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Extending the Latina Paradox: Comparative Findings of Sexually Transmitted Infections among Mexican Origin, Black, and White Birth-Giving Women

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Abstract

This study compares the likelihood of sexually transmitted infections (STIs) present or treated during pregnancy among Mexican origin, non-Hispanic White, and Black birth-giving women. Logistic regression analyses of birth certificate records from the National Center for Health Statistics (NCHS), for years 2009-2012, are used to determine the likelihood of presence or treatment of STIs for birth-giving women. Despite Mexican-origin women having the lowest levels of socioeconomic status (SES), as measured by educational attainment, logistic regression results show that the likelihood of presence or treatment of an STI is unexpectedly higher for Whites and Blacks when compared to their Mexican-origin counterparts. The unanticipated results parallel other health advantages commonly found within the 'Latina paradox literature'. Results show that women who defer their first prenatal visit until the last trimester of pregnancy have the highest odds of having an STI present or treated during pregnancy. The present study suggest that the Latina paradox could be extended via future research on STIs, and supports policies that might improve the maternal health of underserved women who defer their first prenatal visit until the third trimester.

Keywords

Latina paradox, epidemiological paradox, Hispanic paradox, STIs, maternal health

Introduction

A long-established positive association exists between socioeconomic status (SES) and health, where it has been shown that individuals with higher SES have lower rates of morbidity, comorbidities and mortality. Furthermore, racial and ethnic comparative studies have consistently indicated that whites enjoy favorable outcomes with regard to SES and health. Among such health outcomes are sexually transmitted infections (STIs), and as with most health advantages, whites have been reported to have lower rates of STIs when compared to other race and ethnic groups, such as Blacks and Latinas/os (CDC 2011 STD Surveillance Report).

The link between STIs and health outcomes has also been well established (Khare 2005). Regardless of gender, if an STI is left untreated it can have adverse short- and long-term health outcomes, such as infertility and cancer (Aral and Guinan 1984). For women, untreated STIs can lead to infertility and complications during pregnancy (Aral and Guinan 1984; Althaus 1991; Aral 2001; Chow et al. 2009), and can also negatively impact the fetus and newborns, leading to such complications as low birth weight (LBW) and pre-term birth (PTB) (Khare 2005; Althaus 1991). The study of STIs is essential not only for understanding sexual health, but also for the reduction of morbidity/ mortality, especially among women and their progenies.

Literature on STI contraction and transmission finds that "STIs tend to concentrate in certain populations including urban, poor, and minority populations, with highest rates among sexually active adolescent females followed by adolescent and young adult men" (Aral and Holmes 2008:53). The literature also posits that individuals with low SES, such as those living in disadvantaged inner-city neighborhoods, are more likely to have higher rates of STIs when compared to individuals living in more advantaged neighborhoods. Additionally, the majority of STIs reported within these communities are from minority groups, especially from second and subsequent non-European immigrant generations (Aral 2001).

Among race and ethnic subgroups, Latinos of Mexican origin have the lowest SES in terms of education and earned income, and are a younger demographic subpopulation (Gonzalez-Barrera and Lopez 2013) when compared to their white and Black counterparts. Given the inverse association between SES and STIs (Annang et al. 2010), it may be expected that Mexican-origin populations are likely to have a higher prevalence and likelihood of contracting STIs. It is likely that rates of STIs among Mexican-origin individuals is comparable to that of Blacks, and likely to be higher than that of more SES-advantaged whites. Persons of Mexican origin in the United States continue to have low access to life opportunities (e.g., college education and upwardly mobile occupations), which creates living conditions that place them in disadvantaged circumstances. In addition, the lack of life opportunities is further exacerbated among immigrants of Mexican origin as they lack access to basic resources and opportunities, and often do not assimilate into the larger society. This is particularly true among undocumented immigrants (Flores-Yeffal 2013).

Despite the aforementioned disadvantages, Mexican-origin people, especially women, have occasionally diverged from expected health trends. Some of these unanticipated health outcomes have been documented within the Hispanic/Latino/epidemiological paradox literature.

The first unanticipated health outcome was documented in 1974 by Teller and Clyburn, using vital statistical tabulations from the mid-1960s. Their study showed that the infant mortality rate of the Spanish-speaking population (assumed as Spanish-speaking according to last name) in Texas was only slightly higher than non-Hispanic Whites; this despite the Mexican-origin population in the study having relatively lower SES when compared to their non-Hispanic White counterparts. Yet both groups experienced, paradoxically, low infant mortality rates. More than a decade later, Markides and Coreil (1986) also unexpectedly found low infant mortality among Latinos in the southwestern part of the United States. This unanticipated finding was then termed the *epidemiological paradox* by Markides and Coreil (1986). Since then, the epidemiological paradox has been referred to as the Hispanic paradox, Latino/a paradox, or the Mexican paradox (Saenz and Morales 2012). For the purpose of this paper, *Latina paradox* is used interchangeably with epidemiological, Latina/o, Mexican, and/or Hispanic paradox.

Since Teller and Clyburn, research in the area of the Latina/o paradox has incorporated potential paradoxical differences in health risk behaviors, which may be linked to health outcomes regardless of race or ethnicity. Examples of these health risk behaviors include: diet, alcohol consumption, tobacco use (Ceballos 2003; Fuller et al. 2009; Padilla, Hamilton and Hummer 2009), illicit drug use (Lara et al. 2005), and needle sharing (Delgado et al. 2008). These negative health behaviors are believed to increase with low SES. Risky health behaviors are more prevalent among those with lower SES, and low SES is more prevalent among minority populations.

One health variable, however, that has received limited attention in Latina paradox research is sexually transmitted infections (STIs) or sexually transmitted diseases (STDs). Established literature, such as that found in CDC reports and other research, uses the term STDs to report rates and other findings while others use STIs. The two terms are synonymous.

Previous research has established that the effects of STIs on health produce both long-term and short-term risks and consequences (Chow et al. 2009; Khare 2005; Aral 2001; Aral and Guinan 1984). These health outcomes are in line with those of the Latina paradox – namely morbidity, mortality and birth outcomes, all of which are commonly studied within the paradox. What remains unknown, however, are the potential differences in prevalence and/ or likelihood of STI contraction among birth-giving women across race and ethnicity. These differences (or lack thereof) merit a closer look.

To date, we have yet to know if there is an unanticipated outcome in the prevalence and/ or likelihood of STIs among Mexican-origin women. To further explore this area, this study uses data from United States birth certificate records from 2009 to 2012. Birth records from 2009 and beyond have started collecting data on presence and treatment of STIs during pregnancy for five

STIs: chlamydia, gonorrhea, syphilis, Hepatitis B and Hepatitis C. The present study seeks to answer two research questions: 1) Are birth-giving women of Mexican origin, controlling for SES and other demographic variables, less likely to have an STI when compared to their white and Black counterparts? 2) If so, do such findings provide supporting evidence for future research in this area to test hypotheses found within the Latina paradox?

Such findings may be explained partially or totally by the Latina paradox, and may have potential implications to extend the breadth of the Latina paradox to include STIs.

