and population, as each country's situation is unique. Equity is at the forefront of UHC, and could prevent the death of millions (46). As the key element to reduce social inequities, certain steps must be taken to continue acknowledging UHC as right to health and move toward an all-inclusive system (9).

As an essential first step, countries must recognize the right to health in their national constitutions, as Brazil did in 1988 (47). UHC is beneficial as it improves the country's health and economy by diminishing OOP costs, and giving way to healthier and

stronger populations (9). It is the duty and responsibility of international partners to support LMICs as they strive for the implementation of UHC (47, 48).

According to General Comment 14, the right to health consists of four elements: "availability, accessibility, acceptability, and quality" (6). Brazil's health care system encompasses at least some portion of each of these elements: a well-run health care system concerned with prioritizing health, an affordable system that does not put excessive financial strain on the individual, access to health care for diagnosis and treatment through SUS, and a sufficient number of qualified health care workers able to provide services.

However, barriers and gaps in the system remain, particularly regarding quality and availability. The quality of private health care in Brazil is significantly higher than that of SUS, and with large socioeconomic divides, this difference creates two discrete health care categories: rich and poor (40).The average monthly income of the study population was US$258 (considered "poor" within this tiered system), forcing these individuals to rely solely on SUS for health care needs. Quality and access go hand-in-hand. As the difference in quality between the two systems is divergent, it becomes evident that access to services outside of SUS, including HPV vaccination for those not included in the PNI program, is unattainable for low SES individuals. Among study participants, there was no statistically significant difference overall in knowledge and attitudes among HPV eligible and ineligible parents. The only restriction perceived is based on the arbitrary restriction imposed by the Brazilian government. Services should be all-inclusive, especially for a country that has had UHC for almost three decades. This

current system for HPV vaccination cannot be considered unified or successful health care.

Expanding health care access widely and then deeply is a large part of successful implementation of UHC. The maximum number of individuals should be covered for basic services including preventive care – such as HPV vaccination – before expanding to other services (49). Based on the participant's attitudes regarding excluded populations, it is evident that an expansion of services is necessary. Ninety-four percent of parents expressed their desire to get their child vaccinated against HPV, if the family could afford the additional expense. Currently, the price of the HPV vaccine is approximately US$135, per dose (50). In a population with average monthly income of US$258, it is not feasible to ask a parent to pay half their monthly income for a vaccine, three separate times. Cost now becomes the biggest deterrent in vaccine uptake for these individuals. Additionally, the majority of parents expressed no hesitation about the HPV vaccine, again, making it evident that the demand for the vaccine and expansion of the vaccination policy is present. For UHC to be successful, progress toward equity should be realized across age, sex, and income level, as well as across the national population (9).

With a high cervical cancer burden in Brazil, preventive care is an important component of UHC in the country. Screening and early treatment programs have been effective for decades, primarily diagnosing cervical cancer through Pap tests; however, these methods can be costly and require highly trained personnel to complete (51). Vaccination is a main component of preventive care, and based on multiple cost-effective studies, HPV vaccination is favorable. Implementation into the PNI system results in a

significant reduction of cervical cancer incidence and mortality in Brazil, while decreasing costs for the government (51).

Undoubtedly, health care coverage must be non-discriminatory (49, 52). If UHC coverage is only reaching specific socioeconomic, age, or gender categories, then the reform should be considered unsuccessful. Brazil's health care reform, despite having many programs that are not sufficiently far reaching (see HPV vaccine), is a great example of reaching the targeted portions of the lower classes. On average, parents in this study are well below the poverty line. Still, knowledge regarding HPV is strong, and there is no discrepancy between HPV eligible and ineligible parents.

When implementing the HPV vaccine into the national vaccination schedule, the Ministry of Health, aided by the states and municipalities, created and disseminated education, outreach, and promotional materials for parents and adolescents to provide education on the HPV vaccine, as well as the virus itself and transmission (35). In this study population, there was no significant difference in knowledge of HPV transmission and vaccination between parent groups. This suggests that knowledge is uniform among all individuals, and the dissemination of information by the government is successful. UHC's success is based on having an all-inclusive system, and a critical role of this system is to include education (35). Health literacy is a large component of vaccination uptake, and these results show that the low-income populations are receiving and synthesizing the information being provided to them, and are able to make informed decisions about the HPV vaccine. Subsequently, it can be hypothesized that informed decisions can be made about other health issues, based on high health literacy

demonstrated by parents. Yet, what good is knowledge if, as mentioned previously, the individual cannot access or afford the vaccine?

