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EDITOR'S INTRODUCTION

We are delighted to share with you the 2021 issue of the *Wingate Research Review*, which includes research that Wingate students conducted in 2020 and spring of 2021. This is my first year as the Editor of the research journal, and I have been extremely impressed with the quality of the research and the papers included in this issue. Wingate students are researching and writing about timely and fascinating topics. Articles in this issue analyze a range of literature from the Bible to Shakespeare, discuss political issues within Charlotte and as far away as Cuba, and investigate critical questions about topics such as local taxes and evidence of bacteria in regional ecosystems. The breadth and depth of the papers is what makes this journal distinctive and exciting.

This issue of the *Wingate Research Review* includes eleven outstanding articles written by undergraduate students from a variety of disciplines, as well as the first article for this journal written by a graduate student. We organized the essays in this issue according to discipline and have a range of departments represented. Even though the articles are listed according to discipline, several themes surface in multiple essays including issues of gender, race, and politics. I have broadened my own knowledge and awareness of important issues through the reading of these essays, and I hope that readers of this journal will as well.

I want to give special acknowledgements to the faculty mentors who worked with the student authors included in this volume. These faculty include: Debra Davis, Allison Kellar, Darrel Staat, Kristin Stowe, and Jacob Wobig. Faculty who offer to mentor students in research do so on their own time and often work overtime to support their students' research. I am especially grateful for these mentors (many of whom mentored more than one student paper) for their time and dedication to student-led research at Wingate. In addition, I appreciate the support

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Christy Cobb, PhD, Editor of the *Wingate Research Review*

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Bartering Bodies in *Measure for Measure*

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ABSTRACT

During the twenty-first century, many Americans have discussed and debated issues involving injustice, human rights, and leadership decisions. Although written over 400 years ago, William Shakespeare's works also address these topics and ethical dilemmas, including human trafficking. Shakespeare's *Measure for Measure* presents the actions, intentions, and emotions of Angelo, Duke Vincentio, Isabella, and others who are involved in incidents of illicit sex. While society typically depicts men as solely responsible for the objectification and commodification of women, Shakespeare clarifies the uncomfortable reality in that women, like Mistress Overdone, are involved in these atrocious acts as well. This paper seeks to analyze the different manners in which Isabella and Mariana are commodified by both men and women. Using literary critiques and documents from the United Nations, this paper argues for the similarity of their experiences to sex and labor trafficking experienced by millions around the world today. Studying *Measure for Measure* through the lens of human trafficking will allow readers to better understand these events as they are aligned with the modern complexities of this unresolved issue and provide them a sense of duty to be a voice for those facing the entrapment of commodification who cannot free themselves.

Shakespeare's *Measure for Measure* reveals the uncouthness and uncomfortable reality in human behaviors, actions, and intentions involving illicit sex. Claudio's imprisonment for having sex outside of marriage significantly impacts the play's themes, yet the ever-present commodification of the play's female characters is often overlooked or not examined closely. Ideas of exchanging sex for freedom with Angelo and Isabella, Mariana's bed-exchange scene instituted by the Duke, and the brothel owned by Mistress Overdone all demonstrate the appalling reality that women are frequently used in exchange for something wanted, as other scholars, such as Alexander Leggatt, have also noted. While this paper aims to defend women from the degradation of being treated as property, this is not its only purpose. Historically, societal concepts, the media, and scholarly works have blamed men for objectifying women as

merchandise, yet Mistress Overdone's involvement in brothel work and Isabella's involvement in the bed-exchange scene exemplify that women's roles in bartering bodies are also important to dissect and acknowledge. The use of humans as commodities is carried out by both men and women and can be identified as human trafficking. Although an initial reading of the text may not openly reveal these concepts, a deeper analysis illustrates the magnanimity of female exchange within *Measure for Measure* and its canonical longevity emphasizes Shakespeare's awareness of exchange occurring in cities near him by both men and women. This paper will analyze the three scenes listed above to show that the play's different women are treated as commodities and take a further look into other *Measure for Measure* characters who attempt to complete these transactions.

In *Measure for Measure*, the value that Isabella places on her virginity and chastity contrasts the strongest with the themes of illicit sex and lust within the play, yet she also shares some characteristics with her opposer Angelo. She requests further "strict restraints" in Saint Clare, the convent where she is currently residing: "But rather wishing a more strict restraint / Upon the sisterhood, the votarists of Saint Clare" (1.4.4). While her words perhaps show devotion, her interest in austere rules and her pride in her virtue could also align her with Angelo (Bellioti 131). Raymond Bellioti gives five different ideas in which Angelo finds himself superior and more virtuous than the others of Vienna:

First, dismissing his treatment of Mariana...Second, in that vein, Angelo has never broken the fornication law...Third, Angelo has steadfastly served Duke Vincentio...Fourth, to the best of everyone's knowledge, Angelo has never broken any other Viennese laws. Fifth, in comparison to the rampant individual license that infects Viennese social life, Angelo is controlled and disciplined (123).

While these qualities would describe someone of good character, pride aggressively settles in his heart, being the cause for his actions as Belliotti writes, “pride corrodes judgement and facilitates sin” (125). Isabella could also be described as seeking to meet these higher principles. However, Angelo’s virtue also brings haughtiness and entitlement to his character making him believe he is powerful enough to trick Isabella into exchanging virtue for Claudio’s life.

