

THE PATTERNING OF SEXUAL VIOLENCE AGAINST WOMEN IN US CITIES AND COUNTIES

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Sexual violence against women is a global public health concern; yet determining its patterning is still largely understudied. Previous research has been useful in identifying key contributors of sexual violence, including the adult sex ratio, which is the ratio of adult men to adult women in a population, as well as elements of gender inequality. However, a more comprehensive and place-based understanding of sexual violence is still needed. Data from the U.S. Census and the National Incident Based Reporting System were used to explore the patterning of sexual violence against women in cities and counties in the United States. Through the use of generalized linear mixed models, the data were analyzed to assess the individual and joint impact that sex ratio and gender inequality have on sexual violence. The results indicated a positive association between both imbalanced sex ratios and gender inequality on sexual violence. Furthermore, models considering the two variables jointly were found to best fit the data, highlighting the benefits of including both for a more comprehensive understanding of

sexual violence against women. The hope is that this research can assist in efforts to both better quantify and diminish rates of sexual violence against women.

THE PATTERNING OF VIOLENCE AGAINST WOMEN IN US CITIES AND
COUNTIES

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CHAPTER ONE:

Introduction

Overview

Violence against women is a persistent, cross cultural feature of societies that has long been recognized as a public health concern (Avakame 1999; Titterington 2006; Amaral and Bhalotra 2017). Current estimates indicate that one in three women will experience sexual violence, yet these cases are among the most underreported crimes, suggesting that the official statistic is a conservative estimate (Smith et al, 2017). However, with the data available from national sources such as the US Census and the National Incident Based Reporting System, it is possible to gain a better understanding of the patterning of factors that contribute to sexual violence. This project will use these two data sources to examine the role the demographic structure of men and women and gender inequality have on the rate of sexual violence against women in populations across the United States.

Intellectual Merit

Despite decades of research on sexual violence against women, there is still considerable uncertainty about its patterning (Messner and Sampson 1991; Barber 2000; Schacht, Rauch and Mulder 2014). This is likely driven by two main factors. 1) Research into sexual violence against women is often concentrated on a single or few variables. While univariate or bivariate analyses have been beneficial in identifying potential drivers of sexual violence against women, the approach fails to account for the multidimensional nature of the behavior. 2) Sexual violence research often focuses on large-scale aggregations of population-level data at the national level,

which does not provide appropriate resolution for determining individual motivation (Trent and South 2012).

While there are many moving parts to the study of sexual violence against women, increasingly recognized is the influence of place on behavior (Barber 2000). Variation in place-based patterning can be a result of differing drivers of social behavior, including cultural norms and community structure. The United States contains a broad range of different cultural regions due to variation in settlement and migration patterns, subsistence, geography, and environment (Meinig 1978; Fischer 1989). For example, in the United States, differing social norms between northern and southern states have been linked to patterns of settlement by Europeans who brought differing economic and social structures with them as they immigrated (Nisbett and Cohen 1996). Accordingly, while previous research has been useful in identifying key contributors to sexual violence against women to gain an accurate understanding of its patterning, a more comprehensive and place-based understanding is needed. Anthropology provides an ideal disciplinary framework from which to study sexual violence against women because the field is structured to consider both biological and cultural aspects that affect the human condition.

Broader Impacts

There has been a surge of awareness regarding the victimization of women through public conversation generated by social media movements such as the #MeToo movement, coined by women's rights activist Tarana Burke (Guerra 2017). The movement is based on the desire to minimize both the frequency and negative impact that sexual harassment and abuse have on the lives of women. What first started as a United States movement has quickly spread

to other countries through its use of social media. This has both encouraged advocacy and allowed for greater public recognition of the magnitude at which sexual abuse against women occurs (Battaglia, Edley, and Newsom 2019). Thus, nuanced research on the topic of sexual violence against women may allow for the restructuring of the stigma associated with victimization and help to better document its prevalence. The following chapters will focus on the literature surrounding the contributing factors previously associated with sexual violence against women and the predictions garnered from the literature. Then, a comprehensive explanation of the data and statistical approach will be presented in the following chapter. Lastly, the results of this study will be presented, followed by discussion and potential outlooks for future studies.

CHAPTER TWO:

Background

Sex Ratio and Violence

The demographic structure of a population has been shown to impact the behavior of individuals within and across societies. Specifically, the discrepancies between the number of men and women have been associated with the prevalence of certain behaviors, particularly violence (Barber 2000). The difference between men and women is quantified as a sex ratio, which is calculated as the ratio of men to women in a population. If there are more men in the population, the population is considered to be “male-biased”. Conversely, if there are more women in the population, the population is considered to be “female-biased”. There are several different ways to calculate the sex ratio; the primary sex ratio is calculated from time of conception and the secondary sex ratio is calculated from time of birth. When considering sexual violence, however, it is beneficial to use the tertiary sex ratio, as it measures the sex ratio from time of sexual maturation.

When studying the sex ratio, popular expectations have often assumed a positive association between the number of men and violence; specifically, that a numerical surplus of men relative to women creates a surplus of violence (Amaral and Bhalotra 2017). Statistically, men are by far more likely to be both the victims and perpetrators of violence across society (Schacht, Rauch, and Mulder 2014). The reasoning behind this phenomenon has been linked to both biological and cultural variables. The biological theory of crime suggests that violent behavior is linked to high levels of testosterone, which is a hormone associated with elevated risk-taking and competitive behavior across several animal taxa, primarily when males are competing over female mates (Newell 1999; 11; Hudson and den Boer 2004). The foundation for

this theory is rooted in extensive literature on some non-human primates; researchers have found that increased levels of testosterone can contribute to impulsiveness and aggressive behavior among males in relation to sexual access to females. (Higley et al. 1996; Eberhart, Keverne, and Meller 1980). Accordingly, because human males also have higher testosterone levels compared to women, men are expected to be more prone to committing violence, particularly in a sexual context.

While the sex ratio has been shown to be associated with violence, the relationship is more complex than simply an excess of men in a population equating to more violence. Most studies in recent years have attempted to determine which sex ratio is associated with sexual violence against women; male biased or female biased. However, the results have been inconclusive, with studies finding support for an elevation of sexual violence in both male and female biased sex ratios, challenging a straightforward understanding of the relationship between the two (Guttentag, M., & Secord 1983; Barber 2000; Titterington 2006; Trent and South 2012). Explanation for the variation in results suggests that it is not simply an excess of men that increases rates of sexual violence, but that there are also underlying behavioral motivations, driven by the sex ratio, that also play a role. Importantly, behavior is highly variable and flexible across individuals and place, which can further assist in explaining the variation in the results of previous studies. Becker (1974; 300) identifies that mating market theory relates relationship behavior to the availability of opposite sex partners in a society. Specifically, the theory postulates that the number of males and females in a population can be thought of as a mating market, operating through supply and demand economics. Mating market theory is focused around two elements: structural power and dyadic power. Structural power is associated with the political, economic, and legal systems and practices of a society rooted in the society's early

development and structuring (Guttentag and Secord 1983:26). Overall, many societies across the world have been predominately structured by men, and therefore societies have generally been structured around patriarchal fundamentals (Guttentag and Secord 1983:27-31). Therefore, mating market theory is robust enough to be applied cross-culturally due to the structural power generally being consistent enough to consider the effect the framework of dyadic power in patriarchal societies.

The sex ratio is key to determining who has dyadic power; that is, which sex can be more demanding in a mating market (Becker 1974; 327). For the populations in which the sex ratio is imbalanced, the rarer sex has more bargaining power and can leverage their scarcity to achieve their preferred relationship strategy, while the more common sex must cater to the preferences of the rare sex (Guttentag and Secord 1983: 21). Conventionally, when women are relatively rare, men focus their relationship and reproductive efforts on long term relationships and attempting to attract and maintain a single partner. However, when women are in excess, male preferences change in response, and they become much more likely to forgo a single long-term relationship to pursue multiple sexual partners (Schacht and Borgerhoff Mulder 2015).

As mentioned previously, an imbalance in the sex ratio, in either direction, has been associated with violence against women. In populations where women are in excess, rates of homicide, rape, assault, and sex offenses are all more common (Yost and Zurbriggen 2006; Schacht, Tharp, and Smith, 2016). One explanation for the increase in violence have been associated with the short-term male mating orientation seen when men are rare in a population. In the terms of mating market theory, when men are rare, there is an increase of non-committal sexual encounters due to men holding the dyadic power. Women who engage in non-committal sexual relationships are at an increased risk of exposure to violence, because having more sexual

partners increases the probability of encountering a sexually aggressive partner (Kanin 1988). An unrestricted sociosexual orientation, the preference for casual sexual encounters, has increasingly been associated with heightened risk of sexual violence, particularly on college campuses, where a majority of the studies have taken place (Adams and Forbes 2004; Flack et al 2007; Sutton and Simons 2016). Possible explanation for the increase in violence is that when women are in oversupply, men are able to be more sexually aggressive because the risk of not finding a partner is much lower.

However, in contradiction, a surplus of men has long been associated with a surplus in violence. A potential explanation for this is that men may similarly use violence in a reproductive context when women are rare. While an excess of men indicates an increase in the likelihood of men to engage in long term relationships with women, due to the limited number of women, partners may be difficult for men to find and maintain. Buss (2002: 23) notes that the robust research on mate guarding in the scientific literature, where males attempt to physically control a partner, posits that partner scarcity will incentivize males to engage in more violent means to maintain a partner. As the sex ratio becomes more male biased, intimate partner relationships are expected to be more abundant and partner scarcity for men increases. The combination of intimate partner mating preferences and increased partner scarcity can lead to keep and maintain a relationship once it is obtained. Thus, mate-guarding behavior can manifest particularly in intimate partner violence, as men may express violent behavior when attempting to keep their partner.

In congruence with the supply and demand economics in mating market theory, in places with more balanced sex ratios, there is less of a motivation for men to exhibit mate guarding behavior, because women are not in demand and there is less partner scarcity. At the same time,

there is less of an incentive for women to engage in non-committal sexual relationships, because men are not in demand either. Overall, the combined literature suggests that a sex ratio imbalance motivate behaviors that are drivers of sexual violence against women, such as mate guarding and sociosexuality, thus increasing rates of these crimes; while sex ratio parity lowers the rate.