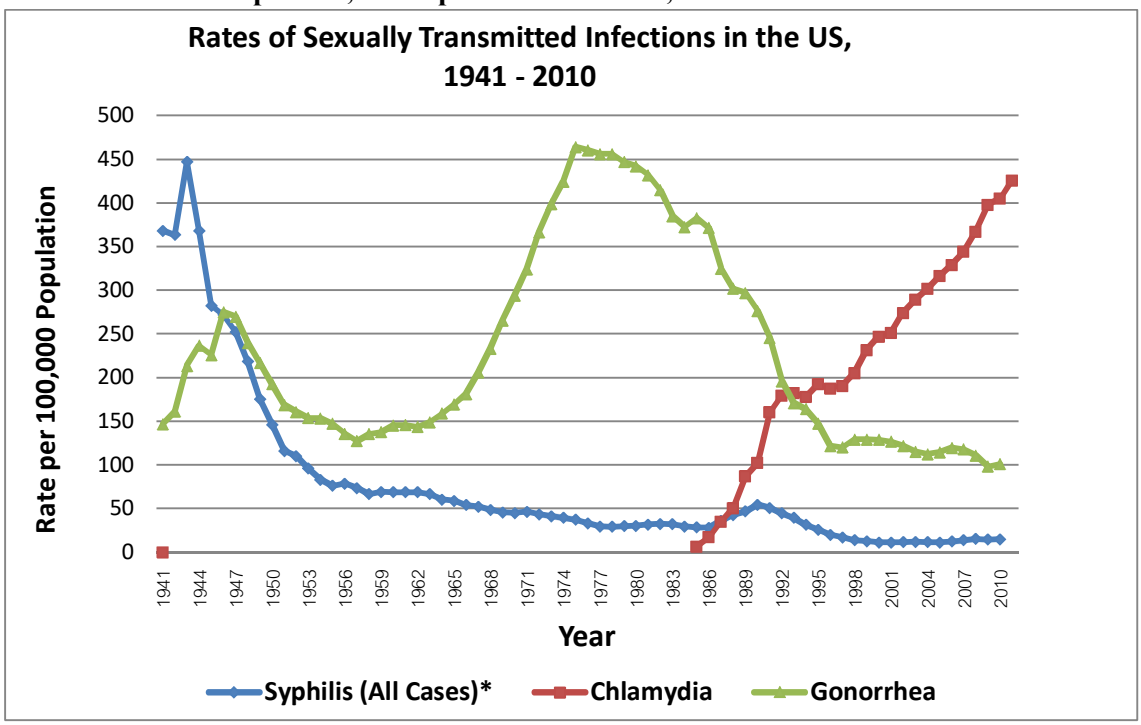
Literature review

This study looks at a proxy of health as measured by STI diagnosis and compares the likelihood of STIs during pregnancy of Mexican-origin Latinas to their White and Black counterparts. Prior to such an investigation, it is important to understand the prevalence of STIs within the three most commonly considered groups in the paradox, which are Mexican-origin Latinas, non-Hispanic White women, and non-Hispanic Black women. These serve as the comparative groups for the study, and hereafter are referred to as Mexican, White, and Black women. Initially, the study considers the most prevalent STIs in the US and compares infection rates by race and ethnicity among the birth-giving population in the US. Subsequently, SES factors associated with health outcomes are considered.

STIs: National rates and race/ethnic preliminary comparisons

Three of the most prevalent STIs in the US (for males and females) are gonorrhea, chlamydia and syphilis (CDC 2011 STD Surveillance Report). The Centers for Disease Control and Prevention (CDC) is tasked with collecting and reporting rates of all STIs. Figure 1 (next page) provides trend information for chlamydia, gonorrhea and syphilis from 1940 to 2010 in the US. While syphilis is now the least prevalent of the three STIs, in 1943 it peaked at 447 cases per 100,000 population. Gonorrhea, now the second most common STI, peaked at 464 cases per 100,000 population in 1975. Chlamydia was the least common when cases were first reported in 1985, but now is the most prevalent at 426 per 100,000 (as of 2010).

Figure 1. Reported Cases of Sexually Transmitted Infections by State Health Departments Converted to Rates per 100,000 Population in the US, 1941 - 2010



Note: *Syphilis cases include primary, secondary, early latent, and late latent cases.
Source: CDC 2011 Sexually Transmitted Diseases Surveillance.

The above noted STIs have at some point reached epidemic-like proportions where public health officials reacted to disease outbreaks. From the early 1940s to mid-1940s, syphilis rates were at their highest. While these rates have decreased over time, and have remained low, outbreaks have been reported. From the late 1980s to early 1990s, reported outbreaks were concentrated in a small number of geographic areas, particularly in the southern region of the US, where nearly 50% of all national cases were documented (2010 STD Surveillance). In response to outbreaks of syphilis, CDC developed the *National Plan to Eliminate Syphilis* (first announced in 1999 and revised in 2006) to enhance surveillance, provide a rapid outbreak response, and expand clinical/ laboratory services (2010 STD Surveillance).

When rates of gonorrhea were at their peak, public officials implemented the national gonorrhea control program in the mid-1970s. Gonorrhea rates declined 74% from 1975 to 1997 (2010 STD Surveillance: 17). And in the late 1980s – in response to public concern over pelvic inflammatory disease (PID) and other related complications related to chlamydia – health officials implemented public programs for screening and treatment of chlamydia. However, reported rates of chlamydia have been on the rise since the mid-1980s and are likely to increase due to "expansion of screening activities [such as those taken during pregnancy], use of increasingly sensitive diagnostic tests, and [the] increase in case reporting from providers and laboratories." (2010 STD Surveillance: 7).

STIs within the birth-giving population

Among women, the highest reported age-specific rates of STIs continue to be among those aged 15-24 years. These age-specific groups for women correlate with the common patterns of fertility rates that start in the teen years and peak in the 20s, especially among minority and low SES populations (Morgan and Hagewen 2005).

With respect to STIs among birth-giving populations, chlamydia is the most common STI in the US (Chow et al. 2009; Johnson 2007; Andrews et al. 2006) and is more evenly distributed among other STIs across individual counties within states and throughout the US (Chesson et al. 2010). Prevalence of chlamydia among pregnant women in the general US population is estimated to be approximately 5% (Goldenberg, Culhane and Johnson 2005; Johnson 2007).

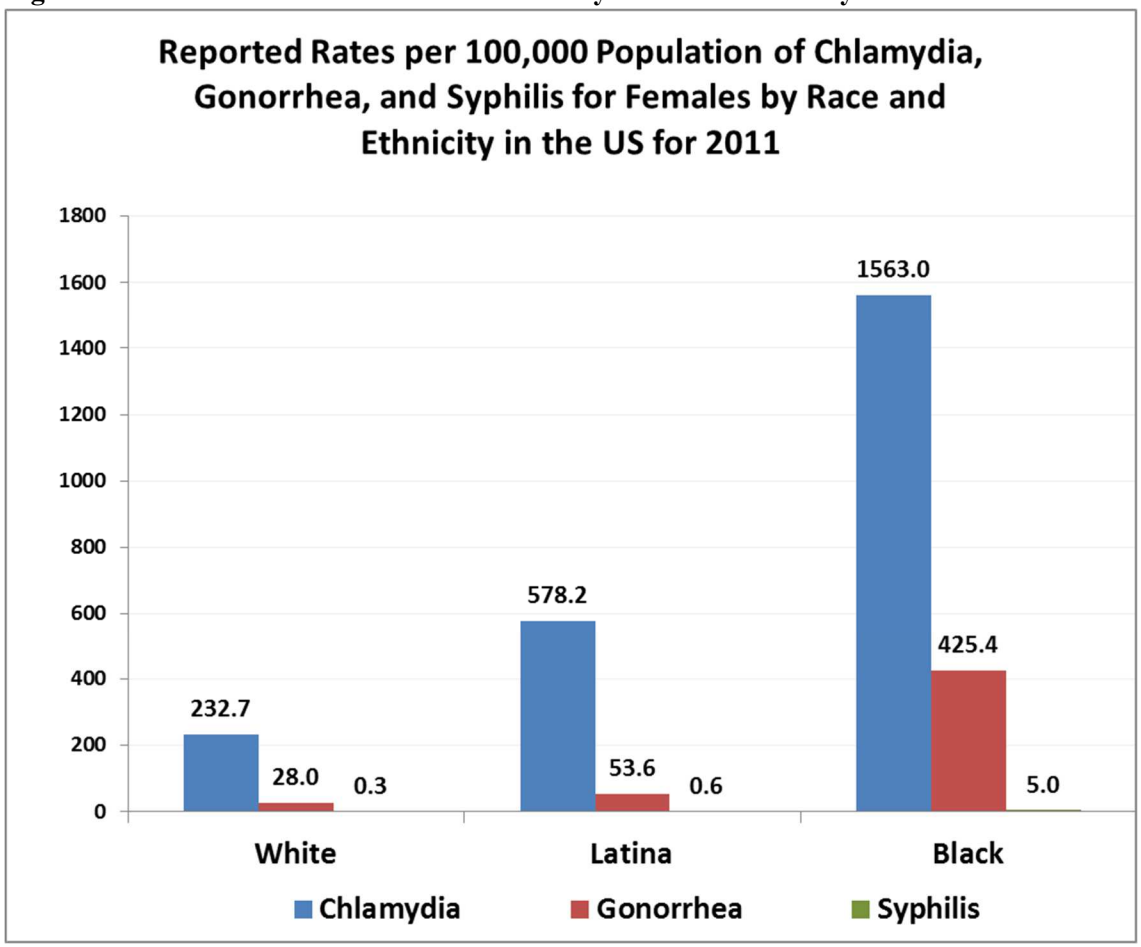
Gonorrhea is the second most reported STI in the US with a prevalence among pregnant women of approximately 1%, and it varies widely among different populations. Syphilis is not as common as gonorrhea and chlamydia. Prevalence of syphilis is estimated to be 0.12% among pregnant women in the general US population (Goldenberg, Culhane and Johnson 2005; Johnson 2007).

The prevalence of the Hepatitis B Virus (HBV) among pregnant women in the general US population is estimated to be approximately 0.2%; and the Hepatitis C Virus (HBC) is estimated to be at approximately 2% among pregnant women in the general US population (Goldenberg, Culhane and Johnson 2005).

STIs by race and ethnicity

Reported rates of chlamydia, gonorrhea and syphilis for females by race/ ethnicity from CDC are shown in Figure 2 (next page). CDC reported rates of chlamydia show that, as expected, white women have the lowest reported rate (232.7 per 100,000 population). However, the chlamydia reported rate for Latinas is 578.2 per 100,000 population, and is lower when compared to the reported rate for Black women, at 1,563.0 (CDC 2011 STD Surveillance Report). The reported rate for Latinas is somewhat unexpected as the rate is 2.7 times lower when compared to the rate of their Black counterparts. Higher SES decreases STI likelihood (Annang et al. 2010), and Black women are more likely to have higher SES when compared to Latinas. Similar trends are found for reported rates of gonorrhea and syphilis. Indeed, these preliminary data provide some support for expected STI outcomes across subgroups based on the literature.