Acting as the devil’s advocate, Angelo initiates a conversation of deceit in which he uses Isabella’s love for both her brother and her virtue against one another in an attempt to evoke feelings of guilt. Before proposing his idea, Angelo repetitively and strongly comments on the inevitability of Claudio’s death: “Your brother cannot live...yet he must die” (2.4.32.36). He also asserts his authority explaining to Isabella that he is the one who sentenced Claudio to death (2.4.37). Angelo continues pressing guilt onto Isabella's mind comparing her to Claudio’s lover, Juliette, and questioning the depth of her love for her brother: “or to redeem him / Give up your body to such sweet uncleanness / As she that he hath stained” (2.4.52-54). Would she be willing to give her body to Angelo to save her brother just as Juliette gave her body to Claudio? The article “Measure for Measure: Sex and Power in a Patriarchal Society” furthers Belliotti’s idea explained above that Isabella unknowingly portrays herself as the “female Angelo” in placing her identity in her virtue (Gay 125). As Isabella places her identity in her virtue, seen in her mention of a stricter nunnery and continuous religious diction, she becomes similar to Angelo as they develop tunnel vision in trying to accomplish something without truly considering those around them and are both, as Belliotti describes, “wired tightly” (131). Her self-perception pushes many audience members and readers not to feel as affectionately for her as her exceeding purity is not relatable. However, a significant contrast between Angelo and Isabella appears in terms of their virtue relating to religion. Angelo’s convictions regarding the connection between

faith, religion, and purity are not as prevalent in his character which gives the impression of failure in the temptations of Isabella's beauty. Contrastingly, Isabella's firm foundation in her religion was "preserved by virtue" (Geckle 114).

With Isabella's religious foundation, Angelo's proposal could be him thinking she is attempting to be like Christ by sacrificing her life for her brother. Contradictorily, this exchange and transportation of Isabella also exhibits signs of a form of human trafficking known as bonded labor. Bonded labor, Justin Henley explains, is a person working, or performing sexual acts, to "pay back an inherited debt" (8). Isabella's heinous situation can be subcategorized under sex trafficking as Angelo's proposal includes exchanging Claudio's debt for sex, also considered sexual exploitation (Henley 8). As many victims of sex trafficking are placed in a position in which giving themselves to their victimizer is their only choice, Isabella is also placed in this position as Angelo tells her to

Admit no other way to save his life

No earthly mean to save him, but that either

You must lay down the treasures of your body

To this supposed, or else to let him suffer (2.4.89, 95-97).

Maintaining the idea of bonded labor, Angelo's mention of Isabella's chastity and purity as her body's "treasures" commodifies her (2.4.96). Additionally, like victims of sex trafficking, guilt and wrongful justification are strongly brought into his iniquitous suggestion saying, "Might there not be a charity in sin / To save this brother's life?" (2.4.63-64). Both are made to feel guilty in that not giving themselves to their opposer, their family members or other loved ones might not receive resources falsely promised or freedom and safety.

Henley also explains that often the debt attempting to be cleared does not amount to the work required to rectify it within bonded labor (8). Isabella fights against the restraints of prospective bonded labor explaining to Angelo it would be better for Claudio to die than for her to give over body, believing it to be synonymous with giving him her soul. Threatening to tell all that Angelo has just done, Isabella fights for her life, but he rebuts using his chaste characteristics for support, saying, “Who will believe thee, Isabel? / My unsoiled name, th’ austereness of my life, / My vouch against you, and my place i’ th’ state” (2.4.55-57). While, unfortunately, threats of this level do not free a victim from escaping forthcoming trafficking, Isabella is able to verbally free herself from being used as a sacrificial offering. If not able to do this, she would also be brought alongside Angelo “in an abuse of political authority” (Bellioti 131).

Although Angelo mishandles his power, his characteristics overrule his deceptive disposition and strengthen his candidacy to be elected to his position. Lack of communication and self-awareness and a rampant desire for freedom cause Duke Vincentio to bring Angelo to power. The Duke understands the ramifications of the repression of laws concerning fornication but now needs Angelo to become an enforcer for the people’s love for him to remain (1.4.19-29). Additionally, the Duke grants Angelo the power to enforce these laws as the Viennese people, in their attempt to gratify their desires, would be more upset with a ruler who takes their property and women away from them (Bellioti 105). Not only is the Duke’s method of gaining praise deceitful, his methodology in using the people’s sins against them proves him to be manipulative and controlling (Rosell 374). His disguise as Friar Lodowick allows him to continue to possess a level of control while keeping his reputation of being loved by the people, but it is also hiding a deep part of his character. The play's comedic factor is the reason for the inclusion of

disreputable characters, as their low-status and crude comments, like the ones of Lucio, are meant to provide comedy. In Lucio and Friar Lodowick's conversation in act three scene two, Lucio hints at the Duke's involvement in local brothels. "Who not the Duke? Yes, your beggar of fifty: and his use was, to put a ducat in her clack-dish. The Duke had crotches in him. He would be too drunk too, that let me inform you" (3.2.111-13). Both Lucio and the Duke hypocritically accuse others while both frequenting of local brothels: the Duke accuses the people of Vienna for their sexual crimes and Lucio accuses the Duke.