High HPV vaccination coverage rates throughout Brazil show the extent to which UHC can be successful and influential. Prior to 2014, the prevalence of HPV infection was between 24.8% and 35.0% (53). As of 2016, over 13 million Brazilian girls are protected against four types of HPV responsible for 90% of genital warts and 70% of cervical cancers (21). Vaccination rates have remained high in these communities, and if expanded to the excluded populations, these rates would continue to increase. Almost 90% of parents expressed that they would have all of their children vaccinated against HPV, regardless of age and sex, if the vaccine was available through SUS. This finding is also supported by similar results among a qualitative study of Brazilian parents in 2014 (54). These results make it clear that that the barriers to HPV vaccination in Brazil are cost and government policy, not population hesitancy.

Given government commitment to UHC and scientific efficacy, why has the Brazilian government imposed the restriction on females over 13 and males receiving the HPV vaccine through SUS, in its HPV vaccination policy? The commitment to the UHC basket of benefits should be non-discriminatory, and these limitations prevent unified health services and care for all. Universal and equal access implies the inclusion of all eligible individuals in the population, and the exclusions within the HPV vaccination policy are a violation of human rights and Brazil's commitment to UHC.

The limitations imposed by the government regarding the HPV vaccine are not only directly impacting men and women across the country, but seem to be affecting the attitudes of parents, as well. Overall, parents supported vaccinating children and

adolescents against HPV, agreed the HPV vaccine was beneficial for girls 9-13 years of age, agreed that the vaccine is effective in preventing cervical cancer, and that the HPV vaccine is safe. These attitudes seem to follow closely with the SUS guidelines for vaccination.

However, once parents were asked about policies that were not covered through SUS, such as how beneficial the vaccine is for males and females over 13 years, and whether men should be vaccinated against HPV, parents' attitudes changed drastically in opposition of these policies. Interestingly, 71.4% of these same parents correctly identified the recommendation that both males and females should be vaccinated against HPV. These conflicting data then suggest that there is a cognitive disconnect between the study parents' knowledge and attitudes. This is despite the fact that vaccination of males has many benefits for both the males themselves as well as their female partners (55). Vaccination against HPV can prevent genital warts, along with oropharyngeal, penile, and anal cancers (26). The pressing issue now becomes how to address this disconnect, and whether the government's exclusions to the HPV vaccination policy are what is influencing the population's attitudes.

Similar studies on parental attitudes and knowledge have been performed in Brazil, but were completed prior to the implementation of the HPV vaccine into the PNI (56). This study is the first to demonstrate the scope of government reach in terms of health literacy and universal access to information about HPV for this population.

Since implementing SUS in 1988, Brazil has remained proactive in prioritizing health care and diminishing excessive costs for the individual, despite being in a situation of limited resources. Transitioning to UHC has proved beneficial to Brazilians, as life

expectancy has increased from 66 years in 1990 to 75 years in 2013 (57). This change in lifespan can largely be attributed to increased access to health services and preventive care in Brazil. In the future, it will be beneficial to further expand on the cost-effectiveness of vaccinating males and females over 13, specifically in Brazil. The majority of parents expressing their desires to get all of their children vaccinated, regardless of age and sex, evidences support for this. Additionally, a follow-up study evaluating knowledge of why certain SUS recommendations are made would be beneficial to further explore exclusions and parental knowledge. This could help guide future policy improvements.