Figure 2. Rates of STIs in the US for Females by Race and Ethnicity



Source: CDC 2011 Sexually Transmitted Disease Surveillance.

While the preliminary results above show that Latinas have high reported rates of STIs, it is important to note that Latinas encompass a large and diverse population which includes Mexican, Puerto Rican, Central American, Cuban, and other Spanish speaking populations. The above-mentioned data from CDC combines all Latina groups. Literature on the Latina paradox has long established possible differences in health outcomes, even within the Latina subpopulation. For example, there have been notable differences in low birth weight and infant mortality rates between Mexican, Puerto Rican and Cuban populations, with Puerto Ricans having the least favorable outcomes (Albrecht et al. 1996; Becerra et al. 1991).

The present study focuses specifically on Latinas of Mexican origin. The Mexican-Latina subpopulation is the largest Latina subgroup and is the most frequently used in comparison with Whites and Blacks when investigating the Latina paradox (Osypuk, Bates and Acevado-Garcia 2010; Padilla, Hamilton and Hummer 2009; Fuller et al. 2009; Wingate and Alexander 2006; Guendelman et al. 1999). The proximity of the US to Mexico and the long history of migration

from Mexico to the US makes women of Mexican origin an ideal social unit to use when investigating the Latina paradox. Women of Mexican origin are, therefore, the Latina comparative group for the present study.

Socioeconomic status (SES) and health

At the global level, SES is intrinsically correlated with health outcomes and is one of the most important and widely used predictors of social determinants of health (Robert and House 2000; Sudano and Baker 2006; Do et al. 2008). Differences in SES have long been associated with co-morbidity and mortality across time and is referred to as a 'social cause of inequalities in health' (Link and Phelan 2000; Mirowsky, Ross, and Reynolds 2000). Examples of health risk behaviors leading to co-morbidities are high-fat diets, tobacco use, alcohol consumption, and substance abuse. All of these risk behaviors are more common among people with lower SES (Kraut-Becher et al. 2008). It is posited that higher levels of education are associated with a lower tendency toward risky health behavior. With regard to sexual health, higher levels of SES (measured in terms of educational attainment) have been found to have an inverse relationship with STI diagnosis (Annang et al. 2010; Dean and Fenton 2010). As educational level, and thus SES increases, the likelihood of STI contraction decreases.

Studies that have measured SES in the US have commonly relied on income and educational attainment (Sudano and Baker 2006; Robert and House 2000; Navarro 1990). However, educational attainment has been found to be more beneficial among disadvantaged groups and among the general population when dealing with stressors, such as time spent in the category of low income (Mirowsky, Ross, and Reynolds 2000). This may be more relevant among foreign born populations as not all foreign attained human capital is transferable to the US. Indeed, it has been found that younger and more recent immigrants that enter the labor market are more likely to be overeducated for their respective occupations when compared to their native-born counterparts, much in part to the less-than-perfect international transferability of foreign experience (Chiswick and Miller 2009).

Despite the imperfect degree of human capital transferability, higher levels of educational attainment are associated with mental and physical well-being, contribute towards acquisition of information to effectively cope with life challenges, instill better health habits, and increase a sense of personal control. More educated people are more likely to engage in healthy behaviors, such as exercising, avoiding obesity and drinking moderately. They are also less likely to smoke and more likely to engage in preventive medical care (e.g., annual physical exams and immunizations, health screenings). And people who have higher levels of education are more likely to have health insurance to cover check-ups, which allows for early detection of illnesses – some of which may be life-threatening (Mirowsky, Ross, and Reynolds 2000).

Although the research literature relies mainly on more general concepts, SES, using educational attainment, is reliable and avoids the problem of content validity, which is commonly associated with measuring SES comprehensively. Educational attainment is easy to measure and stable over

time (Sudano and Baker 2006; Mirowsky, Ross, and Reynolds 2000). Accordingly, the present study uses educational attainment to measure SES.

SES among persons of Mexican origin

The Pew Research Center provides periodical reports on an array of demographic topics. I refer to two reports from the Pew Research Center to draw comparisons on several SES and demographic factors for Mexican-origin persons and compare these to Whites and Blacks. For these reports, PEW Research Center uses data derived from the 2011 American Community Survey (ACS, 1% IPUMS) which provides detailed geographic, demographic and economic characteristics of each group. Data on historical trends for the Mexican-origin populations are derived from the Current Population Survey (CPS). Data from the ACS and CPS are collected and housed by the US Census Bureau.

Table 1 (next page) provides comparison results for Whites, Blacks and Mexican-origin populations. Please note that data for the Mexican-origin population (middle column) and fertility data are from 2011, and all other data correspond to 2012 data.

In general, the Mexican population is the youngest of the three groups, having a median age value of 25 median years, while Whites are the oldest (42 median years). Among women who had a child in the previous year (2010) between the ages of 15-44, more Whites tend to be married when compared to Mexicans and Blacks.

With regard to SES factors, Mexicans clearly fare worse than Whites and Blacks. Mexicans have a higher percentage of people with less than a high school diploma (42.3%) when compared to Whites (8.5%) and Blacks (16.5%). Educational attainment levels increase for Whites and Blacks, with the exception of Blacks who have earned a college degree or beyond (18.8%). But for Mexicans, educational attainment decreases from 27.0% for those who have a high school diploma, 21.1% for those who have some college, and 9.6% for those who have a college degree and beyond.

According to previous research, low levels of educational attainment should result in lower wages for Mexican-origin persons. When considering median annual personal earnings, we do indeed find that Mexicans ($28,000) make lower wages per year in 2012 when compared to Whites ($46,000) and Blacks ($35,000). Finally, when considering persons insured, Mexicans have the highest percentage of uninsured (32.5%) when compared to Whites (10.5%) and Blacks (18.2%).

Data from the US Census used by the Pew Research Center show that Mexicans have lower SES than their Black and white counterparts. Although these data combined male and female SES characteristics for the comparative groups, Mexican females may have even lower levels of SES when compared to their male counterparts. The data for the present study considers educational attainment as an SES indicator, as has been commonly used in the Latina paradox literature. Given data presented from the Pew Center, it is likely that the present study may find that Mexican origin

birth-giving women have a comparable likelihood of having an STI as their Black counterparts, and a significantly higher probability of having an STI when compared to their white counterparts.

Table 1. Demographic and Socioeconomic Status Characteristics by Race and Ethnicity for Years 2011 and 2012

Race/Ethnicity	White		Mexican*		Black	
	N	%	N	%	N	%
Demographic Characteristics						
Population	197,275,734	69.1%	33,539,000	11.0%	38,535,707	12.0%
Median age in years	42	X	25	X	33	X
Fertility in the past year*						
(Women aged 15-44)*						
Married	1,610,885	74.3%	637,000	68.9%	208,373	34.2%
Not married	556,417	25.7%	287,000	31.1%	401,107	65.8%
All	2,167,302		924,000		609,480	
Marital status						
Married	86,594,294	54.6%	10,520,000	45.3%	8,700,130	30.6%
Not married	71,916,056	45.4%	12,721,000	54.7%	19,698,121	69.4%
All	158,510,350		23,241,000		28,398,251	
Socioeconomic Status						
Education attainment						
Less than HS diploma	11,986,737	8.5%	7,280,000	42.3%	3,933,327	16.5%
High school diploma	40,434,736	28.7%	4,638,000	27.0%	7,467,778	31.4%
Some college	42,583,563	30.2%	3,630,000	21.1%	7,919,107	33.3%
College or more	45,909,369	32.6%	1,659,000	9.6%	4,462,348	18.8%
Total	140,914,405		17,207,000		23,782,560	
Median annual personal earnings						
Full-time, year-round workers	$46,000		$28,000		$35,000	
Persons uninsured						
All ages	20,714,142	10.5%	10,910,000	32.5%	6,995,077	18.2%

Note: * Denotes 2011 US Census data. 2011 data includes all data for "Mexican" column and "Fertility in the past year (women ages 15-44)."

Note: X denotes not applicable.

Source: Pew Research Center's Hispanic Trend Project tabulations of 2012 American Community Survey (1% IPUMS).

Source: Pew Research Center's Hispanic Trend Project tabulations of 2011 American Community Survey (1% IPUMS).

Data on table are adapted from Brown, Anne and Eileen Patten. 2014. "Statistical Portrait of Hispanics in the United States, 2012." *Pew Research Center: Hispanic Trends*. April 29, 2014, and Brown, Anna and Eileen Patten. 2013. "Statistical Profile Hispanics of Mexican Origin in the United States, 2011." *Pew Research Center. Pew Hispanic Center*. Wednesday, June 19, 2013.