As the Duke deceptively provides Angelo with the ability to enforce laws against illicit sex, he also provides him with his villainous role within *Measure for Measure*. Despite this, Angelo is not the only individual exchanging women within this play. Exchange and commodification become evident within the theme of brothels, owned by Mistress Overdone, and her introduction establishes her character. A few of Mistress Overdone's first lines are directed towards Pompey, the pimp who works for her, and comment on the decline in business within her brothels due to present war, punishment for sexual crimes, and poverty (1.2.73-75). As Pompey informs her of Angelo's proclamation to tear down brothels in Vienna's suburbs and for the ones in the city to be sold, her complaints continue and illustrate her selfishness as a bawd, woman owner of a brothel, as she says, "Why, here's a change indeed in the commonwealth. What shall become of me?" (1.2.96-97). Her view of sexual trade for financial stability is completely different from that of Angelo and Isabella. Where they take pride in their virtue, Mistress Overdone sees illicit sex as an opportune economic investment. Similar to Claudio, Lucio has also gotten a woman pregnant, Mistress Kate Keepdown, a prostitute. Mistress Overdone is the one to report Lucio's actions in an attempt to protect herself and keep her business running, "My lord, this one Lucio's information against me. Mistress Kate

Keepdown was with child by him in the Duke's time, he promised her marriage, his child is a year and a quarter old come Philip and Jacob - I have kept it myself - and see how he goes about to abuse me" (3.2.173-77). In "Measure for Measure: Sex and Power in a Patriarchal Society," Penny Gay comments, as pointed out by Kathleen McCluskey, that Shakespeare's attempt to deconstruct comedy is to "deny the lively energy of the pimps and the boards, foregrounding their exploitation of female sexuality" (121). In the composition of this play, Shakespeare's attempt to create comedic factors of the actions of Lucio, Pompey, and Mistress Overdone further allude to the ethical dilemmas, problems that many audience members might have been facing.

The topic of brothels was not new to London during Shakespeare's time. Members of Parliament instated laws for these centers of prostitution, and many church leaders felt these places were important to keep women of their church virtuous and pure (Shugg 292). The London enactment of 1393 can be seen as what set the idea of protection for these women's virtue into place. This enactment allowed brothel houses to be placed in Southwark and Smithfield but became illegal everywhere else. In towns where prostitution was illegal, this enactment "strictly forbade prostitutes to wander in any other districts on pain of forfeiting [as a fine] their upper garments and hoods..." (Shugg 292-93). With this knowledge, it is said that Shakespeare modeled the brothel house of Mistress Overdone after one largely known in Southwark (Shugg 293). While Shakespeare brought attention to this problem, it was not new. Years before *Measure for Measure* was written, Henry VIII felt the promiscuity and crime within these districts was becoming rampant and decided to close them. Despite his best efforts, the closing of these houses did not hinder prostitution as the houses opened once again but under aliases (Shugg 292-94, 303).

Despite the overwhelming reality that positive outcomes were commonly absent for women in brothels, the women were able to do their part in placing consequences on their male adversaries. Wallace Shugg explains that oftentimes many of these prostitutes would use “crossbiting” on the men (301). “Crossbiting” within prostitution refers to prostitutes first tricking different men into buying them wine. After receiving the wine, in addition to the woman, a giant, burly man was included in their purchase. To escape their fate with the gargantuan protector, the men would pay even more money, which in turn brought benefit to the prostitutes (Shugg 301). Men who escaped the punishment of these men in “crossbiting” often contracted sexual diseases through fornication such as syphilis, also known as the “French disease” (Shugg 301). Lucio refers to the sexual disease in act one, scene two when he says, “Whilst I live, forget to drink after thee” (1.2.35). In this phrase, Lucio alludes to contracting syphilis from a drink, further suggesting “crossbiting.” While these things are mentioned within *Measure for Measure*, other punishments for those involved in brothels are also a topic. Pompey is threatened with being whipped, a common form of punishment for bawds and those helping bawds during this time, and Juliet and Claudio are mocked publicly (Shugg 303).

Although many people within *Measure for Measure* receive punishment for their involvement in brothels or another subcategory of illicit sex, the Duke escapes retribution. His involvement in local brothels in his position illustrates the contradiction and hypocrisy in striving to keep himself well respected and well reputed. Directly following Angelo and Isabella’s disagreeable interaction, the Duke, disguised as Friar Lodowick, converses with Claudio about being pardoned by Angelo. As Isabella enters and tells Claudio about the transaction Angelo suggested, the Duke hides. One reader may interpret this act as an act of shame for being the one to give Angelo the power to go about his proposal. If he were to stay hidden, this might be the

case, but his reappearance to propose his own suggestion of exchange proves otherwise. Duke Vincentio begins his proffer by making Isabella aware of Angelo's prior betrothal to a woman named Mariana; a woman whom he left, after the loss of her dowry, alongside her brother at sea. At this, Angelo's villainy advances in Isabella's perception, but following a similar style to Angelo, the Duke appeals to Isabella's kindness and Christian ideals of redemption. In this appeal, he suggests to her that the reunification of Angelo and Mariana will not only save her brother but will also keep her pure: "It is a rupture that you may easily heal, and the cure of it not only saves your brother but keeps you from dishonour in doing it" (3.1.225-27). His complete plan involves deceiving Angelo into going to bed with Isabella, but in turn, an exchange will be made with Mariana. In other words, Mariana will be exchanged for Isabella, the one being exchanged for Claudio. In his article, Alexander Leggat says, "...the substitute cannot be exact; one person simply does not equal another. Angelo is not the Duke, Mariana is not Isabella, Nor is Isabella Mariana. Made to act on another's behalf, they reveal their own individuality" (Leggat 349). Mariana is standing in the place of Isabella, but Angelo perceives that the woman he has just completed a transaction with is Isabella. Is Angelo so blind to miss the new exchange happening right before his eyes or does this allude to an additional idea?