Conclusion

Although the system is far from perfect, moving equitably toward UHC is one of Brazil's greatest achievements, and it gives hope to countries around the world striving for UHC in limited resource settings. Brazil is a prime example for showing the right to health and UHC are worth the challenges, as the rewards, including overall healthier populations, increased health literacy, and decreased financial burden, are infinite. UHC's main goal is to protect citizens from financial hardship resulting from health care costs, and Brazil has shown to be incredibly successful in the implementation and maintenance of the UHC system for decades. As demonstrated by the strong knowledge of the participants in this study, SUS has been particularly successful in reaching low-income populations. However, despite its success, Brazil's system still requires improvements to be considered "all-inclusive." Brazil's constitution states that every individual has the right to universal and equal access to health services. The exclusion of females over 13 and all males from HPV vaccination through SUS is a direct violation of the right to

health provision within the country's constitution. As evidenced by this study, parents are looking to the government for improvements, with positive attitudes regarding the HPV vaccine and sufficient knowledge to make educated health-related decisions for their children. It is clear that there is a demand for universal vaccination, and this demand should be addressed on the principle of non-discrimination and scientific efficacy for this population. In order for UHC to be considered all-inclusive, every individual in Brazil should have equal access to HPV vaccination services. To achieve this, the Brazilian government must consider the expansion of these services in the future.

CHAPTER 3: PUBLIC HEALTH IMPLICATIONS

Since implementing SUS in 1988, Brazil has remained proactive in prioritizing health care and diminishing excessive costs for the individual, despite being in a situation of limited resources. The results from this project provide baseline data for the expansion of the HPV vaccination campaign to males of all ages and females over 13 years of age. With the appropriate planning, this study can be scaled up in order to improve the prevention of cervical cancer, genital warts, and other HPV-associated diseases at the national level. A national level survey with a larger sample size could carry out important implications for Brazil regarding HPV viruses and the vaccination campaign.

As the HPV affects both males and females alike, and the vaccine is meant to protect against more than 150 different strains, it is essential for males and older females to be vaccinated (22, 23). Nearly all sexually active men and women will be infected at some point in their lifetime; therefore, vaccination for all is ideal for the population's well-being (25). Countrywide vaccination without these limitations could prevent countless cases of genital warts and cancers of the vagina, penis, anus, vulva, cervix and oropharynx in the coming years.

In the future, it will be beneficial to further expand on the cost-effectiveness of vaccinating males and females over 13. This is evidenced by the majority of Brazilian parents expressing their desires to get all of their children vaccinated, regardless of age and sex. Additionally, a follow-up study evaluating knowledge of why certain SUS recommendations are made would be beneficial to further explore exclusions and parental knowledge. This could help guide future policy improvements.

The exclusion of females over 13 and all males from HPV vaccination through SUS is a direct violation of the right to health provision within the country's constitution. As evidenced by this study, parents are looking to the government for improvements, with positive attitudes regarding the HPV vaccine and sufficient knowledge to make educated health-related decisions for their children. It is clear that there is a demand for universal vaccination, and this demand should be addressed on the principle of non-discrimination and scientific efficacy for this population. In order for UHC to be considered all-inclusive, every individual in Brazil should have equal access to HPV vaccination services. To achieve this, the Brazilian government must consider the expansion of these services in the future.

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APPENDIX A: TABLES

Table 1. Demographic characteristics among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015, stratified by child eligibility for the HPV vaccine through SUS. Differences in responses between the two parent groups were found to be not statistically significant at the 0.05 level for each question (N=219).

Table 2. Knowledge about human papillomavirus, human papillomavirus vaccine, transmission, and Brazil's eligible population for vaccination among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015.

Table 3. Attitudes about vaccination and the HPV vaccine among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015. Differences in responses between the two parent groups were found to be not statistically significant at the 0.05 level for each question.

Table 4. Attitudes of parents with children between the ages of 9 and 17 regarding excluded populations of HPV vaccination through SUS in Sao Paulo, Brazil, 2015.

Table 1. Demographic characteristics among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015, stratified by child eligibility for the HPV vaccine through SUS. Differences in responses between the two parent groups were found to be not statistically significant at the 0.05 level for each question (N=219).