Gender Stratification and Violence

While evidence suggests that sex ratios play an important role for the patterning of sexual violence against women across populations, it is also important to consider the pre-existing cultural norms governing the behavior of men and women within a society. Historically, power relationships between men and women have been unbalanced due to patriarchal and patrilineal aspects of social organization (Abeya, Afework, and Yalew 2011). Within patriarchal societies, women are expected to be subordinate to men. The sharp contrast between the values of the two genders can influence the social understandings of normalized and expected behaviors of each gender. For example, hegemonic masculinity defined by Connell (1995; 830-831) encapsulates the advocacy of men to engage in stereotypical masculine behavior. In the understanding of a modern male dominance framework, hegemonic masculinity suggests that males are encouraged to engage in behavior that reflects power, strength, and control; and violence can be a result of the manifestation of these behaviors (Collier 1998; 168). Furthermore, hegemonic masculinity perpetrates the social norms often seen in patriarchal societies that suggest not only that men should be powerful, but also that women should be subordinate to that behavior. These norms can impact the behavior of men, as Robinson (2005; 31) posits that men use violence when confronted with challenges to masculinity as a method of reconfirming the power associated with

being male. Similarly, Jewkes, Levin, and Penn-Kekana (2002) argue that men use violence to assert power to achieve and sustain the traditional masculine role postulated by hegemonic masculinity.

According to Gilbert (2002: 1274), societies with high rates of gender inequality often cause low self-worth among women because stereotypical male behaviors are seen as good traits while stereotypical female behaviors are often viewed as negative traits. The self-worth of many women in patriarchal societies is negatively impacted by the patriarchal views that suggest that traits such as assertiveness, intelligence, and power are important in society but that they are only attainable to men (Reskin 1988). Research conducted by Karakurt et al. (2014), which studied the impact that intimate partner violence can have on mental health, found that domestic abuse in particular is often associated with self-blame and low self-esteem on the part of the victim, and can result in women staying with abusive partners. Furthermore, the dichotomy between the ways in which men and women are viewed can further impact the understanding of sexual violence against women. For example, there is a popular “rape myth” that men are incapable of repressing sexual urges and it perpetuates the notion that sexually aggressive behavior is inherent to men while at the same time perpetrates that women sexuality is a flaw that can provoke violence.

Furthermore, social movements towards gender equality may be beneficial in combating high rates of violence against women. Many achievements that were once unattainable by women have become increasingly more common in modern societies. The amelioration hypothesis, in which a decrease in gender inequality is associated with a decrease in violence, suggests that the more equality women have in a society, the more capability women have to defend themselves from violence (Whaley and Messner 2002; Heirigs, and Moore 2018).

Studies have shown that the reduction of gender disparities in income, employment, and education have been associated with reduced frequencies of violence against women (Vieraitis, Britto, and Kovandzic 2007; Chon 2013). For example, a cross national study of female homicide victimization rates by Valdimarsdottir (2018; 100) found that both high rates of income inequalities and low rates of education and employment in a population were associated with an increase in female homicide victimization. Equally, several other cross-national studies have found that high rates of both female education and female employment are negatively associated with rates of sexual violence and physical violence, suggesting that women directly benefit from the availability of education and employment opportunities. (Yodanis 2004; Vieraitis, Britto, and Kovandzic 2007; Sen and Bolsoy 2017).

Societies that deny women access to education and employment can cause a woman to be less self-sufficient to the point where a woman is not able to financially advocate for her safety if violence were to occur (Jewkes, Levin, and Penn-Kekana 2002; Conner 2013). Furthermore, female autonomy, the freedom of women to promote self-interest, can play a large role in limiting exposure to violence against women (Pallitto and O'Campo 2004). Promoting self-interest is closely tied to the availability of education, employment, and income. Women who have access to these three variables often do not have to rely on others for basic needs, and in turn, have a higher chance of being able to leave a dangerous situation with some security (Golden, Perreira, and Durrance 2013). In particular, studies have shown that increased poverty is consistently positively associated with higher levels of rape, female homicide victimization, and intimate partner violence (Whaley 2001; Vest et al 2002; Valdimarsdóttir 2018). For example, Bailey (1999; 56) investigated determinates of forcible rape and found that the rate of rape in US cities was directly associated with the low socioeconomic status level of women.

However, an increase of gender equality is not always found to be linearly related with decreasing rates of sexual violence against women (Wilson and Daly 1998; Ackerson et al 2008, Sanz-Barbero et al 2015). The societal expectations of women in a given population can impact the acceptance of the shift towards gender equality. For example, women in societies that have traditionally had few women in education or in the workforce may experience an intense initial backlash that manifests in increased sexual violence against women; differing from societies in which female education and employment have become a norm. The backlash hypothesis suggests that an increase in female status, particularly where women have not had high status before, can result in sexual violence as an attempt at regaining male dominance (Russell 1975, Avakame 1999). In societies with previously limited gender equality, men are more likely to be threatened by women advancing in the workforce and educational sphere and an attempt can be made to maintain dominance through sexual violence against women (Whaley 2001; Heirigs, and Moore 2018). For example, some studies have found that an increase in female educational attainment and employment rates have specifically been associated with increased rape (Gartner, Baker, and Pampel 1990; DeWees and Parker 2003). In places such as the United States, female education and employment has increasingly become normative in certain locations but is still minimal in others. Heirigs and Moore (2018; 7-8) find that overall, in places where female employment has increasingly become normative, high rates of female employment are associated with lower rates sexual violence; thereby indicating that while there may be initial backlash to gender equality, changes in social norms over time result in a negative association between female social empowerment and sexual violence against women.

Summary

Based on the literature, there is confirmation that both sex ratio and gender inequality can be used as predictors of sexual violence in a community. Previous research has been mainly centered around attempts to understand whether male biased sex ratios or female biased sex ratios play the largest role in the perpetuation of sexual violence against women. However, since both sex ratio biases have been associated with increased sexual violence, there is a need to identify if the focus should instead be on comparing balanced and imbalanced sex ratios. The common measures of gender inequality have consistently been associated with sexual violence against women; however, when considering issues of interaction between the covariates of gender inequality as well as issues such as the backlash effect, a straightforward explanation of the association is difficult.

Additionally, previous studies have often focused on either sex ratio or gender inequality as the predictor to sexual violence against women. Since they both have been shown to impact sexual violence against women, it is beneficial to consider the two predictors jointly as well. Lastly, many of the studies have been cross-national or national studies. While large studies such as these can garner beneficial data, it is also important to consider the variation that can occur within a nation, as behavior can vary across geographical place. The research conducted for this study will hopefully assist in contributing and progressing the literature on the role both sex ratio and gender inequality have on sexual violence against women both when considering the predictors separately and collectively across the United States.

CHAPTER 3

Predictions

Based on the literature review, there are certain expectations for the effect of both the adult sex ratio and gender inequality on sexual violence against women. The first prediction is that as the sex ratio becomes more imbalanced in a population, the rate of sexual violence against women increases due to the effects of the relationship strategies held by the sex with dyadic power. Populations with a male biased sex ratio are expected to see an increase in sexual violence due to the increase of non-committal sexual encounters associated with higher levels of rape. Populations with a female biased sex ratio are expected to see an increase in sexual violence due to the increase of intimate relationships, in which higher rates of intimate partner violence can occur. To clarify, the prediction is that sexual violence against woman will be at its highest when the sex ratio is either highly male biased or highly female biased, and at its lowest when there is little to no discrepancy in the number of men compared to women.

Second, gender inequality is predicted to have a positive association with sexual violence against women. The perpetuation of gender inequality in a population results in lower female autonomy, as women are less able to promote their own self-interest. There is no single variable to depict gender inequality; however, inequality between the two sexes can be observed by analyzing elements of societal structure; such as lack of female education and employment, as well as high rates of poverty. Therefore, the predictions of gender inequality will be explored with these three variables.

The education and employment rates are expected to have a negative relationship with sexual violence against women; as the education rate and employment rate increase, the rate of sexual violence against women in a population is predicted to decrease as a result of higher

levels of autonomy. However, there are indications that the prediction may be more complex. Employment can be conditional based on an individual's educational attainment; women with a college degree often have a better change in securing higher paying jobs. Therefore, the negative association may only occur when considering the two variables together due to the inter-reliance of education level on employment. Poverty, on the other hand, is predicted to have a positive association with sexual violence against women, as increased poverty is commonly and repeatedly associated with decreased levels of autonomy.

To better consider the roles of demographic structure and gender stratification on the patterning of sexual violence against women across place, the joint association between sex ratio and gender inequality also needs to be identified. For this prediction, four possible relationships are explored (Table I).

Table 1: Possible Outcomes

	Imbalanced Sex Ratio +SVAW	Balanced Sex Ratio -SVAW
Gender Inequality (High) +SVAW	<p style="text-align: center;"><u>Quadrant 1</u></p> <p>In communities with imbalanced sex ratios and high rates of gender inequality, sexual violence rates will occur at the highest rates due to low female autonomy as well as high mate guarding behavior and high non-committal sexual relationships.</p> <p style="text-align: right;">#1 (+,+)</p>	<p style="text-align: center;"><u>Quadrant 2</u></p> <p>In communities with balanced sex ratios and high rates of gender inequality, sexual violence rates will occur at rates lower than in quadrant 1 due to reduced mate guarding behavior and non-committal sexual relationships, but higher than 3 and 4 due to low female autonomy.</p> <p style="text-align: right;">#2 (-,+)</p>
Gender Inequality (Low) -SVAW	<p style="text-align: center;"><u>Quadrant 3</u></p> <p>In communities with imbalanced sex ratios and low rates of gender inequality, sexual violence rates will occur at lower rates than Quadrant 2 due to elevated female autonomy despite possible male mate guarding behavior and non-committal sexual relationships.</p> <p style="text-align: right;">#3 (+, -)</p>	<p style="text-align: center;"><u>Quadrant 4</u></p> <p>In communities with balanced sex ratios and low rates of gender inequality, sexual violence rates will occur at the lowest rates due to more female autonomy and few incentives for mate guarding behavior and non-committal sexual relationships.</p> <p style="text-align: right;">#4 (-,-)</p>

***Sexual Violence Against Women (SVAW)

When analyzing and comparing the sex ratio and elements of gender inequality, it is predicted that the population with the largest discrepancies between men and women, as well as high rates of the covariates associated with gender inequality, will have the highest rates of sexual violence against women. Justification for the prediction is based on the literature which suggests that violent mate-guarding behavior more readily occurs when there is an excess of men and that an increase of stranger violence occurs more frequently when there is an excess of women. Simultaneously, high rates of gender inequality illustrate environments in which women are more likely to have less autonomy and can be further susceptible to violence.