Upon Isabella's interaction within the bed exchange, a question about her character arises. Knowing and experiencing Angelo's terrible ideas towards women, how can she subject Mariana to being exchanged for her? It may be that in her Christian foundation, the idea of redemption and reunification was overtly appealing to her. She wanted to be a "Christ-type" by saving the relationships of both Mariana and Angelo and Claudio and Juliet; however, understanding the pride Isabella took in retaining her virtue, she could be acting as the "Christ-type" towards herself in her intense desire to protect her own chastity. A different reading of this

play may call for Mariana and Angelo's past betrothal to be an allowance for the bed exchange to occur under the notion of reconciliation. However, hesitations still occur as it also may be read that the bed exchange is a means by which Mariana is able to pay for the absence of her dowry. One aspect seemingly different in the relationships of Mariana, Angelo, and Isabella is Mariana's deep-seated desperation for Angelo illustrated by her saying, "I crave no other, not no better man" upon the Duke's suggestion of an exchange for a new husband (5.1.420). As explained above that bonded labor, including sex trafficking, is to settle the debt with another, Mariana is being used in exchange for both Claudio and Isabella. And while being brought in as an exchange, commodified to take the place of Isabella, Mariana is the only one in the text who is willing to be the substitute. Her consent to participate in the bed exchange does not fully support the idea of bonded labor, i.e. sex trafficking, but her being persuaded by both Isabella and the Duke disguised as Friar Lodowick points towards a level of coercion associated with sex trafficking.

In 2001, the United Nations drew up a protocol entitled "Protocol to Prevent, Suppress and Punish Trafficking in Persons Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime" in order to fight human trafficking and protect those who fall victim to it. The protocol describes the umbrella term of "trafficking" as the transportation or harboring of a human being through acts of force, abduction, or threats to gain their consent to involve them in exploitation (United Nations article 3, subsect. a). Mariana's consent to be involved in the bed exchange is what separates her from being categorized under this term, but in the case of human trafficking, consent is not always the turning factor of a situation. When facing threats to themselves and their family members, many people are forced to provide their consent. Additionally, this same article explicitly states, "The

consent of a victim of trafficking in persons to the intended exploitation set forth in subparagraph (a) of this article shall be irrelevant where any of the means set forth in subparagraph (a) have been used” (United Nations article 3, subsect. b). Under these horrifying conditions including force, coercion, abduction, and threats, human beings should not be held responsible for actions made in order to protect themselves and their families.

As Shakespeare writes *Measure for Measure* as a problem comedy, the audience never finds satisfaction or resolution at the end of the work. The characters do not receive a solution for their problems and there is no resolution found within the play’s many marriages, a significant contrast to the common literary comedy. Regarding the bed exchange, reconciliation and redemption are what Isabella wished to have been brought forward, yet they were not as Angelo wishes instead for death rather than marriage and mercy: “That I crave death more willingly than mercy. / ‘Tis my deserving, and I do entreat it” (5.2.470-471). Rather than Isabella finding freedom from the looming threat of commodification, she instead begs for Angelo’s mercy at his confession and is repeatedly asked by the Duke for her hand in marriage. Furthermore, Lucio is sentenced to marry Mistress Kate Keepdown, to his dismay.

While most of the characters do not receive a satisfying ending, Claudio does. In the finally successful exchange for Claudio’s life, Barnadine, a drunken prisoner set for death row, is in line to be the substitute, yet in his argument of needing repentance, the head of a dead pirate is sent instead. Similarly, the Duke receives an ending somewhat in his favor as he is not punished in the similar ways as the others but only has his offer of Isabella’s hand in marriage left unanswered. Whereas the actions of the others brought consequences, the Duke’s hypocritical acts of being involved with the brothels, placing Angelo into his position of power, suggesting

the bed trick with Mariana, and doling out all the punishments support the unsatisfied resolutions in this play.

Just like in *Measure for Measure*, the brothels and victims of human trafficking often do not have favored resolutions to their stories. Many victims are never found, never set free, and never live the life that was intended for them. Although he might not have knowingly done so, Shakespeare brings awareness to racism and discrimination within *Othello*, mental illnesses and insanity in *Hamlet*, and the appalling actuality of sex trafficking and women commodification in *Measure for Measure* and other plays for both male and female twenty-first century readers. Many scholars contemplate whether Shakespeare's canon should still be taught with the cultural and societal differences between the two periods being substantial. Yet teaching Shakespeare's works illustrates the development and progression of these realities, for better or worse, and creates a platform for future generations to stand on and grow louder in their vocalization for justice and change.