Characteristic	Level	Overall (N=219)		HPV Eligible (N=115)		HPV Ineligible (N=104)	
		No.	%	No.	%	No.	%
Gender	Female	191	87.2	97	84.4	94	90.4
	Male	28	12.8	18	15.6	10	9.6
Age	25-29	32	14.6	22	19.1	10	9.6
	30-34	43	19.6	24	20.9	19	18.3
	35-39	63	28.8	35	30.4	28	26.9
	40-44`	36	16.4	14	12.2	22	21.1
	45-49	27	12.3	10	8,7	17	16.4
	50 or older	18	8.2	10	8.7	8	7.7
Marital Status[a]	Single	74	33.9	40	35.1	34	32.7
	Married	144	66.1	74	64.9	70	67.3
Responsible for health-related decisions	Self	136	62.1	66	57.4	70	67.3
	Spouse	10	4.6	5	4.3	5	4.8
	Together	73	33.3	44	38.3	29	27.9
Number of children	1-2	109	49.8	56	48.7	53	50.9
	3-4	96	43.8	51	44.3	45	43.3
	5 or more	14	6.4	8	7.0	6	5.8
Age of children[b]	3 or younger	56	9.7	31	10.0	25	9.3
	4-8	91	15.7	52	16.7	39	14.6
	9-15	251	43.4	163*	52.4	88	32.8
	16-20	101	17.4	33	10.6	68	25.4
	21 or older	80	13.8	32	10.3	48	17.9
Gender of children[c]	Female	298	51.5	205	65.9	175	65.3
	Male	281	48.5	106	34.1	93	34.7
		No.	USD	No.	USD	No.	USD
Monthly Income	Median	184	$258.2	100	$236.6	84	$271.1

[a] n = 218
[b, c] n = 579
* Number of eligible girls who received the HPV vaccine between March 2014 and August 2015.

Table 2. Knowledge about human papillomavirus, human papillomavirus vaccine, transmission, and Brazil's eligible population for vaccination among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015.

	Overall N (%)	HPV Eligible N (%)	HPV Ineligible N (%)	X^2 *p*-value
HPV is transmitted through sexual contact (N=207)				0.6320
True*	175 (82.2)	90 (81.1)	85 (83.3)	
False	23 (10.8)	14 (12.6)	9 (8.8)	
Don't know	15 (7.0)	7 (6.3)	8 (7.8)	
Recommended that both males and females be vaccinated against HPV (N=207)				0.2095
True*	152 (71.4)	75 (66.4)	77 (77.0)	
False	47 (22.1)	30 (26.5)	17 (17.0)	
Don't know	14 (6.6)	8 (7.1)	6 (6.0)	
Currently eligible in Brazil to receive the HPV vaccine (N=211)				0.5576
Only girls, 9-13*	141 (65.6)	73 (63.5)	68 (68.0)	
Only girls, 9-26	7 (3.3)	5 (4.3)	2 (2.0)	
Girls and boys 9-13	27 (12.6)	14 (12.2)	13 (13.0)	
Girls and boys, 9-26	30 (14.0)	19 16.5)	11 (11.0)	
Don't know	10 (4.7)	4 (3.5)	6 (6.0)	
Girls can be vaccinated against HPV up to age 26 (N=207)				0.6850
True*	100 (47.0)	50 (44.2)	50 (50.0)	
False	71 (33.3)	39 (34.5)	32 (32.0)	
Don't know	42 (19.7)	24 (21.2)	18 (18.0)	

* Indicates correct answer

Table 3. Attitudes about vaccination and the HPV vaccine among parents with children between the ages of 9 and 17 in Sao Paulo, Brazil, 2015. Differences in responses between the two parent groups were found to be not statistically significant at the 0.05 level for each question.

	HPV Eligible N (%)				HPV Ineligible N (%)		
	Agree	Neutral	Disagree		Agree	Neutral	Disagree
Vaccinating my children against diseases that can be spread from person to person is important (N=219)	114 (99.1)	0 (0)	1 (0.9)		104 (100.0)	0 (0)	0 (0)
It is important for children and adolescents to be vaccinated against HPV (N=214)	109 (97.3)	1 (0.9)	2 (1.8)		98 (96.1)	1 (1.0)	3 (2.9)
The HPV vaccine is beneficial for girls between 9 and 13 years old (N=217)	107 (93.9)	1 (0.9)	6 (5.3)		97 (94.2)	2 (1.9)	4 (3.9)
The HPV vaccine is safe (N=215)	100 (90.1)	5 (4.5)	6 (5.4)		87 (83.7)	12 (11.5)	5 (4.8)
The HPV vaccine is effective in preventing cervical cancer (N=207)	98 (90.7)	4 (3.7)	6 (5.6)		95 (96.0)	3 (3.0)	1 (1.0)
The HPV vaccine is beneficial for women over the age of 13 (N=209)	90 (83.3)	1 (0.9)	17 (15.7)		84 (83.2)	5 (4.9)	12 (11.9)
Men should be vaccinated against HPV (N=213)	85 (74.9)	3 (2.7)	24 (21.4)		85 (84.2)	3 (3.0)	13 (12.9)
he HPV vaccine is beneficial for men (N=202)	66 (62.3)	3 (2.8)	37 (34.9)		62 (64.6)	6 (6.2)	28 (29.2)