In contrast, in communities that approach a balanced sex ratio between men and women as well as low gender inequality, the prediction is that rates of sexual violence against women will be decreased. In these environments, no one sex has the dyadic power. Therefore, the societal pressure to maintain a relationship seen in male biased sex ratios is lessened, as is the associated mate guarding behavior. At the same time, the incentive to engage in non-committal sexual relationships seen in female biased sex ratios is also lacking, which lower chances of stranger violence. Additionally, when there are low rates of gender inequality in a population, women have more autonomy to promote self-interests, thereby decreasing the probability of experiencing sexual violence.

However, there are communities in which the sex ratio and gender inequality have opposite effects on the rate of sexual violence against women; one factor is lowering the probability of violence against women while the other is raising the probability, suggesting more complex results. The prediction is that gender inequality will play a larger role in the prevention of sexual violence against women compared to the sex ratio. Justification for this prediction is based on understanding of the consistency of gender inequality compared to the fluctuation of sex ratios. Sex ratios are more variable across time and are sensitive to aspects such as birth and migration, whereas patterns of gender stratification are much less flexible across time; therefore, gender norms will more often be a larger contributor to sexual violence against women. As the discrepancies between men and women in a population grows more unbalanced and low levels of gender inequality are prevalent, sexual violence against women is predicted to occur at lower rates compared to communities that approach a balanced sex ratio and also exhibit high rates of gender inequality. This prediction is based on the notion that female autonomy secured by

gender equality is more impactful than the male incentives to mate guard or engage in non-committal sexual relationships.

CHAPTER FOUR

Methods

Data

The data used for the analysis comes from both the US Census and National Incident Based Reporting System. The U.S. Census was included because it contains data concerning the demographic structure of the United States populace, age and sex, as well as aspects of larger societal structures, such as education, employment, and poverty (U.S Census Bureau 2016). To account for the various predictors of the analysis, described below, data from the US census came in the form of eight different datasets. The National Incident Based Reporting System, or NIBRS, is a reporting system that collects data on the attributes of 34 different offenses at the incident level, including sexual violence. The datasets from the U.S Census and NIBRS were merged together by the common cities and counties in the states that report to NIBRS. Data was sourced from the year 2016, as this is the most current report available.

Study Population

The study population was pulled from the 34 states that have undergone the certification process to be included in the NIBRS database. Data was extracted both at the city and county level. City and county data have been shown to be appropriate when examining relationship behavior because this level of analysis reflects, albeit imperfectly, the availability of potential partners by capturing individual ranges; which includes where people live, work, and socialize (Fossett and Kiecolt 1991; McLaughlin et al. 1999; Schwartz 2006; Schacht, Tharp, and Smith 2016). Moreover, city and county data are recognized as having a wider range of available measures and sufficiently large populations to generate reliable rates of relatively infrequent

events (Messner and Sampson 1991; Schwartz 2006; Schwartz 2006; Schacht, Tharp, and Smith 2016). It is important to note that a city and county-level approach to the study of violence raises concerns to the analysis and interpretation of results from aggregate data. One particular concern occurs when group-level relationships are inappropriately assumed to reflect individual-level behaviors (Pollet et al. 2014). Consequently, cautious interpretations are needed when attempting to infer behavior with respect to both the level of data and the question of interest.

Predictors

Sex ratio, measurements of gender inequality, and age were the main predictors used to account for individual variation (U.S. Census 2016). Two adult age groups were considered for each of the predictors based on the available data. The measurement used for the adult sex ratio (ASR) is defined as the proportion of adult males in a population compared to the total adult population. The first age group of the sex ratio includes men and women 15 to 44 years of age. The age group was selected to include the individuals most actively involved in the mating pool in each city or county. The second age group extends the range to include men and women ages 15 to 64, since individuals may still be involved in the mating pool past age 44.

As mentioned previously, there is no single variable that measures gender inequality. Therefore, the predictor is measured by including predictors that are often associated with gender inequality. As established in the background, female rates of education, employment, and poverty are all associated with gender inequality and female autonomy. Datasets for these three variables were collected from the U.S. Census. In order to gain an accurate representation of the impact education can have on violence against women, education was based on the attainment of at least an associate degree or higher. The measurement is defined as the proportion of women

who obtained at least one degree compared to the total number of adults in a population. As noted by Trostel (2015;14) the educational attainment of a degree has been associated with reduced risk of poverty and the attainment of additional degrees has been further positively associated with decreasing risks of poverty. The measurement of employment was obtained by collecting data on individuals employed in the workforce and is defined as the proportion of women employed in a population compared to the total adult population. The predictor of poverty was obtained by collecting data on individuals whose total income over twelve months was below the poverty level. Poverty is measured as the proportion of women whose income below the poverty line compared to the total adult population.

Outcomes

The data associated with the outcome measures was collected from NIBRS. The measures associated with sexual violence against women fall under the NIBRS category of forcible sexual offense, which is categorized by a sexual act directed against another person, without the consent of the victim (Uniform Crime Reporting Program National Incidence-Based Reporting System 2016). The data is further divided into penetrative and non-penetrative offenses, of which, incidences of rape, sodomy, and sexual assault with an object are classified as penetrative offenses, and incidences of fondling are classified as non-penetrative offenses. While NIBRS does collect non-forcible sex offense such as incest and statutory rape, these are excluded from the current study. The number of penetrative, non-penetrative, and total incidences were all compiled for the analysis to be compared with each predictor.

Controls and Random Effects

For the analysis, the city or county level will be used as a control variable, because while the community structure is important to consider, it is not the main focus of this research. For the analysis, “State” is included as the random variable, which allows for heterogeneity in the outcome measure by state. State accounts for common clustering in the data due to shared geographic settlement patterns and culture associated with differing migration and settlement patterns (White and Rogers 2000). Each state was coded with a both a region (Northeast, North Central, South and West) and division (New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific) based on geographical location in the United States (Appendix A). It is important to note that of the 34 states currently included in the database, 16 states require crime data from all agencies to be submitted through NIBRS and 18 states allow agencies to submit reports to either NIBERS or through the Summary Reporting System. The fact that not all states require every agency to report is a limitation of NIBRS that needs to be considered in the analysis (Uniform Crime Reporting Program National Incidence-Based Reporting System 2016).

Exclusion Criteria

After compiling the datasets into one master dataset, cities and counties with a total population size less than 1500 people were eliminated from the study. This decision is based on the understanding that rare events in small populations can be disproportionately over or underrepresented in the rates of cross-sectional data. In addition, the ASR ranges were truncated to 0.4 to 0.6, meaning sex ratios included range from 40% male to 60% male. This range was used to account for the typical standard distribution of sexes in a population and accounted for

~98% of this sample. Furthermore, 26 of the cities or counties had discrepancies in the total population size due to the use of multiple U.S Census datasets with different reporting systems. In order to identify cities and counties with a large discrepancy, the differing total populations were divided by each other. Any city or county that had comparison ratio discrepancies smaller than 0.5 or larger than 1.5 were eliminated from the study due to the inconsistency in population size. Lastly, any state that had fewer than 5 city and county entries was eliminated as well due to the lack of potential clustering at the state level that could be explored statistically. After the exclusion criteria, the data for this study resulted in 3181 cities and counties from 32 states.

Statistical Approach

Although it is ideal to keep the model set small and inclusion of covariates based in theory, it is also important to account for possible sources of heterogeneity that may differentially affect the outcome (Burnham and Anderson 2002; Schacht and Borgerhoff Mulder 2015). To address these concerns, and the nested structure of the data, generalized linear mixed-effect models were fit with the sex ratio, education rate, employment rate, and poverty rate as fixed effects, city or county as a control, and state as a random effect. All analyses were performed in R (version 3.6.1) using the package lme4 and the call GLMER to fit Poisson marginal effects of regression models, due to the distribution of the outcome variables. The analysis focused on three types of generalized linear mixed models; bivariate models, multivariate models, and interaction models. The bivariate model is used to examine the association between each predictor and each outcome while considering the control and the random variables. The multivariate models were used to consider the effect that the predictors have on each of the outcomes when the predictors are considered jointly, while also accounting

for the control and random variable. Lastly, the interaction models are used to analyze the association between two interacting predictors and each of the outcomes, while again accounting for the control and the random variable.

CHAPTER FIVE

Results

The penetrative offense rate and non-penetrative offense rate are each a portion of the total incidence rate. All outcome variables were examined and compared to each other to determine if any differing occurred in the association with the predictors. When analyzing the models, it was determined that the results were generally consistent with the overall measures, meaning the penetrative and non-penetrative offenses followed the same pattern as the total incidence rate. Thus, only the incidence rate is shown in this chapter unless specific variation was identified. Likewise, there was no apparent differences between the two age groups, indicating that both age ranges show similar patterns with the rate of sexual violence against women. Since the model of the two age group results were constant with one another, only age one is shown in the chapter unless deviations between the results were identified. For the analysis, the results are grouped by the model used.

Bivariate Models

Each predictor and their individual association with the total incidence rate are depicted in Table 2 and the below figures. All predictors included in the bivariate models had a significant relationship with all outcomes. For the analyses, a positive association indicates that the predictor and the outcome are moving in tandem, whereas a negative association illustrates an inverse relationship between the predictor and outcome. Table 2 indicates support to the prediction of a negative association between degree rate and the incidence rate; the implication being that having more women with degrees in a population is indicative of lower incidences of sexual violence against women. The association is also demonstrated in Figure 1; as the rate of

educational attainment in a population increases, the rate of sexual violence against women decreases. A negative association is also confirmed between the employment rate and the incidence rate, proposing that when more women are employed in a population, there are lower rates of sexual violence against women (Figure 2). The poverty rate, on the other hand, has a positive association with the outcome of incidence rate, which suggests that when there are a high number of women in poverty in a population there are also high rates of sexual violence against women, confirming the prediction as well (Figure 3).

When initially examining the plot of linear association between the adult sex ratio and the incidence rate, indications of the data being quadratic in nature were observed. For confirmation, a quadratic formula was applied to the data. In order to identify if the quadratic formula was a better fit, the Akaike information criterion (AIC) was examined from the output to determine how well the model fit the data (Akaike 1981; Towner and Luttbeg 2007). The AIC measures the goodness of fit against the complexity tradeoffs for each model. Adding additional covariates to a model may show significant association, but the addition may in reality negatively impact how well the data fits the model. In these circumstances, the less complex model is preferred. When comparing models, the lower AIC indicates a better fit to the model. Furthermore, a model does not need to be considered in the AIC if it exceeds the lowest AIC found by more than 10, as it fails to substantially explain the variation in the data (Burnham 2002). After applying a quadratic formula to the data, the AIC reveals that the best fit was indeed the quadratic formula, therefore the quadratic formula was used for the rest of the analysis (Table 2). When looking at this model in Figure 4, a curvilinear relationship is identified between the adult sex ratio and the incidence rate, which is congruent with the prediction. These results indicate that as a sex ratio becomes more imbalanced, with either significantly more men or more women compared to the opposite

sex, the incidence rate increases. Conversely, as the sex ratio approaches parity between the sexes, the rate of sexual violence against women decreases.