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“The Green-Eyed Monster:” Analyzing Homosexual Desire as Iago’s Motivator in *Othello*

Isabella Walle

Faculty Mentor: Dr. Allison Kellar, Associate Professor of English

ABSTRACT

This paper explores the idea of Iago's repressed desire for Othello and how this desire motivates his actions throughout William Shakespeare's *Othello*. Both Othello's promotion of Michael Cassio to the position of lieutenant, a position that Iago feels he better deserves, and Othello's marriage to Desdemona represent Othello's rejection of Iago romantically. It is this rejection that serves as the catalyst for Iago's journey of revenge against Othello. Several scenes and concepts present in the play further support the idea that Iago harbors a homosexual desire for Othello, as other scholars have also noted. These include the manner in which Iago speaks to and about women, the scene in which he describes Cassio's dream of Desdemona to Othello, and the marriage-like scene that takes place between Othello and Iago. Furthermore, analysis of the nature of homosexual relationships in Shakespeare's England provides context for Iago's repressed desire for Othello and defends the idea that Shakespeare created a homosexual character through his writing of Iago. Ultimately, it is Iago's struggle with the “green-eyed monster” that drives him to destroy the lives of Othello, Cassio, and Desdemona.

In William Shakespeare's tragedy *Othello*, a play that is characterized by its intense revenge plot that results in the death of nearly all the major characters, Iago, the instigator of the deadly revenge plot, is the only major character who survives the play. The reasons for his actions remain unknown. Scholars have sought for centuries to understand what motivates Iago to act in such a manner. On the surface, the answer seems simple: Iago is an ambitious man and his desire to be promoted to the position of Othello's lieutenant is important enough to him that he is willing to kill when he does not receive it. Some theorists explore Iago's motivations as a racist, a sociopath, or someone who desires Desdemona, Othello's wife. However, a closer examination of the text shows that Iago is primarily motivated by a homosexual desire for Othello, and this is what drives him to destroy Othello, Desdemona, and Cassio's lives through his machinations. Iago perceives Othello's promotion of Cassio and his marriage to Desdemona as romantic rejections, which prompts him to formulate his plan for revenge out of intense

romantic jealousy of both Cassio and Desdemona. Iago's repressed homosexuality is evidenced by his treatment of women, the way he discusses heterosexual intercourse, the way he describes Cassio's "dream" of Desdemona, and the way he behaves during the faux-marriage scene between himself and Othello. Ultimately, it is Iago's unreciprocated homosexual desire for Othello that drives him to embark on his devastating journey of revenge against Othello and those closest to him.

The crux of the play occurs when Othello chooses Cassio for the lieutenant position rather than Iago, who feels he is more deserving of the promotion. Iago's sense of entitlement toward the role of lieutenant stems from the fact that he has been at Othello's side throughout several wars; this not only demonstrates his loyalty to Othello but also demonstrates that he is a seasoned soldier who knows his way around a battlefield. According to Bruce R. Smith, author of *Homosexual Desire in Shakespeare's England: A Cultural Poetics*, Iago defines his identity in terms of existing in this male-dominated, war-centered world; he possesses a "militant maleness and [a] virulent contempt for women" that he flaunts throughout the play (Smith 62). Thus, when Cassio is chosen to be lieutenant, Iago views this decision with contempt for three reasons: Cassio "is a contemplative theoretician, not an active soldier; he is a Florentine, not a Venetian; and he is a lover of women, not a man's man" (Smith 62). As such, Othello's promotion of Cassio is perceived not only as a slight to Iago's battle prowess but also, by extension, a reinforcement of Othello's heterosexuality. Cassio has "never set a squadron in the field, / Nor the division of a battle knows / More than a spinster," but is renowned for being flirtatious with women (1.1.23-25). Thus, Othello's choosing a man who freely engages in romantic relationships with women to be his lieutenant rather than Iago, who has stayed loyal in the male-dominated environment of war, serves as a professional and romantic rejection of Iago

simultaneously. Othello and Cassio's heterosexuality is a link that bonds the two characters together in a way that excludes Iago. Though Iago has served with Othello on the battlefield on numerous occasions and has proven himself to be a good soldier, Othello's romantic attachment to Desdemona still outweighs the loyalty Iago has demonstrated toward him in war. His loyalty is doubly voided when Othello promotes Cassio, a heterosexual man, over Iago as well.

Though Othello's promotion of Cassio is the impetus for Iago's journey of revenge against Othello, the real romantic rejection takes place through Othello's marriage to Desdemona. To Iago, "women have no place" in the world of soldiers; they only serve to "destroy the bonds that men form with men" (Smith 63). In Iago's eyes, Desdemona does exactly that. She effectively prevents Iago from becoming romantically involved with Othello in any capacity and commands Othello's attention more than Iago ever could. Within Shakespearean England, there was an "antagonism between marriage and same-sex eroticism" (Crawford 255). According to Julie Crawford, marriage's "position in relationship to homoeroticism [had] been relatively fixed: it [was] dominant and deterministic, the trump card to the playful hand or longed-for continuation of homoeroticism" (257). It is important to note that Iago is also a married man, though his marriage is a markedly unhappy one. The dismal nature of his own marriage could indicate that his relationship with his wife, Emilia, is not satisfying for him romantically because of his homosexuality; thus, Iago elects to ignore his marriage to Emilia save for when she can be of use to him to further his plot against Othello. In this case, Iago's marriage to a woman does not serve as the end of his homoerotic desire for Othello; however, Othello's marriage to Desdemona certainly signifies the end of any romantic relationship Iago could hope to have with Othello. Through marriage, Desdemona seems to take her place as Othello's permanent lover since their marriage seems to be rooted in genuine love (or, at least,

mutual respect) as well as a desire to be with one another - this bond precludes Iago from being able to usurp her as the object of Othello's desire.