Literature on the Latina paradox, however, has observed that Latinas, despite having low levels of SES, tend to experience an unanticipated health advantage of lower mortality rates when compared to their white and Black counterparts. Since the seminal study by Teller and Clyburn (1974), other studies have found similar paradoxical results in expected health outcomes that have incorporated mortality and morbidities across the age spectrum in the Latina paradox. Yet, virtually no research has focused on STIs within the Latina paradox literature.

Findings in the Latina paradox

The phenomenon of the Latina paradox has consistently found unanticipated health advantages among Latinas, despite having low levels of SES when compared to their white and Black counterparts. This is paradoxical given the link between lower SES and expected poorer health outcomes. Examples of findings in health advantages among Latinas include low infant mortality rates, low rates of Low Birth Weight (LBW) and Pre-Term Birth (PTB) with respect to birth outcomes. These advantageous and unexpected birth outcomes are similar to Whites and significantly more advantageous when compared to their Black counterparts. The phenomenon is more confounding when considering that Latinas of Mexican origin have similar or lower levels of SES when compared to Blacks. Thus, the expected health outcomes should be more in line to those of Blacks.

Three hypotheses have been used to explain the findings within the Latina paradox:

- Data Artifacts and Salmon Bias hypothesis, which posits that a lack of available data produces an *illusion* of a health advantage for Latinos (Palloni and Arias 2004);
- Health of Migrants hypothesis, which postulates that migrants, relative to their native-born and sending populations, have inherent health advantages (Saenz and Morales 2012; Wu and Schimmele 2005; Hajat et al. 2010; Lu 2008) (in essence, only the healthiest of the sending communities migrate to foreign lands);
- Cultural and Protective Measures hypothesis, which assumes the social buffering effects that promote healthier lifestyles for the Latina/o population – with longer time spent in the US these protective measures diminish and negatively affect a prior healthy lifestyle (Kimbro, Lynch and McLanahan 2008; Saenz and Morales 2012; Lara et al. 2005).

The present study does not test the existing hypotheses of the Latina paradox. Instead, it analyzes the general expectations of SES and race/ ethnicity as they affect health outcomes, particularly the occurrence of STIs. It tests the conjecture, based on prior research, that Mexican-origin women with lower SES should have higher rates of STIs. If, unexpectedly according to general demographic trends, Latinas of Mexican origin have a health *advantage* when compared to their white and Black counterparts, including a lower prevalence and/ or likelihood of having a STI when pregnant, then the results may parallel those found within the Latina paradox.

The established Latina paradox literature provides convincing support for a paradox, at least in regards to newborns and children within the early stages of life. Thus, the health of mothers has

had special attention within the Latina paradox. A distinct difference in the health of mothers has been documented in the literature. In particular, migrant women have been found to give birth to healthy newborns despite having low SES (Saenz and Morales 2012; Hummer et al. 2007; Padilla, Hamilton, and Hummer 2009; Fuller et al. 2009). To date, within the Latina paradox literature, there has been consistent and convincing evidence that supports a health advantage with regard to Latinas and their offspring, even after controlling for SES and other relevant co-variates (Fuller et al. 2009; Padilla, Hamilton, and Hummer 2009; Hummer et al. 2007; Franzini, Ribble, and Keddie 2001; Carter-Pokras et al. 2008).

Research beyond birth outcomes has been extended to incorporate adult mortality and co-morbidities yielding continuing results that favor a health advantage for Latinas/os when compared to Whites and Blacks (Turra and Goldman 2007; Saenz and Morales 2012). These resulting health advantages for Latinas/os, especially among foreign born, remain despite possible Data Artifacts and Salmon Bias with regard to lower rates in specific co-morbidities, such as diabetes, hypertension and obesity (Riosmena, Wong and Palloni 2013), and mortality rates among Latinas/os in later stages of life (Turra and Goldman 2007; Kushang et al. 2004; Carter-Pokras et al. 2008; Rosenberg et al 1999).

Migrant status and their corresponding low health risk behaviors have been posited as the difference in health advantaged outcomes. These health behaviors include having healthier lifestyles with regard to diet and physical activity, consuming less alcohol, having lower levels of smoking and drug use when compared to their native-born counterparts (Saenz and Morales 2012; Arcia et al. 2001; Frisbie, Cho, and Hummer 2001; Garcia-Maas 1999; Gordon-Larsen et al. 2003; Berry 1997; Franzini, Ribble, and Keddie 2001; Morales et al. 2002; Abraido-Lanza, Chao, and Florez 2005; Lara et al. 2005; Sudano and Baker 2006; Delgado et al. 2008).

Despite the expanse of knowledge on the Latina paradox, there is still a gap with regard to a paradox in the prevalence of STIs in Latinas. Indeed, only a handful of articles have been published on this topic. These articles focus on acculturated differences in sexual risk behavior by race (Coonrod, Bay and Balcazar 2004; Page 2007; Guarini et al. 2011) and differences in HIV diagnosis between native and foreign-born Blacks (Satcher-Johnson, Hu and Dean 2010). To date, researchers have not examined this specific aspect of Latina health to see whether or not it falls under the Latina paradox.

Hypotheses

Higher SES has been associated with better health outcomes. Compared to Whites and Blacks, Mexicans continue to have lower levels of SES in the form of educational attainment and annual earned income, and are also more likely to be uninsured. Given their low SES, Mexican women are posited to have a higher risk of contracting an STI. The existing literature reveals two predominant research questions that have not been addressed. First, are STIs unexpectedly lower or less likely among Mexican-origin persons given their low levels of SES? Second, if unanticipated findings are similar to previous findings, can these results provide supporting

evidence to extend the Latina paradox to include STIs? Secondary data from vital statistic birth certificate records for the US from the National Center for Health Statistics (NCHS), a branch of CDC, are used to answer these important questions. Drawing from established literature in the Latina paradox and STI surveillance reports, two hypotheses are tested:

H1: The likelihood of having an STI present or treated during pregnancy is lower for Mexican women when compared to Black women, controlling for SES and demographic variables.

H2: The likelihood of having an STI present or treated during pregnancy is higher for Mexican women when compared to white women, controlling for SES and demographic variables.

If among birth-giving populations Mexican women are found to have a lower likelihood of STI present or treated during pregnancy when compared to their Black and White counterparts, results would parallel other findings within the Latina paradox. Such findings may have long-term implications to include STIs into the Latina paradox, extending the breadth of this phenomenon.

Data and methods

The most recent data on birth certificate records for years 2009-2012 from NCHS are used for the analyses. A description of the data, user guide, technical notes, and the Public Use Natality Files are provided by CDC and NCHS, and can be accessed online[1] for years 2009-2012. Dictionary files, data and user guides can also be found online.[2]

Birth certificate data have long been used in the Latina paradox literature across various levels of studies, including state (Janevic, Savitz and Janevic 2011; Teller and Clyburn 1974), national (Wingate, Swaminatha and Alexander 2009; Osypuk, Bates, and Acevedo-Garcia 2010; Hummer et al. 2007; El Reda et al. 2007; Wingate and Alexander 2006), international (Restrepo-Mesa et al. 2010; Auger et al. 2008) and binational levels (Guendelman et al. 1999). Furthermore, birth certificate data are large population-level samples that provide information from all births in the US that can be generalized to the birth giving US population.

Data on STIs is sensitive and typically restricted. Fortunately, the 2003 revision for reporting on the standard certificate of live births allow for reporting of STIs in a checkbox format, which includes gonorrhea, syphilis, chlamydia, Hepatitis B and Hepatitis C. An option for "none of the above" is included. If checkboxes are not completed or checked, data are classified as "not stated" or missing. Birth certificate records starting from 2009 and beyond have begun collecting data on presence and treatment of STIs during pregnancy at the national level. It is important to note that the 2009 data, first year of STI reporting, has the largest sample of missing data on STIs as not all

[1] https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm
[2] http://www.nber.org/data/vital-statistics-natality-data.html

states had effectively begun reporting STI information on birth certificate records. As more states report on STIs for subsequent years, the data should have smaller counts of missing data and produce more robust results.

Missing data is a shortcoming of many studies using secondary data. This study is no exception, especially when using sensitive data, in this case reported data reported on STIs. Due to a large number of missing data, there is potential concern that the results of the analyses are biased. It should be noted, however, that missing data for analyses in the present study are not contingent on the dependent variable or any other independent variables used for the analyses (Poston and Conde 2014). The missing data are associated with not all states having reported STI information in 2009. As more states report STI information for subsequent years, missing data should decrease.