Table 4. Attitudes of parents with children between the ages of 9 and 17 regarding excluded populations of HPV vaccination through SUS in Sao Paulo, Brazil, 2015.

	Overall N (%)	HPV Eligible N (%)	HPV Ineligible N (%)	FET *p*-value
Would you pay to have your children vaccinated against HPV if they were not eligible for free vaccination? (N=216)				0.5679
Yes	203 (94.0)	108 (95.6)	95 (92.2)	
No	10 (4.6)	4 (3.5)	6 (5.8)	
Not Sure	3 (1.4)	1 (0.9)	2 (1.9)	
If the vaccine was offered at no cost to all individuals between the ages of 9 and 26, would you have *all* of your children vaccinated against HPV? (N=215)				0.2495
Yes, all my children	191 (88.8)	97 (85.8)	94 (92.2)	
Yes, but only the females	15 (7.0)	11 (9.7)	4 (3.9)	
Yes, but only the males	1 (0.5)	1 (0.9)	0	
No	8 (3.7)	4 (3.5)	4 (3.9)	
Do you have any hesitations in regards to the HPV vaccine? (N=216)				0.0925
Yes	23 (10.6)	17 (15.0)	6 (5.8)	
No	187 (86.6)	93 (82.3)	94 (91.3)	
Not Sure	6 (2.8)	3 (2.7)	3 (2.9)	

APPENDIX B: SURVEY INSTRUMENT (ENGLISH)

Human papillomavirus vaccination eligibility and restrictions: An analysis of parental perceptions in São Paulo, Brazil

Thank you for agreeing to participate in this survey. The purpose of this survey is to explore your understanding of and attitudes towards the HPV vaccine, campaign, and exclusion policies. Completion of the survey should take no longer than 25 minutes.

Your responses are confidential. Please do not include any identifying information on the survey. This is done to ensure your privacy. This survey is voluntary and you can stop or skip a question at any time. Upon completion of the survey, please return it back to the researcher.

Section I: Demographic Information	
This section is for demographic purposes only. Please place a check mark in the box that best matches your response.	
[1] Age	[___ ___] Years
[2] Gender	☐ Male ☐ Female
[3] Marital Status	☐ Single ☐ Married ☐ In a committed relationship ☐ Prefer not to answer
[4] Number of children	[___ ___] children

[5] Age and sex of children	[___ ___] Age of child 1 [___ ___] Sex of child 1 [___ ___] Age of child 2 [___ ___] Sex of child 2 [___ ___] Age of child 3 [___ ___] Sex of child 3 [___ ___] Age of child 4 [___ ___] Sex of child 4 [___ ___] Age of child 5 [___ ___] Sex of child 5 [___ ___] Age of child 6 [___ ___] Sex of child 6
[6] What is your monthly income?	[R$_____] ☐ Prefer not to answer
[7] Who is primarily responsible for making healthcare related decisions for the children in the household?	☐ I am responsible ☐ My spouse is responsible ☐ My spouse and I make decisions together ☐ Another individual makes the decisions (please specify):_____ ☐ Prefer not to answer
[8] If your children include girls between the ages of 09 and 15, did they receive the HPV vaccine?	☐ I do not have girls between the ages of 9 and 15 (Please proceed to question 11) ☐ Yes ☐ No ☐ I am not sure or do not remember ☐ Prefer not to answer