Othello's choosing to marry Desdemona is, in part, what fuels Iago to speak so disrespectfully to and about women throughout the play. This, coupled with his identity as a soldier in a world full of men and his repressed homosexual desire for Othello, drives Iago to treat women viciously. He often describes women as "whores," saying that they are changeable, hypocritical, and deceitful. Desdemona's affection for Othello is a target for Iago, who states "When [Desdemona] is sated / with his body she will find the error of her choice," suggesting that her affection stems only out of lust, not love, for Othello (1.3.393-394). Iago wants to portray her as a shallow figure, someone who does not appreciate Othello with the same magnitude that he does. When speaking to both Emilia and Desdemona in Act 2, he says,

Come on, come on! You are pictures out of door,
bells in your parlors, wildcats in your kitchens,
saints in your injuries, devils being offended, players
in your huswifery, and huswives in your beds. (2.1.122-125)

This misogynist comment is directed towards all women, accusing them of appearing pleasant in public settings but then acting opposite when in private (i.e. behaving hypocritically). It could be argued that Iago treats women in this manner because he is sexually disgusted by them, which is further evidenced by the way he describes heterosexual intercourse. Iago often uses obscene language and "bestial imagery" to describe the act of heterosexual sex (Hyman 370). The most obvious occurrence of this is when Iago is informing Desdemona's father, Brabantio, of Desdemona and Othello's relationship. He intentionally uses provocative language to elicit a reaction from Brabantio, but this use of "bestial imagery" also reflects how he views the act of

heterosexual sex as repulsive and unnatural, especially when the object of his desire, Othello, is involved (Hyman 370). Iago says to Brabantio, “Even now, now, very now, an old black ram / Is tugging your white ewe. Arise, arise... / Or else the devil will make a grandsire of you” (1.1.97-98, 100). Within this statement, Iago is portraying Othello as “an old black ram” and Desdemona as a “white ewe,” which is not only dehumanizing but also draws upon the connotations of colors to suggest that Othello, the “black ram,” is the one committing the “evil” action. While it could be a play on Othello and Desdemona’s respective skin colors or a reference to Desdemona’s virtue, it could also suggest that Iago is experiencing a sort of betrayal because of Othello and Desdemona’s sexual relationship. The idea that heterosexual sex is something “evil” to Iago is made even clearer when he suggests the devil has a hand in the relationship, or at least what might become of it (i.e. a grandchild for Brabantio). Iago goes on to say, “I am one, sir, that comes to tell you your daughter / and the Moor are now making the beast with / two backs,” which further suggests that heterosexual intercourse is beastly to Iago and even makes the participants into beasts themselves (1.1.129-131).

To prove Cassio and Desdemona’s “affair” to Othello, Iago falsely tells Othello that he witnessed Cassio have a sexually charged dream about Desdemona. Iago describes,

In sleep I heard him say “Sweet Desdemona,
Let us be wary, let us hide our loves.”
And then, sir, would he gripe and wring my hand,
Cry “O sweet creature!” then kiss me hard,
As if he plucked up kisses by the roots
That grew upon my lips; (then) he laid his leg
O’er my thigh, and (sighed,) and (kissed,) and then

(Cried) “Cursed fate that gave thee to the Moor!” (3.3.475-482)

Superficially, this scene brings Iago’s sexuality into question for a few reasons. Before he launches into the fabricated description of Cassio’s actions, Iago says, “I lay with Cassio lately,” and, historically, the phrase “lie with” often indicates a sexual encounter (3.3.470). Furthermore, he is conjuring up a scene in which Cassio is using Iago’s body for sexual fulfillment, even if he claims that Cassio believes he is acting sexually upon Desdemona. Hyman states that, within this scene, “Iago has turned himself into a Desdemona for Cassio’s sexual enjoyment on the surface of the spurious dream, and for Othello’s in the latent content” (376). As such, Iago’s creation of this fictional exchange with Cassio could suggest that Iago longs to take the place of Desdemona within Desdemona and Othello’s relationship. Thus, this dream functions as a sort of double-edged sword. Iago is damaging Othello’s perceptions of Desdemona and Cassio, the two people he chose over Iago, and is also allowing himself to fulfill the role Desdemona plays in her relationship with Othello, which is the role Iago wants for himself. Robert Matz, in “Slander, Renaissance Discourses of Sodomy, and *Othello*,” writes, “The supposed desire between Cassio and Desdemona substitutes even more clearly for the desire that Iago continually pursues and is pursuing in telling the dream: his own desire to win back Othello’s love” (Matz 265). This desire is recognized shortly after the description of Cassio’s supposed dream; Iago pledges his loyalty to Othello, and Othello accepts it. Both men are kneeling, and the “vows” exchanged between them mirror a sort of marital ceremony. Iago tells Othello that he will enact revenge upon those who wronged Othello, to which Othello replies, “I greet thy love / Not with vain thanks but with acceptance / bounteous... / ...Now art thou my lieutenant” (3.3.533-535, 545). At once, Iago receives the very promotion that seemingly began this journey of revenge in the first place. Iago takes the promotion one step further, saying, “I am your own forever” (3.3.546). This statement

closely resembles a phrase that couples would say to one another while being married (i.e. “Til death do us part”); it is through this declaration that Iago is professing his love and loyalty to Othello simultaneously. He is not only promising to be Othello’s loyal lieutenant and comrade but is also stating that he is Othello’s in a romantic sense no matter what may happen.