Despite what may be a large number of missing data, especially for 2009, the sample should be large enough to provide statistically significant results. Subsamples for this study are large, ranging from N=2,324,026 for 2009 data to N=2,891,300 for 2012 data. For a breakdown of sample sizes and missing data see Appendix A, Table A1. Given that missing data are likely to come from the STI variable of interest, and that the prevalence of STIs are small among pregnant population when compared to the overall population, power sample calculations were performed. This was done to determine if the samples for this study are large enough to provide statistically significant and scientifically meaningful results. For power sample calculations see Appendix B, Table B1. For descriptive statistics see Appendix C, Tables C1, C2, C3 and C4.

The "Mother's Race/Hispanic Origin" variable on birth certificate data distinguishes individuals who report being of Latina origin and provides place of origin (e.g., Mexico, Puerto Rico, Cuba, etc.). Similarly, individuals reporting to be White and Black are categorized as being of Hispanic or non-Hispanic origin. Thus, these recommendations for collecting data allow for more reliable data in regards to race and ethnicity, especially when studying specific subgroup samples.

To test hypotheses, a logistic regression model is employed to determine the likelihood of having an STI present or treated during pregnancy. Delgado et al. (2008) provide a model to test acculturation difference of the risk behavior of needle sharing among native-born and island-born Puerto Rican injection drug users. Likelihood of needle sharing was used as the dependent variable. The present study employs a similar model using STI diagnosis as the dependent variable to predict health outcomes across the three groups.

The dependent variable for the logistic regression, STI, is infection(s) present or treated during pregnancy, where one or any combination of chlamydia, gonorrhea, syphilis, Hepatitis B, Hepatitis C = 1; otherwise = 0. Thus, the STI (dependent) variable for the logistic regression is a binary outcome, where subject is or is not diagnosed as having an STI(s).

The control variables for the logistic regression model are also dichotomous. This allows comparison of results by social location – that is, comparing odd ratios of where subjects are

located based on their categorical/ social location (e.g., comparing subjects' likelihood of having an STI present or treated during pregnancy based on their age group, educational attainment, marital status, etc.). Stata/SE 13.1 statistical software is used for the analyses.

Results

Descriptive summary results (see Appendix C, Tables C1, C2, C3 and C4) show that Mexican women have the lowest levels of education when compared to Whites and Blacks; this is also a consistent pattern found within Latina paradox studies. According to US birth certificate data, Mexican women have the largest percentage of "less than high school education" and the lowest percentage of "bachelor's degree and beyond" for years 2009-2012 when compared to Whites and Blacks. A second finding is the rising percentages of women of Mexican origin reported to have chlamydia. Starting in 2009, the prevalence of chlamydia diagnoses among pregnant women increased steadily from 1.38% in 2009 to 1.71% in 2012 for Mexican women. It is uncertain at this point if the increase in chlamydia cases for birth-giving Mexican women is due to an outbreak in chlamydia (see Appendix C, Tables C1, C2, C3 and C4), an increase in reported cases due to more data being collected by states, or the quality and/ or increase of data from 2009-2012. Whatever the case may be, the increase in reported cases of chlamydia increased the gap in prevalence of STIs among pregnant Mexican and White populations.

Results of the logistic regression analyses (see Table 2, next page) show that being married decreases likelihood of having an STI present or treated during pregnancy, controlling for other variables. Odds ratios ranged from 0.367 to 0.391 for years 2009-2012. Likelihood of having an STI present or treated during pregnancy decreases for women aged 30 years and beyond. Whereas for women who are 24 years and younger, the odds increase. Women aged between 15-19 years had the highest odds in the likelihood of having an STI present or treated during pregnancy (from 1.739 to 1.836 for years 2009-2012). Women aged 25-29 served as the reference group.

Higher educational attainment was found to be inversely associated with likelihood of having a STI present or treated during pregnancy among birth-giving women; these results were expected. For the years 2009-2012, utilizing high school attainment as the reference group, data indicates that having some college or associate degree in educational attainment decreases the likelihood of having an STI present or treated during pregnancy (from 0.782 to 0.799); a bachelor's degree decreases the likelihood (from 0.366 to 0.403), and a master's and beyond is associated with a much lower likelihood of having an STI present or treated during pregnancy (from 0.276 to 0.326). Women who report an educational attainment level of 9^{th} to 12^{th} grade, who do not graduate from high school or who receive a GED are more likely to have an STI present or treated during pregnancy, with odds ratios ranging from 1.206 to 1.225, holding other variables constant.

Odds ratio results for first prenatal care visit taking place during the first to third trimester show that women deferring their first prenatal visit for the third trimester had a higher likelihood of having an STI present or treated during pregnancy, ranging from 2.022 to 1.614 for years 2009-

2012 when compared to not having a prenatal care visit, all else equal. Women having their first prenatal visit during the first trimester of their pregnancy had a lower likelihood of having an STI present or treated during pregnancy; odds ratios ranged from 1.076 to 1.353.

Table 2. Results of Logistic Regressions: Likelihood of Having a STI Present or Treated During Pregnancy Using 2009-2012 Birth Certificate Records

	2009 N=2,324,026		2010 N=2,578,674		2011 N=2,827,651		2012 N=2,891,300	
Independent Variables	**Odds Ratio**	**Std. Error**	**Odds Ratio**	**Std. Error**	**Odds Ratio**	**Std. Error**	**Odds Ratio**	**Std. Error**
Marital Status (1=Yes)	0.391 ***	0.005	0.387 ***	0.005	0.373 ***	0.004	0.367 ***	0.004
Education (1=Yes)								
8th Grade or Less	1.031	0.025	0.957	0.023	1.000	0.023	0.971	0.023
9th-12th/No Diploma	1.245 ***	0.015	1.206 ***	0.013	1.211 ***	0.013	1.225 ***	0.013
HS/GED (ref)								
Some Coll./Assoc. Deg.	0.789 ***	0.010	0.799 ***	0.009	0.787 ***	0.008	0.782 ***	0.008
Bachelor's Degree	0.403 ***	0.011	0.384 ***	0.009	0.367 ***	0.008	0.366 ***	0.008
Master/Dr/Prof. Deg.	0.326 ***	0.014	0.301 ***	0.012	0.295 ***	0.011	0.276 ***	0.010
Unknown	0.889 *	0.044	0.798 ***	0.040	0.887 **	0.041	0.895 **	0.040
Age (1=Yes)								
Under 15 Years	1.672 ***	0.135	1.760 ***	0.133	1.603 ***	0.123	1.602 ***	0.124
15-19 Years	1.739 ***	0.026	1.797 ***	0.025	1.836 ***	0.024	1.795 ***	0.023
20-24 Years	1.478 ***	0.019	1.527 ***	0.018	1.537 ***	0.017	1.515 ***	0.016
25-29 Years (ref)								
30-34 Years	0.773 ***	0.014	0.747 ***	0.013	0.758 ***	0.012	0.756 ***	0.011
35-39 Years	0.704 ***	0.018	0.668 ***	0.016	0.675 ***	0.015	0.647 ***	0.014
40-44 Years	0.658 ***	0.033	0.685 ***	0.031	0.694 ***	0.029	0.655 ***	0.027
45 and Above	0.674 *	0.124	0.924	0.135	0.723 *	0.111	0.723 *	0.106
First Prenatal Visit (1=Yes)								
1st Trimester	1.353 ***	0.033	1.274 ***	0.028	1.103 ***	0.025	1.076 ***	0.022
2nd Trimester	1.821 ***	0.045	1.693 ***	0.039	1.435 ***	0.033	1.390 ***	0.030
3rd Trimester	2.022 ***	0.057	1.906 ***	0.050	1.618 ***	0.042	1.614 ***	0.039
No Prenatal Care	1.096 *	0.044	1.081 *	0.040	0.976	0.035	0.963	0.033
Unknown (ref)								
Race/Ethnicity (1=Yes)								
White (ref)								
Mexican	0.643 ***	0.009	0.655 ***	0.009	0.682 ***	0.009	0.694 ***	0.009
Black	2.291 ***	0.024	2.209 ***	0.022	2.192 ***	0.020	1.997 ***	0.018
LR chi2(20)	53025.42***		62950.71***		74185.72***		76080.08***	

Note: Excludes reported unknown cases or no information on STI present or treated during pregnancy.
Source: NCHS Vital Statistics 2009-2012.
* p<.05; **p<.01 ***p<.001

Results mentioned above were expected based on existing literature and current STI rates across the three groups. The major findings resulting from the logistic regression models that estimate likelihood of having an STI present or treated during pregnancy by race/ ethnicity found unanticipated results, which do not follow general demographic trends. These results, however, do align with those found within the Latina paradox. Results show that consistently, Mexican women are 0.643, 0.655, 0.682, and 0.694 times less likely than Whites to have an STI present or treated during pregnancy for years 2009-2012, holding all other variables constant (results are significant with p values less than .001). Furthermore, results of the logistic regression model for years 2009-2012 show that Black women have higher odds than Whites of having an STI present or treated during pregnancy by 2.291, 2.209, 2.192, and 1.997 times. Results of the logistic regression support hypothesis H1. Hypothesis H2, however, is rejected, which states that Mexican women are more likely to have an STI present or treated during pregnancy when compared to their White counterparts, controlling for SES and other demographic variables; results of the logistic regression show otherwise, at least for birth-giving women of Mexican origin for years 2009-2012.