The intraclass correlation, ICC, was included in the analysis to examine clustering in the data. The ICC is a measure of variance that describes how strongly the values within a group are similar to one another. The ICC ranges from 0 to 1, with 0 indicating no similarity and 1 indicating the values are identical (Merlo et al 2005). Furthermore, the ICC can also support the decision for a more complex model. A low ICC, $<.1$, would indicate a necessity for a single level model, but a higher ICC lays credence to a multilevel model (Snijders, Bosker 2012). Further analysis reveals high intraclass correlations in the bivariate models (0.82, 0.81, 0.83, 0.81). These results illustrate that there is high clustering of city and county by U.S. states and also lays support for a more complex model.

The AIC was also evaluated to identify how well each of the predictor models fit the data when compared to each other. When evaluating the AIC for each of the models in Table 2, the degree rate had the lowest AIC in both age groups, thereby determining that the degree rate was the best fit to the data. The implications of degree rate having the lowest AIC is that, when comparing the predictors to the outcomes individually, the degree rate of a population is the most impactful variable in relation to sexual violence against women. Lastly, since each predictor has a significant effect on the outcome, and all models have AIC values within 10 of the lowest model, all of the predictors in Table 2 can be considered for the multivariate models.

Table 2: Bivariate Summary of Incident Rate Models

<i>Predictors</i>	<i>IR Model 1</i>			<i>IR Model 2</i>			<i>IR Model 3</i>			<i>IR Model 4</i>		
	<i>Estimate</i>	<i>CI</i>	<i>p</i>									
Intercept	4.91	4.82 – 5.00	<0.001	4.68	4.59 – 4.77	<0.001	4.26	4.17 – 4.35	<0.001	17.95	17.23 – 18.67	<0.001
Degree Rate	-5.51	-5.65 – -5.36	<0.001									
City or County	-1.11	-1.13 – -1.10	<0.001	-1.10	-1.12 – -1.09	<0.001	-1.07	-1.08 – -1.06	<0.001	-1.06	-1.07 – -1.05	<0.001
Employment Rate				-1.27	-1.44 – -1.11	<0.001						
Poverty Rate							4.39	4.23 – 4.55	<0.001			
ASR										-52.79	-55.55 – -50.03	<0.001
ASR^2										51.51	48.84 – 54.19	<0.001
Random Effects												
σ^2		0.01			0.01			0.01			0.01	
τ_{00}		0.07 _{state}			0.06 _{state}			0.07 _{state}			0.06 _{state}	
ICC		0.82			0.81			0.83			0.81	
N		32 _{state}										
Observations		3177			3177			3177			3177	
Marginal R ² / Conditional R ²		0.777 / 0.960			0.773 / 0.958			0.762 / 0.959			0.779 / 0.958	
AIC		113890.328			119451.559			116820.781			118349.548	