For a moment, it seems that Iago’s wish to be Othello’s lover is beginning to come to fruition; however, once Othello learns of Iago’s treachery, any semblance of a relationship between them is destroyed. Othello then refers to Iago as “that demi-devil” who “ensnared his soul and body,” and demands to know why he would do such a thing to Othello (5.2.353-354). Iago’s response is noteworthy; he says, “Demand me nothing. What you know, you know. / From this time forth I will never speak a word” (5.2.355-356). This statement, while purposefully vague, may indicate that Iago believes Othello knows about Iago’s romantic attraction toward him. If Iago’s claim that he is Othello’s forever in the faux-marriage scene is, in fact, a declaration of love, Iago could mean that he made the reason for his treachery clear to Othello already. However, Othello may not understand this reason because he is too blinded by his heterosexual desires to do so. Either way, Iago ultimately does not become Othello’s lover as he wishes, but he does succeed in effectively destroying Othello’s life before driving him to suicide as revenge for romantically rejecting him.

Ultimately, *Othello*’s Iago is primarily motivated by his repressed homosexual desire for the titular character of the play. Othello’s promotion of Cassio to the position of lieutenant and his marriage to Desdemona are perceived by Iago as romantic rejections, which drive him to enact revenge on Othello for refusing to love him romantically. The way Iago treats and speaks to women as well as the terms he uses to describe heterosexual intercourse further indicates Iago’s homosexuality, as does the way he describes Cassio’s “dream” of Desdemona and the

faux-marriage scene that takes place between himself and Othello. Thus, in an ironic twist of events, it is the very “green-eyed monster” Iago warns Othello to be wary of that ultimately brings about Iago’s downfall (3.3.196). Iago’s repressed desire to be Othello’s lover instead of Desdemona and his explicit desire to be Othello’s lieutenant instead of Cassio serve as catalysts for his envy-driven revenge.

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**Forget the Baby, Don't Throw Out the Bathwater!:
A Feminist Interpretation of Healing in the Infancy Gospels**

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ABSTRACT

There are many books that were read by early Christians but for various reasons were not canonized. These books belong to a category known as the apocrypha, which in Greek means “secret” or “hidden.” These texts are fascinating and present many interesting areas for study regarding their transmission history, translation, and their role in the lives and worship of early Christians. Two of these books are the *Infancy Gospel of Thomas* and the *Arabic Infancy Gospel*. The *IGT* focuses on Jesus’ childhood, from around the ages of five to twelve, where the *Arab. Gos. Inf.* includes scenes from Jesus’ birth, the Holy Family’s trip to Egypt, and Jesus’ childhood. In these texts, Jesus performs many miracles of healing; however, in the *Infancy Gospel of Thomas*, Jesus confines his healing to the male gender, never once healing a woman. Contrastingly, in the *Arab. Gos. Inf.*, Jesus heals many women and women play an active role in this healing – especially Mary. By reading the two texts through a feminist lens, one can conclude that the *Arab. Gos. Inf.* elevates the status of women, whereas the *IGT* excludes women from being healed and from most of the text’s major events.

During Jesus’ infancy, a woman used perfumed water to wash the sacred baby.

Afterward, she poured some of this holy bathwater on a girl with leprosy. Immediately, the young girl was healed. This story, found in the *Arabic Infancy Gospel*, is of particular interest because of the gendered dynamics present. Here, a female healer uses the bathwater of an infant male Christ to heal a young female with leprosy. In addition to the elevated status granted to women in the *Arab. Gos. Inf.*, this text also highlights female relationships, allowing women to connect over their shared illnesses and the pursuit of healing from Mary. Contrastingly, in the *Infancy Gospel of Thomas*, young Jesus confines his healing to the male gender, never once healing a woman. In this paper, I interpret the apocryphal infancy gospels (particularly the *Infancy Gospel of Thomas* and the *Arabic Infancy Gospel*) through a feminist lens, analyzing the

role that gender plays and centering the female characters in these stories. How does gender presentation affect healing? How does the healing of the adult Jesus compare to the woman who heals by holding the infant Jesus? What role do the mothers of these afflicted children play in these healings? What role does Mary, the mother of the infant Jesus, play? How does it affect our reading of the text if we focus on these women healers?

Many of the healing stories found in the *Infancy Gospel of Thomas* and the *Arabic Infancy Gospel* are shared between multiple infancy gospels - namely, the *IGT*, *Gospel of Pseudo-Matthew*, the *Arab. Gos. Inf.* and an *Irish Versified Narrative*.¹ These shared stories were likely familiar to early Christians and featured some interesting feats such as the turning of clay birds into breathing sparrows and Jesus' attempts at learning the alphabet. However, all of the episodes shared between these aforementioned gospels show a young Jesus who heals only men. Only the *Arabic Infancy Gospel* possesses instances of young Jesus healing women. Consequently, the young Jesus found in *Arab. Gos. Inf.* even allows for women to be involved in healing, including his own mother, Mary.