To ensure no issues of multicollinearity are found in the models, Variance Inflation Factor (VIF) analyses were performed (see Appendix D, Table D1). All VIF values are less than 10. Collinearity is not a concern in the models. The mean VIF scores range from 1.72 to 1.88 for years 2009-2012 data.

Discussion, limitations and future research

For four decades, the Latina paradox has persistently posited that Latinas, despite having low levels of SES, have been found to have unanticipated favorable health outcomes when compared to their White and Black counterparts. Some of these outcomes include low rates of infant mortality, LBW and PTB. While the Latina paradox continues to perplex researchers, continuing research seeks to expose all possible elements with the hope to more appropriately understand and explain the phenomenon. New emerging research has considered possible elements, such as stress and mental health, that have extended the reach of the Latina paradox. Unraveling the Latina paradox carries important health policy implications, especially for women with low levels of SES. A possible route at unravelling the Latina paradox is to determine the breadth or reach of the paradox. Continuing research in the Latina paradox benefits from exposing all possible elements that could help unravel this phenomenon. The present study has attempted to expose a new potential element by considering STI diagnosis among birth-giving women.

Results of this study show unexpectedly, and much like Teller and Clyburn in 1974, that Mexican women are less likely to have an STI present or treated during pregnancy when compared to their White and Black counterparts. These unanticipated findings parallel other findings within the Latina paradox, such as unanticipated birth outcomes among Latinas (e.g., LBW, PTB, infant mortality). The present study suggest, via future research on STIs, that the breadth of the Latina paradox could be extended to include STIs among birth-giving women in the US.

Determining an explanation as to why Mexican-origin women are less likely to have an STI present or treated during pregnancy when compared to their White and Black counterparts is beyond the scope of this study. However, results from this study certainly raise questions for future research in this area. Future research to explain these unanticipated results is necessary and could yield very interesting findings that might propel new areas of research.

A limitation to the present study is the absence of nativity data. Current policies by NCHS do not allow for the use of nativity data from birth certificate records. This study also did not intend and/ or attempt to test hypotheses used in the Latina paradox. And while this may be seen as a limitation, data analysis alone was a necessary first step in confirming the existence of an unanticipated pattern of health outcome across race and ethnicity. Results of this study serve as a preparatory step for future research. This study, however, does set up the process for testing hypotheses commonly used in the Latina paradox, specifically the Health of Migrants, Protective Measures, and Data Artifacts hypotheses. Future research testing these hypotheses would provide a more proper test and fit if the unanticipated results from this study can be explain partially or totally using the Latina paradox hypotheses. STI morbidity has not been considered within the Latina paradox as differences in this health outcome have not been observed. This study is the first step towards an area that merits more research. A series of future research in this area will determine if the Latina paradox should be extended to include STIs.

As is common with the use of secondary data, results of this study are limited to data for years 2009-2012. Nevertheless, the pattern of major findings of unanticipated results (i.e., likelihood of STI present or treated during pregnancy) in the data remains consistent with those found in the Latina paradox. In addition, using birth certificate records which provide data for all births in the US is generalizable at least to all birth-giving women of the three comparative groups. Furthermore, future research using these national level data beyond 2012 should provide just as robust, if not more robust, results to those of 2012 as more states implement the 2003 revision for reporting on the standard certificate of live births. The data used in this study would benefit from the use of new and additional data found in birth certificate records from future years to further explore and expose new elements that may bring clarity to the data artifacts hypothesis of the Latina paradox.

The use of reported STIs from birth certificate records may be seen as a limitation as these data only represent the birth-giving population. To incorporate these results and analytical approach to the general population, at this time, is restricted, as STI data from the general population is collected and kept by the CDC. Thus, additional research incorporating the use of STI counts for the general population is likely to remain as 'in-house research' by the CDC. Given these restrictions, data on reported STIs from birth certificate records are the best available data to use at the national level. It should be noted, however, that data on birth certificates does not include women who may have refused to be screened for STIs. While screening for some STIs is required (e.g., HIV, syphilis and Hepatitis B), screening for other STIs (e.g. gonorrhea and chlamydia) is only recommended. The number of women who turn down "recommended" screening is uncertain.

The strong association between women who deferred their first prenatal visit until the third trimester, and the increased odds of having the presence or treatment of an STI is concerning. These results promote further policy implications for early screening to reverse this trend as maintenance of STIs and treatment is readily available to avoid adverse pregnancy outcomes if screenings are done in the early stages of pregnancy. Future research should provide policy implications to promote continuing policies of STI screenings during pregnancy.

Finally, given the link between STIs and morbidity health outcomes at the individual level (e.g., infertility and cancer), and those affecting fetuses during and after pregnancy (e.g., IUGR, LBW, PTB), the strong association found in this study between deferred prenatal visits and STIs may expose a link between STIs and adverse birth outcomes in the Latina paradox, such as LBW and PTB. While it is enticing to consider the link between STIs and the aforementioned health outcomes, it is important to determine if there are unanticipated outcomes, such as lower prevalence and/ or likelihood of STIs among Latinas first, specifically among Mexican-origin women when compared to their White and Black counterparts.

Future research may indeed show STIs as a missing link and serve as an explanatory factor within the Latina paradox with respect to birth and other health/ morbidity outcomes. Birth outcomes can be used as the dependent variable(s). A suggested place to start would be women who report to have an STI present or treated during pregnancy and who have their first prenatal visit during the third trimester.

Conclusion

The positive association between SES and health has long been established and posits that having or attaining higher levels of SES can bridge the gap to better health. Still, there have been noted exceptions. Some of these exceptions have consistently been found among Latinas, especially those of Mexican origin. Given their lower levels of SES, such as educational attainment, when compared to their White and Black counterparts, it would be expected that they would also have disadvantaged health outcomes. Repeatedly, however, this group has unexpectedly had health *advantages* comparable to Whites who continue to have higher levels of SES attainment – this is the paradox. Unravelling the mystery of the Latina paradox has significant implications for improved health for the overall populations. If the reasons behind the Latina paradox can be explained, it is possible that similar populations who also have fewer opportunities to enhance their SES could benefit. Additionally, if further research in the Latina paradox can expose the elements which cause it, these findings may lead to policy change that would improve health outcomes for all populations.

This study exposes a potential element of health outcome (STIs) that may, when thoroughly considered, extend the breadth of the Latina paradox. Given the existing literature on the correlation between SES and STI contraction and transmission, women of Mexican origin, given their likelihood of having the lowest levels of SES and likelihood to live in disadvantaged

neighborhoods, are expected to have the highest odds of contracting an STI when compared to Whites and Blacks. However, results of this study found that Mexican-origin women are significantly *less* likely to have an STI present or treated during pregnancy when compared to Whites and Blacks – a finding that parallels other unanticipated health outcomes commonly found within the Latina paradox (e.g. infant mortality, LBW and PTB).

The present study has policy implications, suggesting that STI screenings should be performed, especially during the first trimester of pregnancy. With respect to prenatal care, results of the study found that women deferring their first prenatal visit until the last trimester of their pregnancy had the highest odds of having an STI present or treated during pregnancy when compared to women who had their first prenatal visit during the first and second trimester. Ideally this trend should be reversed to allow for time and proper treatment of STIs in order to avoid adverse maternal and neonatal health outcomes. Results of the study provide support for continuance of programs that focus on the importance of STI screening. In addition, there is support for continuance and, where necessary, implementation of programs that focus on STI prevention, especially for at-risk populations such as the underserved. With regard to family planning, results of the study provide evidence for the need of preconception and interconception screenings of STIs across all populations.

Within the broader context of the Latina paradox, the present study sets the platform for future investigations that attempt to determine if the unanticipated results found in the study can be explained partially or totally by hypotheses within the Latina paradox. While providing a necessary first step for future research related to STIs, the study also fills a gap in the Latina paradox relating to maternal health, providing evidence that within the US, birth-giving women of Mexican origin, controlling for SES and other demographic variables, are less likely to have an STI present or treated during pregnancy than both their White and Black counterparts.