[9] If you answered "yes" to the above question, where did your child/children receive the HPV vaccine? Please select all that apply.	☐ School ☐ Health post ☐ Private physician ☐ I am not sure or do not remember
[10] If you answered "yes" to the above question, where did your child receive the second dose of the HPV vaccine? Please select all that apply.	☐ My daughter(s) did not receive the second dose ☐ School ☐ Health post ☐ Private physician ☐ I am not sure or do not remember
[11] If your children include boys, have they been vaccinated for HPV through a private physician?	☐ My children do not include boys (Please proceed to question 12) ☐ Yes ☐ No ☐ Not sure ☐ Prefer not to answer

Section II: Knowledge	
This section is intended to assess your understanding regarding HPV and vaccination. Please place a check mark in the box that best matches your response.	
[12] HPV is transmitted through sexual contact.	☐ True ☐ False ☐ Don't know
[13] It is recommended that females and males be vaccinated against HPV.	☐ True ☐ False ☐ Don't know

[14] According to the Ministry of Health, who is <u>currently eligible</u> to receive the HPV vaccine?	☐ Only girls, 9-13 ☐ Only girls, 9-26 ☐ Girls and boys, 9-13 ☐ Girls and boys, 9-26 ☐ Don't know
[15] Girls can be vaccinated against HPV up to age 26.	☐ True ☐ False ☐ Don't know

Section III: Vaccine Attitudes	
This section is intended to understand your attitudes towards vaccines, in general, and HPV vaccination. Please place a check mark in the box that best matches your response.	
[16] Vaccinating my children against diseases that can be spread person-to-person is important. **Adapted from* [44]	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[17] The HPV vaccine is beneficial for girls between 9 and 13 years old. **Adapted from* [43]	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[18] The HPV vaccine is beneficial for women over the age of 13.	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree

[19] The HPV vaccine is beneficial for men.	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[20] The HPV vaccine is effective in preventing cervical cancer. **Adapted from* [43]	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[21] The HPV vaccine is safe. **Adapted from* [43]	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[22] It is important for children and adolescents to be vaccinated against HPV.	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree
[23] Men should be vaccinated against HPV.	☐ Strongly agree ☐ Somewhat agree ☐ Neither agree or disagree ☐ Somewhat disagree ☐ Strongly disagree

Section IV: Excluded Populations	
This section is intended to assess your opinions about the excluded populations. Please place a check mark in the box that best matches your response.	
[24] Would you pay to have your children vaccinated against HPV if they were not eligible for free vaccination?	☐ Yes ☐ No ☐ Not sure ☐ Prefer not to answer
[25] If the vaccine was offered at no cost to all individuals between the ages of 9 and 26, would you have <u>all</u> of your children vaccinated?	☐ Yes, all my children ☐ Yes, but only the females ☐ Yes, but only the males ☐ No ☐ Prefer not to answer
[26] If you answered "no" to the previous question, what is the reason? If you answered "yes", proceed to question 26. **Responses adapted from* [42]	☐ Not necessary for males ☐ Not necessary for females outside the age range ☐ I worry about safety ☐ I worry about increased sexual activity ☐ Other (please specify): _____ _____ _____
[27] Would you like to be provided more information about the current vaccination program and the specific populations who are currently ineligible?	☐ Yes ☐ No ☐ Not sure ☐ Prefer not to answer
[28] Do you have any hesitations in regards to the HPV vaccine?	☐ No (Proceed to question 29) ☐ Yes ☐ Not sure ☐ Prefer not to answer

[29] If you answered "yes" to the above question, what are your concerns?	☐ I worry about my child(ren)'s safety ☐ Efficacy of the vaccine ☐ The vaccine promotes promiscuity ☐ My child's primary physician did not recommend it ☐ I do not have enough information about the vaccine ☐ Prefer not to answer

Section V: Open-ended questions	
This section is comprised of questions that require short answers. If you need additional room, please alert the researcher and you will be provided with additional sheets of paper.	
[29] In your opinion, what kind of changes would you like to see in the vaccine policy?	_____ _____ _____ _____ ☐ No changes ☐ Prefer not to answer
[30] In your opinion, why are women over 13 years old and males of all ages excluded from the vaccination policy?	_____ _____ _____ _____ _____ ☐ Don't know ☐ Prefer not to answer

This concludes the survey. Thank you for your participation. Please return this survey to the researcher.