Figure 1: Bivariate Association Between Education and Incidence Rate

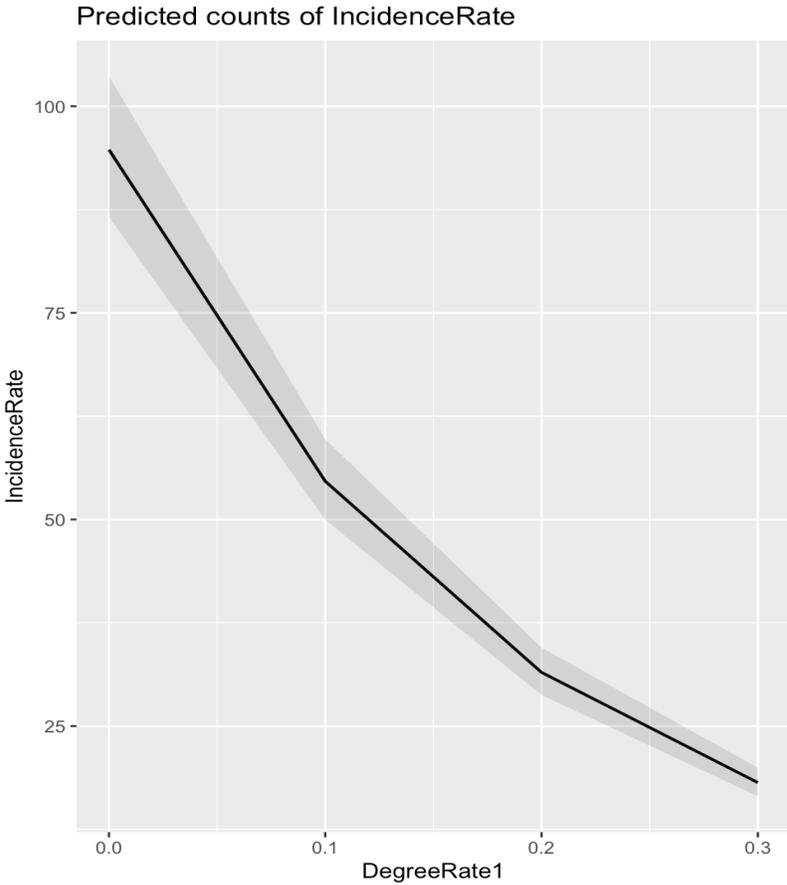


Figure 2: Bivariate Association Between Employment and Incidence Rate

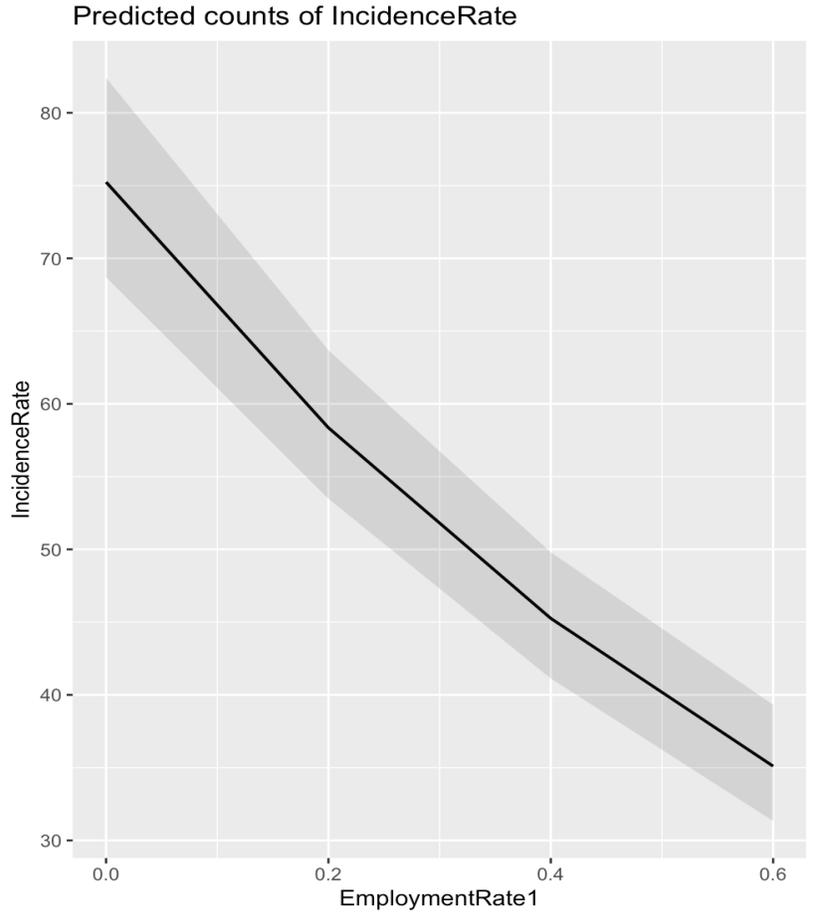


Figure 3: Bivariate Association Between Poverty and Incidence Rate

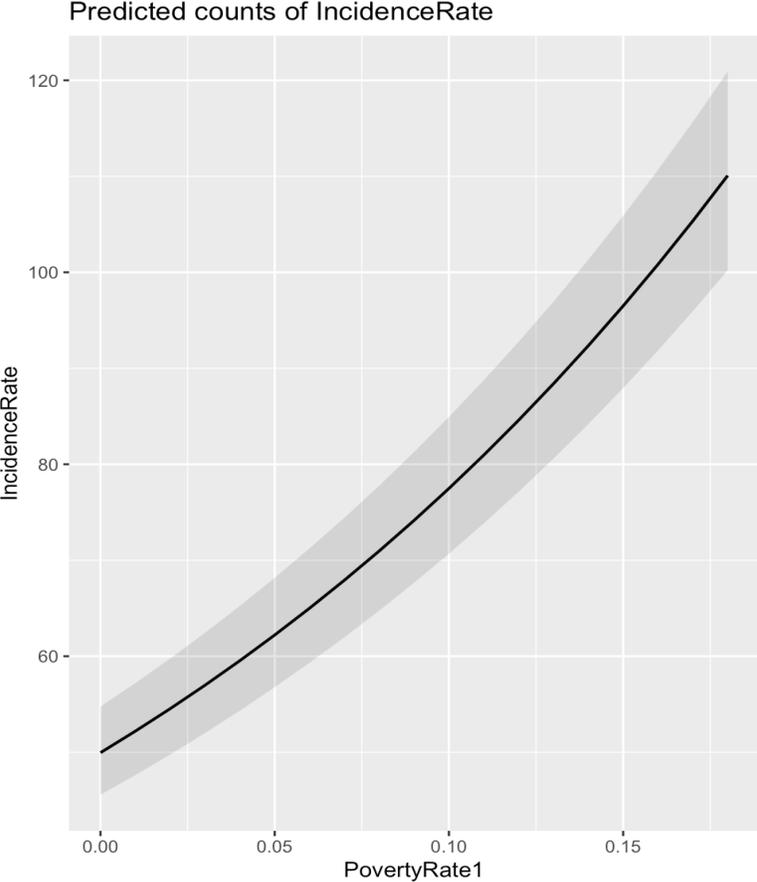
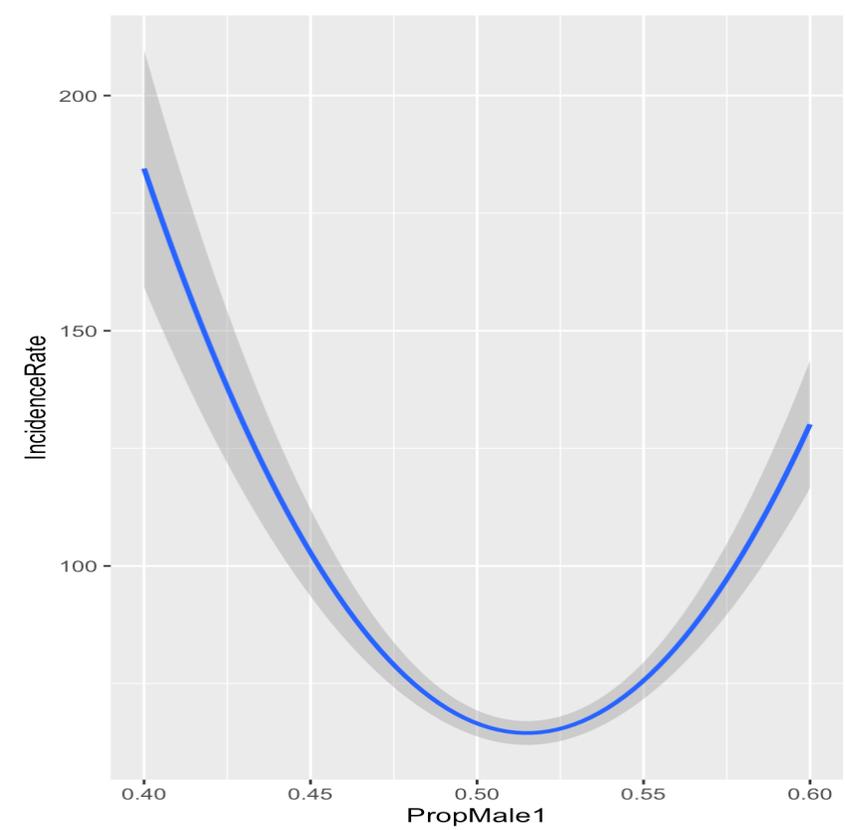


Figure 4: Bivariate Association Between Adult Sex Ratio and Incidence Rate



Multivariate Models

The multivariate model was used to examine the effects the covariates have on the outcome when considered together. Table 3 examines the summary output of the multivariate model analysis with the incidence rate outcome. Similar to bivariate model, in Table 3, the adult sex ratio confirms the prediction of a curvilinear association with the incidence rate, suggesting that sexual violence is occurring at higher rates when the sex ratio is imbalanced in either direction. Furthermore, the degree rate is again negatively associated with the outcome, indicating that an increase of women in a population who obtain a degree is indicative of a decrease in sexual violence against women. The poverty rate is also again positively associated with high incidence rates, suggesting that when more women in a population are in poverty,

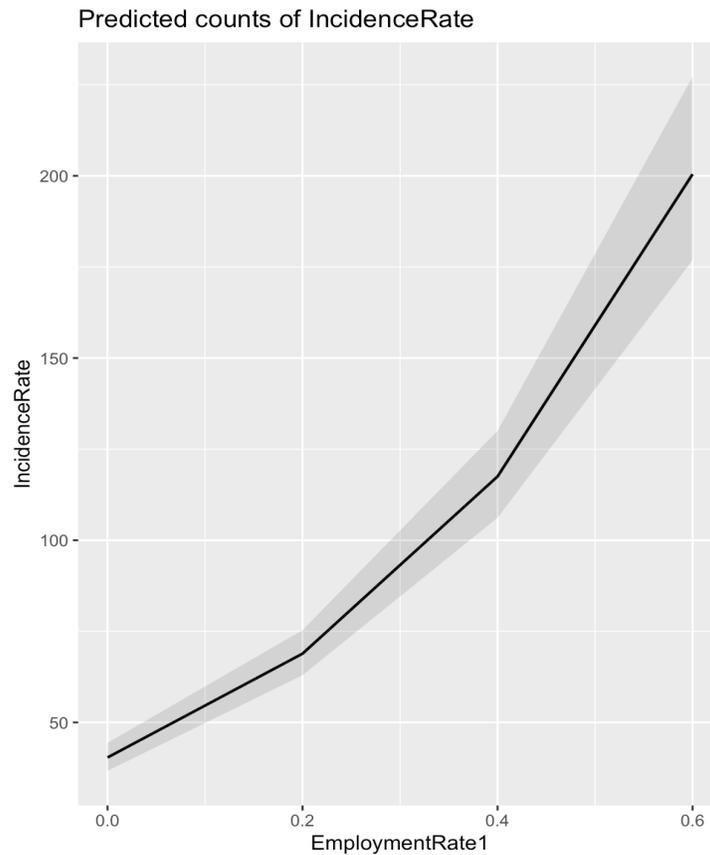
there are higher rates of sexual violence against women. However, differing from the previous models, the employment rate is positively associated with the incidence rate; a high women's employment rate in a population is correlated with a high rate of sexual violence against women (Figure 5). While this result is contradictory to the bivariate model, it is not entirely unsuspected, as it was also predicted that the education and employment may need to be considered together due to co-dependence of the two variables.

The ICC of the multivariate model (0.82) is quite large, revealing high clustering of city and county by state. Since the ICC is also above 0.1, the use of a multilevel model is further supported. Furthermore, when considering the AIC in Table 3 (111986) compared to the lowest AIC in Table 2 (113890), the AIC for the multivariate model is significantly lower. Similar associations were found for the other outcomes and age groups. This result indicates that despite complicating the model, the multivariate model is the best fit for the data.

Table 3: Multivariate Summary of Incidence Rate Model

<i>Predictors</i>	<i>Q0</i>		
	<i>Estimate</i>	<i>CI</i>	<i>p</i>
Intercept	15.35	14.62 – 16.07	<0.001
ASR	-43.24	-46.03 – -40.45	<0.001
ARS^2	42.41	39.70 – 45.11	<0.001
Degree Rate	-5.40	-5.58 – -5.23	<0.001
Employment Rate	2.67	2.47 – 2.87	<0.001
Poverty Rate	2.20	2.01 – 2.39	<0.001
City/County	-1.05	-1.06 – -1.04	<0.001
Random Effects			
σ^2		0.01	
$\tau_{00 \text{ state}}$		0.07	
ICC		0.82	
N_{state}		32	
Observations		3177	
Marginal R^2 / Conditional R^2		0.777 / 0.960	
AIC		111986.181	

Figure 5: Multivariate Association Between Employment and Incidence Rate



Interaction Models

The results of the relationship between employment rate and sexual violence against women in the multivariate model prompted a closer look into the relationship between employment rate and education rate. Therefore, in congruence with the literature, an interaction model was used to determine if the degree rate of a population interacts with the association between the employment rate and sexual violence against women. In Tables 4-6, as seen with the previous bivariate model, there is a positive association between employment rate and incidence rate. However, the addition of the degree rate into the equation for the interaction models suggests that the degree rate is in fact interacting with the association between employment and

sexual violence. As seen in Figures 6-8, a high degree rate lessens the positive association between the employment rate and the outcome. In populations with higher degree rates, there is a decrease in the rate of sexual violence against women when compared to populations with lower degree rates. The results reveal education is indeed playing a role in the association, confirming the previous prediction.

When comparing the AIC of the interaction model to the bivariate and multivariate model, it can be confirmed that the interaction model's AIC (113316) is lower than the bivariate model's (113890), but not the multivariate model's (111986), suggesting that the multivariate model is still the best fit to the data. Furthermore, while the previous models have revealed little to no differences between the age groups, for the interaction model the age groups appear to differ. In comparing Figures 6-8, the effect that degree rate has on the association between employment rate and sexual violence against women is much more pronounced in the second age group. Particularly, high degree rates are seen to have a more noticeable effect on the association. In addition, there is also variation between the outcomes as the interaction seems to especially impact the association between employment rate and non-penetrative offenses. Although variation was observed, the association did not change, and therefore it can be confirmed that the education rate is interacting with the employment rate for all outcomes.

When considering the interaction within a multivariate model, similar associations are produced. However, under further analysis, for each model, either the interaction or the degree rate was not supported statistically. Therefore, the multivariate interaction will not be considered further due to the models' lack of significance.

Table 4: Summary of Incidence Rate Interaction

<i>S0</i>				<i>SS0</i>			
<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>	<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>
Intercept	4.72	4.63 – 4.82	<0.001	Intercept	4.46	4.34 – 4.58	<0.001
Employment Rate	1.59	1.30 – 1.88	<0.001	Degree Rate	-2.35	-3.30 – -1.40	<0.001
Degree Rate	-7.68	-8.13 – -7.24	<0.001	Employment Rate	3.83	3.31 – 4.34	<0.001
City/County	-1.09	-1.11 – -1.08	<0.001	City/County	-1.10	-1.11 – -1.09	<0.001
Employment*Degree Rate	7.75	5.21 – 10.29	<0.001	Employment*Degree Rate	-27.70	-33.80 – -21.60	<0.001
Random Effects				Random Effects			
σ^2		0.01		σ^2		0.01	
$\tau_{00 \text{ state}}$		0.06		$\tau_{00 \text{ state}}$		0.07	
ICC		0.82		ICC		0.83	
N_{state}		32		N_{state}		32	
Observations		3177		Observations		3177	
Marginal R^2 / Conditional R^2		0.781 / 0.960		Marginal R^2 / Conditional R^2		0.770 / 0.960	
AIC		113316.112		AIC		112893.007	