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APPENDIX A

Table A1. Total Size of Samples by Race, Ethnicity and Year with Reported Information on STIs from US Birth Certificate Records, 2009-2012

	2009	2010	2011	2012
Mexican Sample (N)				
Total number of birth certificates	651,384	604,620	572,948	562,250
Birth certificates reporting on education, prenatal care, and STIs (n)	522,974	530,296	521,847	513,974
Percentage of birth certificates removed from sample[a]	19.71%	12.29%	8.92%	8.59%
Frequency and (percentage) of cases reporting "unknown/not stated" in STI variables[b]	1,672 (0.32%)	1,750 (0.33%)	1,108 (0.21%)	914 (0.18%)
White Sample (N)				
Total number of birth certificates	2,213,030	2,163,096	2,147,243	2,134,726
Birth certificates reporting on education, prenatal care, and STIs (n)	1,439,764	1,621,590	1,822,870	1,874,167
Percentage of birth certificates removed from sample[a]	34.94%	25.03%	15.11%	12.21%
Frequency and (percentage) of cases reporting "unknown/not stated" in STI variables[b]	8,717 (0.6%)	7,273 (0.45)	9,383 (0.51%)	6,731 (0.36)
Black Sample (N)				
Total number of birth certificates	609,787	590,081	582,593	583,758
Birth certificates reporting on education, prenatal care, and STIs (n)	361,288	426,788	482,934	503,159
Percentage of birth certificates removed from sample[a]	40.75%	27.67%	17.11%	13.81%
Frequency and (percentage) of cases reporting "unknown/not stated" in STI variables[b]	6,569 (1.79%)	5,683 (1.31%)	5,687 (1.16%)	4,557 (0.90%)
Total combined sample size for data (n)	**2,324,026**	**2,578,674**	**2,827,651**	**2,891,300**

Note: [a]Includes reported "unknown/not reported" cases of STIs.

[b]Frequencies are from birth certificates reporting infromation on STIs.

Source: NCHS Vital Statistics 2009-2012.

APPENDIX B

Table B1. Power Sample Calculations for Subgroup Sample Populations Using Summary Statistics from STI Variable, 2009-2012 US Birth Certificate Records

	Power	N	N1	N2	N2/N1	delta	m1	m2	sd1	sd2
2009										
Mexican/White	0.86	1,962,738	522,974	1,439,764	2.7530	-0.0006	0.0153	0.0147	0.1229	0.1202
Mexican/Black	1.00	884,262	522,974	361,288	0.6908	0.0426	0.0153	0.0579	0.1229	0.2336
2010										
Mexican/White	0.99	2,151,886	530,296	1,621,590	3.0579	-0.001	0.0161	0.0151	0.1258	0.1218
Mexican/Black	1.00	957,084	530,296	426,788	0.8048	0.0424	0.0161	0.0585	0.1258	0.2346
2011										
Mexican/White	1.00	2,344,717	521,847	1,822,870	3.4931	0.0433	0.0174	0.0607	0.1309	0.2388
Mexican/Black	1.00	1,004,781	521,847	482,934	0.9254	-0.0021	0.0174	0.0153	0.1309	0.1226
2012										
Mexican/White	1.00	2,388,141	513,974	1,874,167	3.6464	-0.0027	0.019	0.0163	0.1367	0.1266
Mexican/Black	1.00	1,017,133	513,974	503,159	0.9790	0.0404	0.019	0.0594	0.1367	0.2363

Note: Alpha level is 0.05.

Note: Power sample calculations use sample size (N, N1, N2), mean (m1, m2), and standard deviation (sd1, sd2) for each subsample. with significant level of .05

Note: Samples exclude unknown and/or not reported cases of STIs.

Source: NCHS Vital Statistics 2009-2012.

Summary statistic results for means and standard deviations, as well as sample sizes for the STI variable by race/ethnicity are used for the power sample calculations. Estimated power is calculated for two-sample means, using Sattertwhaite's t-test and assuming unequal variances where Ho: m2 equals m1 versus Ha: m2 not equal m1.

The 2009 power sample calculation between the White and Mexican subsamples yielded a power calculation of .86. For 2010, the power sample calculation between the White and Mexican subsamples yielded a .99 power calculation. All other subsample calculations between subgroups yielded a score of 1.00. Data for all subgroups are large enough to provide statistical significance and provide scientifically meaningful results.

APPENDIX C

Table C1. Descriptive Results by Race and Ethnicity, US Birth Certificate Data 2009 (N=2,324,026)

Variables	Mexican		Whites		Blacks	
	N	%	N	%	N	%
	522,974	22.50	1,439,764	61.95	361,288	15.55
Marital Status						
Yes	256,631	49.07	1,016,639	70.61	100,125	27.71
No	266,343	50.93	423,125	29.39	261,163	72.29
Age						
Under 15 Years	1,156	0.22	658	0.05	958	0.27
15-19 Years	74,669	14.28	105,282	7.31	57,133	15.81
20-24 Years	145,199	27.76	326,643	22.69	113,141	31.32
25-29 Years	141,073	26.98	430,912	29.93	91,483	25.32
30-34 Years	100,102	19.14	360,824	25.06	59,638	16.51
35-39 Years	49,605	9.49	173,431	12.05	30,786	8.52
40-44 Years	10,634	2.03	38,830	2.70	7,612	2.11
45-49 Years	522	0.10	2,932	0.20	505	0.14
50-54 Years	14	0.00	252	0.02	32	0.01
Education						
8th Grade or Less	90,786	17.36	20,965	1.46	6,678	1.85
9th-12th/No Diploma	151,579	28.98	133,802	9.29	73,036	20.22
HS/GED (ref)	151,989	29.06	342,659	23.80	120,787	33.43
Some Coll./Assoc. Deg.	87,895	16.81	439,387	30.52	111,128	30.76
Bachelor's Degree	25,626	4.90	326,365	22.67	30,758	8.51
Master/Dr/Prof. Deg.	8,379	1.60	166,019	11.53	14,205	3.93
Unknown	6,720	1.28	10,567	0.73	4,696	1.30
Prenatal Care (Month Began)						
1st to 3rd Month	324,384	62.03	1,075,687	74.71	204,001	56.46
4th to 6th Month	129,993	24.86	252,049	17.51	92,372	25.57
7th to Final Month	32,913	6.29	49,125	3.41	24,002	6.64
No Prenatal Care	14,894	2.85	13,655	0.95	11,159	3.09
Unknown or Not Stated	20,790	3.98	49,248	3.42	29,754	8.24
Present or Treated Infections (STIs)						
Gonorrhea						
Yes	541	0.10	1,918	0.13	3,738	1.03
No	522,433	99.90	1,437,846	99.87	357,550	98.97
Syphilis						
Yes	194	0.04	339	0.02	665	0.18
No	522,780	99.96	1,439,425	99.98	360,623	98.82
Chlamydia						
Yes	7,199	1.38	15,668	1.09	17,309	4.79
No	515,775	98.62	1,424,096	98.91	343,979	95.21
Hepatitis B						
Yes	207	0.04	993	0.07	1,188	0.33
No	522,767	99.96	1,438,771	99.93	360,100	99.67
Hepatitis C						
Yes	255	0.05	3,457	0.24	444	0.12
No	522,719	99.95	1,436,307	99.76	360,844	99.88

Source: NCHS Vital Statistics 2009

Table C2. Descriptive Results by Race and Ethnicity, US Birth Certificate Data 2010 (N=2,578,674)

Variables	Mexican		Whites		Blacks	
	N	%	N	%	N	%
	530,296	20.56	1,621,590	62.88	426,788	16.55
Marital Status						
Yes	258,345	48.72	1,146,159	70.68	118,272	27.71
No	271,951	51.28	475,431	29.32	308,516	72.29
Age						
Under 15 Years	1,084	0.20	741	0.05	1,101	0.26
15-19 Years	71,593	13.50	109,133	6.73	63,431	14.86
20-24 Years	143,605	27.08	352,860	21.76	134,261	31.46
25-29 Years	143,092	26.98	489,257	30.17	106,281	24.90
30-34 Years	105,009	19.80	426,207	26.28	74,241	17.40
35-39 Years	53,563	10.10	194,989	12.02	37,150	8.70
40-44 Years	11,783	2.22	44,987	2.77	9,584	2.25
45-49 Years	549	0.10	3,160	0.19	687	0.16
50-54 Years	18	0.00	256	0.02	52	0.01
Education						
8th Grade or Less	85,724	16.17	23,090	1.42	7,353	1.72
9th-12th/No Diploma	150,784	28.43	141,421	8.72	82,543	19.34
HS/GED (ref)	154,815	29.19	367,363	22.65	138,808	32.52
Some Coll./Assoc. Deg.	95,222	17.96	496,953	30.65	136,080	31.88
Bachelor's Degree	27,999	5.28	379,660	23.41	38,507	9.02
Master/Dr/Prof. Deg.	9,212	1.74	203,001	12.52	19,026	4.46
Unknown	6,540	1.23	10,102	0.62	4,471	1.05
Prenatal Care (Month Began)						
1st to 3rd Month	341,220	64.35	1,227,639	75.71	246,065	57.66
4th to 6th Month	127,867	24.11	272,560	16.81	106,471	24.95
7th to Final Month	30,677	5.78	52,708	3.25	27,313	6.40
No Prenatal Care	12,949	2.44	14,899	0.92	12,216	2.86
Unknown or Not Stated	17,583	3.32	53,784	3.32	34,723	8.14
Present or Treated Infections (STIs)						
Gonorrhea						
Yes	566	0.11	2,116	0.13	4,427	1.04
No	529,730	99.89	1,619,474	99.87	422,361	98.96
Syphilis						
Yes	196	0.04	382	0.02	799	0.19
No	530,100	99.96	1,621,208	99.98	425,989	99.81
Chlamydia						
Yes	7,687	1.45	17,653	1.09	20,738	4.86
No	522,609	98.55	1,603,937	98.91	406,050	95.14
Hepatitis B						
Yes	194	0.04	1,229	0.08	1,401	0.33
No	530,102	99.96	1,620,361	99.92	425,387	99.67
Hepatitis C						
Yes	285	0.05	4,497	0.28	550	0.13
No	530,011	99.95	1,617,093	99.72	426,238	99.87

Source: NCHS Vital Statistics 2010

Table C3. Descriptive Results by Race and Ethnicity, US Birth Certificate Data 2011 (N=2,827,651)

Variables	Mexican		Whites		Blacks	
	N	%	N	%	N	%
	521,847	18.46	1,822,870	64.47	482,934	17.08
Marital Status						
Yes	253,456	48.57	1,291,750	70.86	133,971	27.74
No	268,391	51.43	531,120	29.14	348,963	72.26
Age						
Under 15 Years	923	0.18	738	0.04	1,112	0.23
15-19 Years	65,417	12.54	109,094	5.98	65,143	13.49
20-24 Years	138,947	26.63	383,251	21.02	153,678	31.82
25-29 Years	141,238	27.07	553,396	30.36	122,192	25.30
30-34 Years	107,020	20.51	502,119	27.55	86,860	17.99
35-39 Years	55,200	10.58	219,453	12.04	42,204	8.74
40-44 Years	12,484	2.39	51,171	2.81	10,919	2.26
45-49 Years	604	0.12	3,376	0.19	746	0.15
50-54 Years	14	0.00	272	0.01	80	0.02
Education						
8th Grade or Less	79,258	15.19	24,985	1.37	8,817	1.83
9th-12th/No Diploma	143,382	27.48	143,693	7.88	88,254	18.27
HS/GED (ref)	154,675	29.64	398,331	21.85	156,298	32.36
Some Coll./Assoc. Deg.	99,900	19.14	565,072	31.00	158,548	32.83
Bachelor's Degree	29,267	5.61	440,695	24.18	44,239	9.16
Master/Dr/Prof. Deg.	9,628	1.84	239,311	13.13	22,127	4.58
Unknown	5,737	1.10	10,783	0.59	4,651	0.96
Prenatal Care (Month Began)						
1st to 3rd Month	342,860	65.70	1,400,566	76.83	290,798	60.21
4th to 6th Month	125,786	24.10	299,120	16.41	121,356	25.13
7th to Final Month	29,036	5.56	58,574	3.21	31,143	6.45
No Prenatal Care	11,443	2.19	15,398	0.84	13,134	2.72
Unknown or Not Stated	12,722	2.44	49,212	2.70	26,503	5.49
Present or Treated Infections (STIs)						
Gonorrhea						
Yes	657	0.13	2,273	0.12	5,197	1.08
No	521,190	99.87	1,820,597	99.88	477,737	98.92
Syphilis						
Yes	235	0.05	473	0.03	977	0.20
No	521,612	99.95	1,822,397	99.97	481,957	99.80
Chlamydia						
Yes	8,119	1.56	20,008	1.10	24,203	5.01
No	513,728	98.44	1,802,862	98.90	458,731	94.99
Hepatitis B						
Yes	221	0.04	1,217	0.07	1,709	0.35
No	521,626	99.96	1,821,653	99.93	481,225	99.65
Hepatitis C						
Yes	319	0.06	5,424	0.30	632	0.13
No	521,528	99.94	1,817,446	99.70	482,302	99.87

Source: NCHS Vital Statistics 2011

Table C4. Descriptive Results by Race and Ethnicity, US Birth Certificate Data 2012 (N=2,891,300)

Variables	Mexican		Whites		Blacks	
	N	%	N	%	N	%
	513,974	17.78	1,874,167	64.82	503,159	17.40
Marital Status						
Yes	249,490	48.54	1,325,048	70.70	141,433	28.11
No	264,484	51.46	549,119	29.30	361,726	71.89
Age						
Under 15 Years	804	0.16	731	0.04	1,069	0.21
15-19 Years	61,034	11.87	103,553	5.53	60,865	12.10
20-24 Years	136,983	26.65	388,125	20.71	160,787	31.96
25-29 Years	138,841	27.01	565,912	30.20	129,135	25.66
30-34 Years	106,726	20.76	531,492	28.36	93,595	18.60
35-39 Years	55,829	10.86	229,274	12.23	45,047	8.95
40-44 Years	13,103	2.55	51,345	2.74	11,737	2.33
45-49 Years	634	0.12	3,446	0.18	859	0.17
50-54 Years	20	0.00	289	0.02	65	0.01
Education						
8th Grade or Less	71,294	13.87	25,090	1.34	8,551	1.70
9th-12th/No Diploma	134,137	26.10	138,949	7.41	86,335	17.16
HS/GED (ref)	156,414	30.43	401,841	21.44	163,632	32.52
Some Coll./Assoc. Deg.	105,035	20.44	583,977	31.16	167,930	33.38
Bachelor's Degree	30,704	5.97	458,277	24.45	47,238	9.39
Master/Dr/Prof. Deg.	10,278	2.00	256,103	13.66	24,566	4.88
Unknown	6,112	1.19	9,930	0.53	4,907	0.98
First Prenatal Visit (Month)						
1st to 3rd Month	340,567	66.26	1,434,681	76.55	303,403	60.30
4th to 6th Month	120,122	23.37	304,581	16.25	124,676	24.78
7th to Final Month	28,403	5.53	61,450	3.28	33,240	6.61
No Prenatal Care	11,049	2.15	15,653	0.84	13,296	2.64
Unknown or Not Stated	13,833	2.69	57,802	3.08	28,544	5.67
Present or Treated Infections (STIs)						
Gonorrhea						
Yes	748	0.15	2,428	0.13	5,288	1.05
No	513,226	99.85	1,871,739	99.87	497,871	98.95
Syphilis						
Yes	184	0.04	466	0.02	1,091	0.22
No	513,790	99.96	1,873,701	99.98	502,068	99.78
Chlamydia						
Yes	8,765	1.71	21,629	1.15	24,439	4.86
No	505,209	98.29	1,852,538	98.85	478,720	95.14
Hepatitis B						
Yes	247	0.05	1,325	0.07	1,888	0.38
No	513,727	99.95	1,872,842	99.93	501,271	99.62
Hepatitis C						
Yes	344	0.07	6,474	0.35	768	0.15
No	513,630	99.93	1,867,693	99.65	502,391	99.85

Source: NCHS Vital Statistics 2012

APPENDIX D

Table D1. Variance Inflation Factor Results for Logistic Regression Models

	Variance Inflation Factor			
Variable	**2009**	**2010**	**2011**	**2012**
1st Trimester	5.38	5.44	6.80	6.17
2nd Trimester	4.63	4.69	5.83	5.28
3rd Trimester	1.98	1.97	2.26	2.14
Bachelor's Degree	1.65	1.70	1.74	1.76
Some Coll./Assoc. Deg.	1.56	1.59	1.61	1.62
20-24 Years	1.53	1.53	1.52	1.52
Master/Dr/Prof. Deg.	1.43	1.48	1.52	1.55
Married	1.46	1.48	1.48	1.48
30-34 Years	1.43	1.44	1.45	1.46
No Prenatal Care	1.38	1.36	1.44	1.39
9th-12th/No Diploma	1.44	1.44	1.42	1.39
15-19 Years	1.47	1.45	1.41	1.38
35-39 Years	1.27	1.27	1.27	1.28
Mexican	1.31	1.29	1.27	1.25
8th Grade or Less	1.25	1.23	1.21	1.19
Black	1.19	1.20	1.19	1.19
40-44 Years	1.07	1.07	1.07	1.07
Unknown Education	1.03	1.03	1.03	1.03
Under 15 Years	1.02	1.02	1.01	1.01
45 and Above	1.01	1.01	1.01	1.01
Mean VIF	1.72	1.73	1.88	1.81

Note: High school/GED, 25-29 Years, Unknown Prenatal Care, and White serve as reference groups.
Source: NCHS Vital Statistics 2009-2012

Variance Inflation Factor (VIF) analyses were performed to ensure no issues of multicollinearity are found in the models. Results of the VIF diagnostics are shown above (Appendix D, Table D1). All VIF values are less than 10. Colinearity is not a concern in the models. Highest VIF value is 6.80 under "1st Trimester," representing the first prenatal care visit within a trimester found in the 2011 data. First (1st) Trimesters consistently have the higher VIF value, albeit well below a value of 10, of all variables of interest. The second highest VIF values are followed by "2nd Trimester"

and "3rd Trimesters," again, well under the desired value of 10. The mean VIF scores range from 1.72 to 1.88 for years 2009-2012 data.

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