Figure 6: Interaction for Incidence Rate

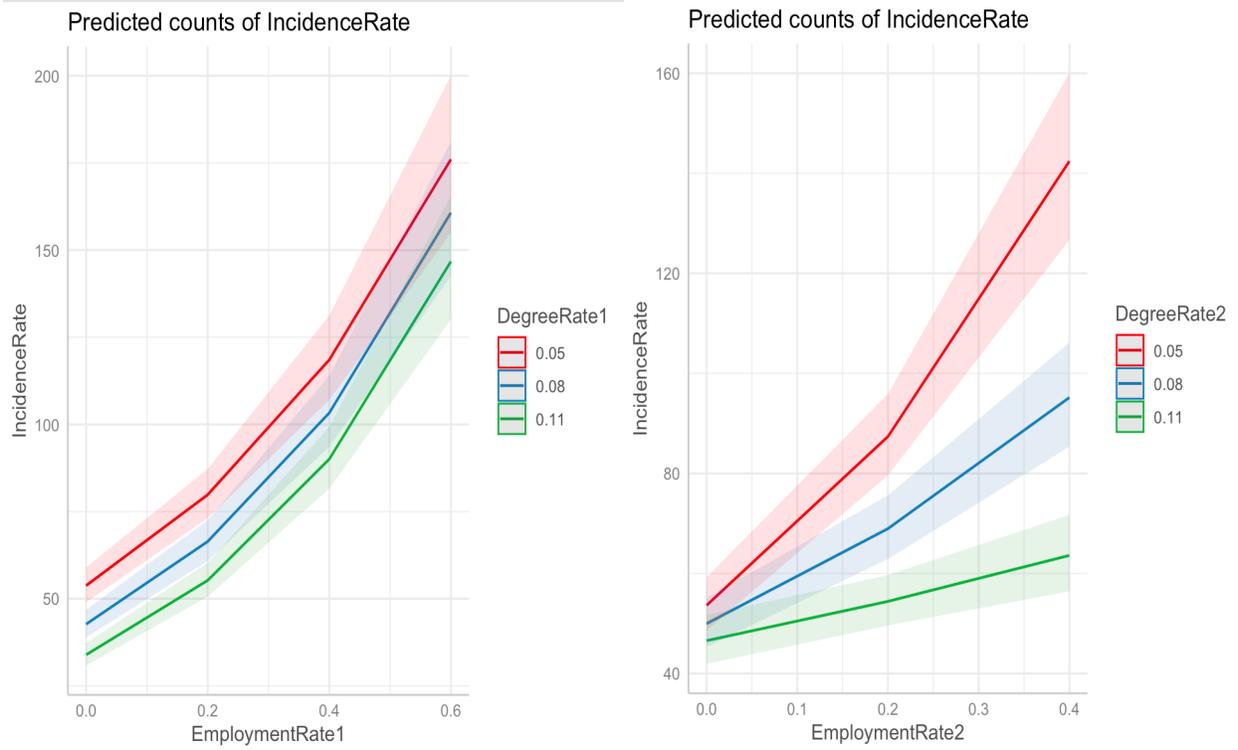


Table 5: Summary of Penetrative Offense Rate Interaction

<i>SI</i>				<i>SSI</i>			
<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>	<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>
Intercept	4.13	4.03 – 4.24	<0.001	Intercept	4.05	3.94 – 4.17	<0.001
Degree Rate	-8.07	-8.55 – -7.59	<0.001	Degree Rate	-5.10	-5.97 – -4.23	<0.001
Employment Rate	1.61	1.25 – 1.96	<0.001	Employment Rate	2.58	2.05 – 3.10	<0.001
City/County	-1.17	-1.19 – -1.15	<0.001	City/County	-1.18	-1.19 – -1.16	<0.001
Employment*Degree Rate	10.60	7.96 – 13.25	<0.001	Employment*Degree Rate	-9.05	-14.58 – -3.52	0.001
Random Effects				Random Effects			
σ^2		0.03		σ^2		0.03	
$\tau_{00 \text{ state}}$		0.06		$\tau_{00 \text{ state}}$		0.07	
ICC		0.71		ICC		0.73	
N_{state}		32		N_{state}		32	
Observations		3177		Observations		3177	
Marginal R^2 / Conditional R^2		0.782 / 0.936		Marginal R^2 / Conditional R^2		0.771 / 0.937	
AIC		99192.319		AIC		99018.357	

Figure 7: Interaction for Penetrative Offense Rate

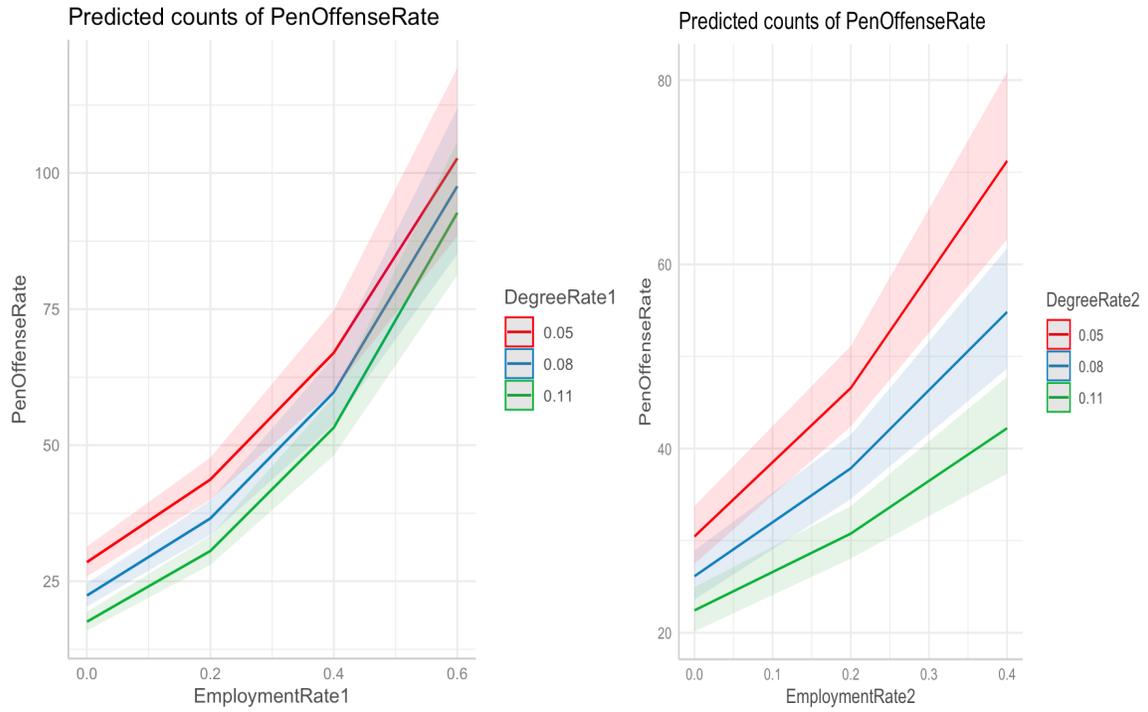
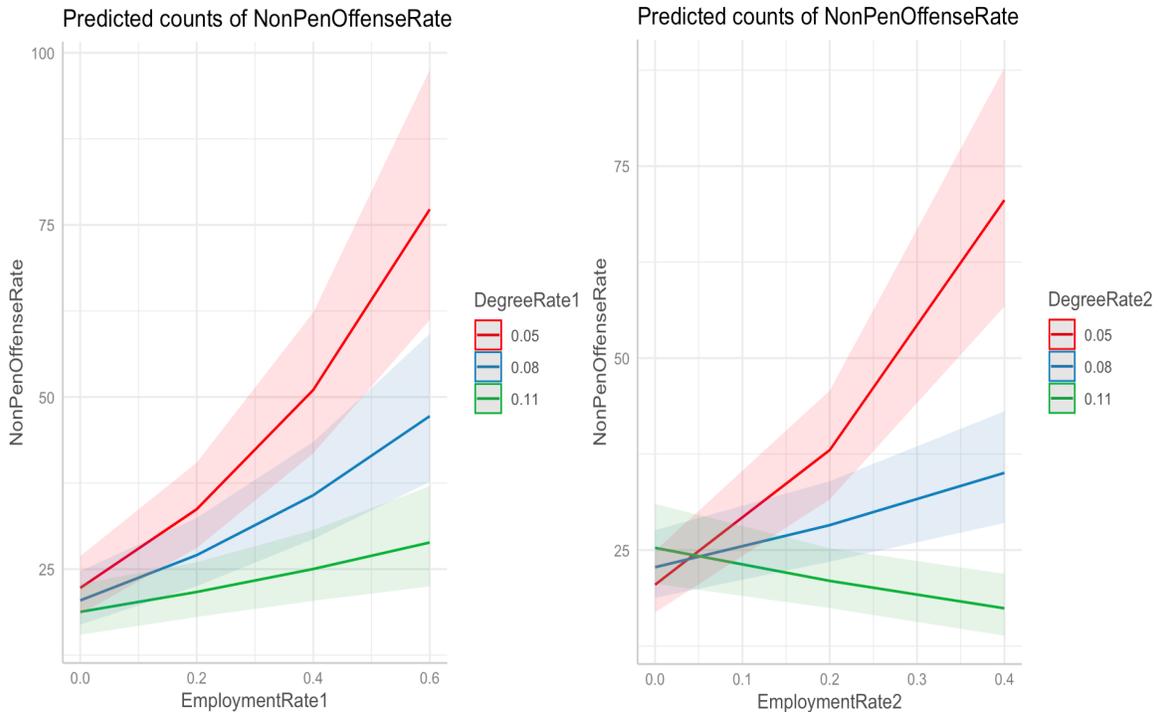


Table 6: Summary of Non-Penetrative Offense Rate Interaction

S2			
<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>
Intercept	3.57	3.37 – 3.77	<0.001
Degree Rate	-2.83	-3.92 – -1.73	<0.001
Employment Rate	3.21	2.67 – 3.74	<0.001
City/County	-1.01	-1.03 – -0.99	<0.001
Employment*Degree Rate	-22.64	-29.14 – -16.13	<0.001
Random Effects			
σ^2		0.03	
$\tau_{00 \text{ state}}$		0.27	
ICC		0.89	
N_{state}		32	
Observations		3177	
Marginal R^2 / Conditional R^2		0.435 / 0.937	
AIC		94353.830	

SS2			
<i>Predictors</i>	<i>Estimate</i>	<i>CI</i>	<i>p</i>
Intercept	3.17	2.94 – 3.40	<0.001
Degree Rate	3.51	1.70 – 5.31	<0.001
Employment Rate	6.44	5.51 – 7.38	<0.001
City/County	-1.01	-1.03 – -0.99	<0.001
Employment*Degree Rate	-67.05	-78.76 – -55.34	<0.001
Random Effects			
σ^2		0.03	
$\tau_{00 \text{ state}}$		0.28	
ICC		0.89	
N_{state}		32	
Observations		3177	
Marginal R^2 / Conditional R^2		0.434 / 0.937	
AIC		94106.722	

Figure 8: Interaction for Non-Penetrative Offense Rate



Control and Random Effects

Brief analysis of city and county indicated that city incident rates were much higher than county rates, possibly due to the elevated crime rate associated with cities compared to counties (Glaeser and Sacerdote 1999). State was included as a random variable to account for geographical variation. In Figures 9-11, the state level deviations are shown relative to the mean. The blue circles represent intercepts higher than the mean and the red circles represent intercepts lower than the mean. When evaluating the random effects, the pattern of sexual violence varied by state. Furthermore, the intercept of the random effect varied depending on the outcome. For example, in looking at Arkansas, the random effects intercept was higher than the mean for

penetrative offenses and lower for non-penetrative. There was no discernable difference between the two age groups for each outcome.

When examining the four regions (Northeast, North Central, South and West) the Northeast region had a majority of the intercepts to fall above the mean. Conversely, the South, had a majority of the intercepts to fall below the mean. This result is confirmed in Figure 12, which indicates that both the Northeast and West regions were shown to have a higher incident rate compared to the North Central and South. When looking at the division associated with each state (New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific) there were a limited number of samples and because of this, the results were too sparse to fully analyze.

Figure 9: Random Effects for Incidence Rate

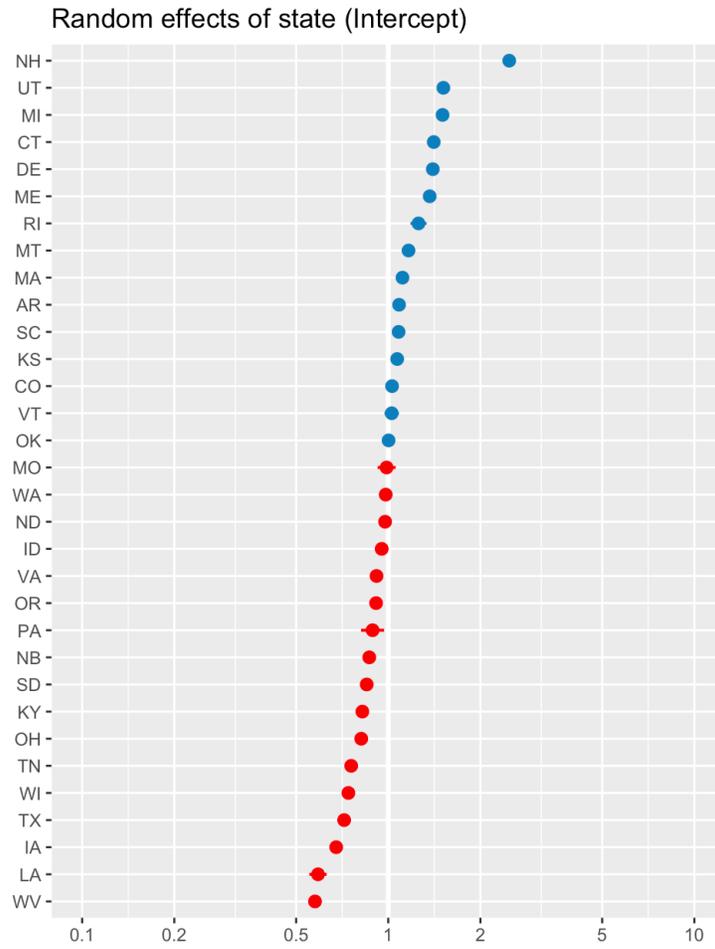


Figure 10: Random Effects for Penetrative Offense Rate

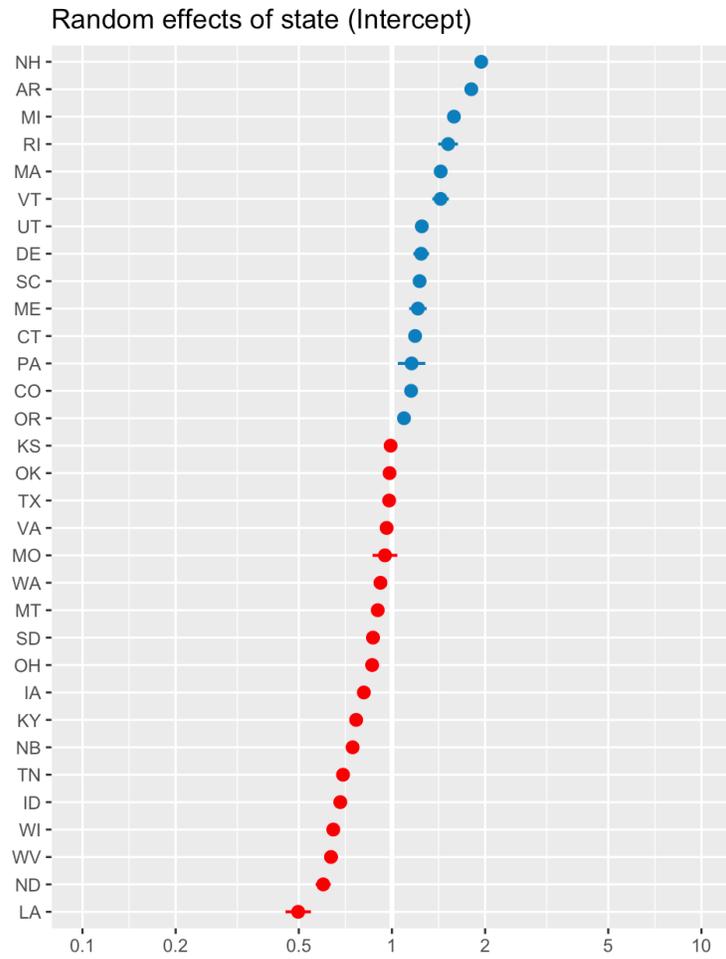


Figure 11: Random Effects for Non-Penetrative Offense Rate

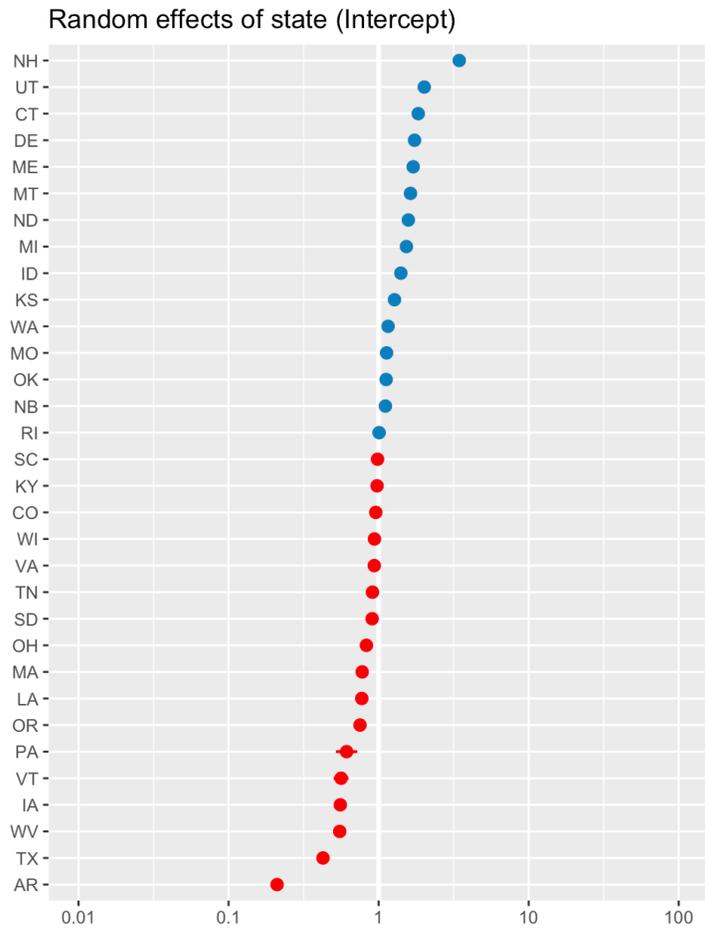
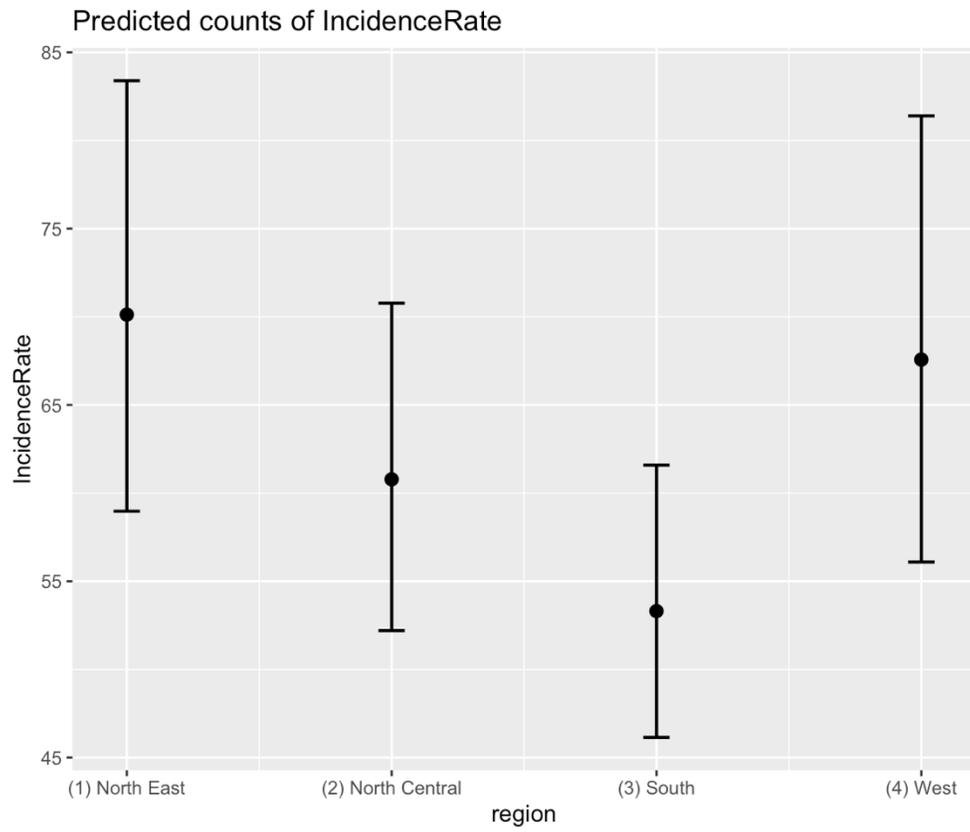


Figure 12: Random Effects by Region



CHAPTER SIX

Discussion

The Role of Sex Ratio

There have previously been incongruities in the literature about the association between the sex ratio of a population and sexual violence against women (Guttentag and Secord 1983; Barber 2000; Titterington 2006; Trent and South 2012). Discussion has often revolved around whether male biased or female biased sex ratios are positively associated with an increase in sexual violence. The results from this study are in support of the prediction that sexual violence against women should not be evaluated on a scale of male biased versus female biased sex ratios, but rather balanced versus imbalanced sex ratios. Populations that had larger discrepancies between the number of men and women were associated with higher rates of sexual violence against women, and populations that saw more balance between the sexes were associated with lower rates of sexual violence against women. In essence, the association of sex ratio with sexual violence against women is not conditional on which sex is more abundant, but rather if there is a substantial discrepancy in the number of men compared to the number of women. When considering imbalanced and balanced sex ratios, it is important to note that this study was not able to determine at what discrepancy the sex ratio switches from more balanced to more unbalanced. Further studies will need to be conducted to analyze this.

When considering the results in the framework of Mating Market Theory, for the populations with more closely balanced sex ratios, no one sex has the dyadic power to be more demanding in the mating market. Conversely, in places where one sex does have the dyadic power to structure the mating market for their specific sex's preference, sexual violence against

women occurs at higher rates (Becker 1974). Based on this literature, the results suggest that when men are in control of the mating market, the mating structure is that of mainly non-committal sexual encounters, which have been associated with increase in sexual violence committed by a stranger. When women are in control of the mating market, the structure involves an increase in intimate relationships in which intimate partner violence can more often occur. Further analysis with more specific incidence types needs to be conducted for confirmation of these predictions. What can be identified with the current data is that both a significant number of men compared to women and a significant number of women compared to men are associated with increased rates of sexual violence against women.

The Role of Gender Inequality

Each of the predictors used as a measurement of gender inequality were significantly associated with the outcomes. The three predictors: education rate, employment rate, and poverty rate, are all inherently intertwined with their impact on sexual violence against women. The negative association between education and sexual violence was consistent with both the prediction and previous literature (Whaley 2001; Valdimarsdóttir 2018). In populations with high rates of women who obtain a college degree, the rate of sexual violence against women was lessened compared to populations with lower college degree rates. The benefits that accompany earning a college degree are vast.

Women who have at least one post high school degree have a higher probability of securing jobs, and more specifically higher paying jobs, and as a result have more capabilities to elevate their socio-economic status and become more self-sufficient and autonomous (Trostel 2015). Furthermore, obtaining a college degree can elevate a women's self-worth, which can lead to the dismantling of issues conducive of patriarchal societies, because female education

both challenges patriarchal frameworks and instills women with the knowledge and means to confront social norms (Reskin 1988).

In comparison, the association suggests that in places with low rates of women with degrees, the rate of sexual violence against women is more likely to occur. Women without a degree often lack the autonomy to leave a dangerous situation, whether the dangers be in the home, work, neighborhood, etc. Greater levels of autonomy and self-sufficiency are needed to have the means to promote one's own safety, and educational attainment of a college degree is a large step towards accumulating autonomy. A lack of a college degree can sometimes limit women to certain employment fields or certain pay ranges and as a result, women who are unable to secure a job, especially a higher paying one, can find themselves stuck in an unsafe environment with little method of escape (Jewkes, Levin, and Penn-Kekana 2002). For example, women who have limited employment options not only cannot always leave their job if an unsafe situation arises but are often limited to living in certain locations based on employment and income levels that may have increased crime rates (Heirigs, and Moore 2018).

Overall, poverty is a key variable in understanding the effect gender inequality can have on sexual violence against women. In agreement with the literature, the results indicate that when more women are below the poverty line in a population, the rate of violence against women of that population is higher. The impact of poverty on women's safety can best be seen in the lack of financial security (Vest et al 2002). Women who live in poverty are both more vulnerable to sexual violence and can often face challenges when attempting to remove themselves from dangerous situations without monetary means. Equally, women with financial security can have the benefit of removing themselves from potentially hazardous situations without having to worry about monetary issues.

The association between employment rate and sexual violence against women was by far the most complex of the three gender inequality predictors. A possible explanation for the complexly connected with employment revolves around the backlash effect. In instances of the backlash effect, when areas with traditionally lower levels of female employment have a shift of increased female presence in the workforce, there is a backlash response against women, which is encapsulated by the increased rates of sexual violence against women. This backlash is not as prominent in populations where female employment is normative (Heirigs and Moore 2018).

In addition, it is also important to consider the close relationship employment has with the attainment of degrees. The analysis identified an interaction between educational rate and employment rate, suggesting that the rate of educational attainment in a population impacts the association between employment rate and the rate of sexual violence in a population. The results suggest that women employed without degrees are at a higher risk of sexual violence compared to women employed with degrees. A potential explanation for the discrepancy lies in the differing employment opportunities that women with a college degree have compared to women without a college degree. As mentioned previously, women with a college degree are typically able to secure higher paying jobs compared to women without college degrees, which can increase their socio-economic status and autonomy (Pallitto and O'Campo 2004). Therefore, their employment may look significantly different from the type of employment that women without college degrees occupy. The work environment of women who do not have degrees may not grant women the financial security and autonomy that the jobs that require college degrees often give.

The Role of Age

Initially, minimal to no variation occurred between the two age groups when comparing each bivariate model and the multivariate model, indicating that an extenuation of the age group does not impact the direction of the association. This suggests that ages above 45 may still be involved in the mating market. However, variation between the age groups did occur in the interaction models. For the interaction models, the degree rate for the second age group shows a more drastic effect on the association between the employment rate and offense rate. The variation between the two age groups may be associated with the backlash effect, as the societal expectations of female employment between the generations could vary. Since female employment has increased over the generations, men who initially entered the workforce in a time with less female employment could react violently to the increase of women in the workforce. Overall, the variation between the age groups seen in the interaction model confirmed the need for the distinction between the two groups despite the mostly similar results.

The Role of Offense

Similar to age, the three outcomes of the study demonstrated general uniformity between each other. Both the penetrative and non-penetrative offenses were similarly associated with each of the predictors, following the same patterns of association, despite the fact that they are quite different crimes. This suggests that the covariates are not specific to one type of crime, but rather that they are all adequate predictors of the varying types of sexual violence against women.

The Role of State

State was included as a random effect variable to account for common clustering seen in shared geographic settlement patterns. The results determined that there is variation in the incidence rate across state. Although some variation could be on account of states not reporting all data to NIBRS, overall the results indicate that place may play an important role in the patterning of sexual violence. Furthermore, analysis into the results indicated that there were some similar patterns in geographic location based on region. Particularly, the Northeast region was found to have a high incidence rate compared to the other regions. In comparison, the South was found to have the lowest incidence rate out of the four regions. This result was somewhat unexpected, but some of the variation could be explained by variation in reporting across the different regions. Overall, the main goal was to determine if it is beneficial to consider place in the patterning of sexual violence against women and the results suggest that place may explain some variation where other variables cannot.

Limitations

There are some limitations to the study that need to be noted. As mentioned previously, NIBRS is an incredibly beneficial source for crimes rates, but there are certain limitations that may impact the results pertaining to variation by place. The database is not used by all US states and in addition, not all states included in NIBRS require all agencies to report, which can impact the understanding of incidence rate per state. Furthermore, there can also be variation in both the enforcement and reporting rates that can impact the statistics in the dataset. There is a greater number of reporting from the South and many of the agencies reporting are smaller ones, which can impact the data (Walfield 2016).

There are also limitations to the outcomes analyzed in this study, the outcomes used for the study were crimes of sexual violence, and the outcomes were not differentiated by the victim-perpetrator relationship, most notably by an intimate partner or stranger. While the literature suggests that sexual violence committed in female biased populations is perpetrated by strangers and that sexual violence committed in male biased populations is perpetrated by intimate partners; with the data available, only speculations can be made.

CHAPTER SEVEN

Conclusion

The patterning of sexual violence against women is complex, but the results of this study are indicative of a possibility for a more comprehensive understanding of potential population-based risks. The study was able to evaluate two vastly different contributors of sexual violence against women, and for gender disparity in particular, three contributing factors were used to encapsulate its multidimensional nature. First, an imbalanced sex ratio was conducive to the prevalence of sexual violence against women in a community; thus, in places with significantly more of one sex compared to the other, an increased rate of sexual violence against women is to be expected. In addition, the high rates of education and poverty, as well as the interaction between education and employment, were all associated with increased incidence rates of sexual violence, further indicating that gender inequality plays a large role in the prevalence of violence against women.

Secondly, the results support analyzing both sex ratio and gender inequality jointly, because the multivariate model was the overall best fit to the data; since both variables are impacting the incidence rate, it is beneficial to consider them both. Lastly, place-based variation concerning the patterning of sexual violence against women was observed in the 32 states studied and tentative relationships were comparable across the 4 regions. Overall, these results indicate that sexual violence against women is indeed multifaceted and further research should consider the impact that place can have on patterning of sexual violence against women.

Further Research

In particular, the association between an imbalanced sex ratio and sexual violence against women needs to be explored further. Differentiation between the types of sexual violence against women, chiefly stranger violence and intimate partner violence, can assist in better explaining the conditions of sexual violence in a population. The results for this study were able to confirm that an imbalanced sex ratio, both significantly high and low sex ratios, was associated with increased rates of sexual violence against women. However, the results did not distinguish between the conditions of the perpetration of sexual violence, meaning the study was unable to identify the victim-perpetrator relationship. Further research is needed to analyze the differentiation between the two types of conditions, intimate partner violence and stranger violence, surrounding sexual violence in the hope that further clarification will aid in creating a better understanding of sexual violence against women in various populations. In addition, further studies would be beneficial to consider the point at which the sex ratio of a society transitions from a more balanced sex ratio to a more imbalanced one. Better understanding into this transition would aid in determining the locations that may exhibit higher rates of sexual violence against women. Overall, with the research, the hope is that further understanding into risk factors can be explored to assist in efforts to prevent sexual violence against women

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APPENDIX A

Region	Division	State
Northeast	New England	CT
		MA
		ME
		NH
		RI
		VT
North Central	Middle Atlantic	PA
	East North Central	MI
		OH
	West North Central	WI
		IA
		KS
MO		
South	South Atlantic	NB
		ND
		SD
		DE
	East South Central	SC
		VA
		WV
	West South Central	KY
		TN
		AR
West	Mountain	LA
		OK
		TX
	Pacific	CO
		ID
		MT
		UT
		OR
		WA

Bolded states indicate states that submitted all agencies crime data through NIBRS