Compared to the miracle stories found in the canonical gospels, this is notable. As Satoko Yamaguchi points out, "In the entire Christian testament. . . there are no accounts of sign-working specifically attributed to women..."² Yet, in the Greco-Roman world there is evidence of women healers, named and catalogued by Elaine Wainwright and which includes Mousa and Antiochis.³ Wainwright also highlights the relationship between gender and healing in the story of the Canaanite woman found in Matthew, claiming: "Such healing is not brought about by the male healer's action and or words but rather by the woman whose bodily presence and speech

¹ Elliott catalogues these similarities in *The Apocryphal Jesus: Legends of the Early Church*.

² Yamaguchi, *Mary and Martha: Women in the World of Jesus*, 75.

³ Wainwright, *Women Healing/Healing Women: The Genderization of Healing in Early Christianity*, 50.

continues to confront and challenge Jesus, her faith thereby shifting gender categories.”⁴ Using similar methodology as these scholars, I analyze the healing stories in two apocryphal infancy gospels with specific attention to gender and healing.

Essential to the understanding of these gender roles within these apocryphal gospels is the definition of what it means to be apocryphal. The word apocrypha comes from the Greek word ἀπόκρυφος meaning to be “secret” or “hidden.” Scholars have debated what these texts may have been and meant to early Christians, but it is now generally accepted that this word, and the category of texts associated with it, refers to texts that are outside of the biblical canon. However, most apocryphal texts were circulating for years before Biblical canonization, meaning that early Christians likely read and were familiar with these texts.

The history of the *Infancy Gospel of Thomas* is fascinating given that it is likely the only account of Jesus’ childhood that came from early Christianity.⁵ While there are other apocryphal texts describing the childhood of Jesus, most focus on the birth of Jesus like the *Protevangelium of James*, which means it is likely that *IGT* is the oldest source of writing on Jesus’ childhood. This text tells of episodes of Jesus’ childhood from infancy until he was around twelve years old. In the Biblical canon, there is only one story of Jesus as a child – the *Gospel of Luke* includes a scene where Jesus is twelve years old and is found sitting in the temple rather than traveling back home from Jerusalem with his parents – but nothing else is present in the Biblical canon regarding Jesus’ childhood. Pericopae found in *IGT* include miracles of Jesus turning clay birds into breathing ones, carrying water with his clothes, and of course, healing the sick and raising people from the dead.

⁴ Wainwright, “Of Dogs and Women: Ethology and Gender in Ancient Healing; The Canaanite Women’s Story - Matt 15:21-28,” 68.

⁵ Aasgaard, *The Childhood of Jesus: Decoding the Apocryphal Infancy Gospel of Thomas*, 1.

The text was written originally in Greek and there are some debates over its dating, but many scholars, including Reider Aasgaard and Tony Chartrand-Burke, agree that the text can be traced back to the second century.⁶ Much of the research pertaining to *IGT* and other infancy gospels has centered around its dating, transmission history, and translation. Recently, scholars such as Aasgaard, Chartrand-Burke, Christopher Frilingos, and Kristi Upson-Saia have made important contributions to the study of *IGT*; most of this work focuses on the child Jesus and family—Jesus as a child, Jesus’ anger, Christology, and the idea of masculinity. Until Aasgaard’s publication of *The Childhood of Jesus* in 2009, the issue of gender in *IGT* was unaddressed.

The *Arabic Infancy Gospel* is dated later than *IGT*, because it repeats some of the same episodes as *IGT*. This text is a compilation of stories from the *Protevangelium of James*, *IGT*, and other stories unique to the *Arab. Gos. Inf.* This text was originally written at least partially in Syriac around the fifth or sixth century, before the emergence of Islam.⁷ Many of the episodes found in this text center around Jesus and his family’s journey to Egypt and back, which refers to a story from Matthew’s gospel.⁸ Unique to the stories found in *Arab. Gos. Inf.* is the power held by items associated with infant Jesus. Jesus’ tiny body has the ability to heal simply by someone holding him, as do items like his bathwater and swaddling clothes. The text features women and girls, allows Jesus to heal them, and even allows the mothers of the afflicted to have some agency and involvement in their child’s healing. Because of this, I argue that this text grants a higher status to women, including Mary the mother.

⁶ Aasgaard, 2.

⁷ Gregory and Tuckett, *The Oxford Handbook of Early Christian Apocrypha*, 28.

⁸ Matthew 2:13-23.

Compared to the *Infancy Gospel of Thomas*, the *Arabic Infancy Gospel* shows much more female involvement in healing. Mary and Jesus heal a number of women whose ailments are described in detail—ranging from leprosy to possession to tormenting by the devil. Not only are women healed by Jesus in this text, but women play roles in the healing of their children, even Mary the mother herself. In fact, in this text, a woman is even healed from demonic possession by Mary’s pity alone. Paying attention to the status given to women in this text can help us better understand that lack of female inclusion in the *Infancy Gospel of Thomas*. Therefore, I will begin by describing the stories of healing by women in the *Arab. Gos. Inf.* and then will describe similar stories, but without female presence, found in the *IGT*.

Perhaps one of the most obvious instances of elevated female status in the *Arabic Infancy Gospel* is in chapter 14. The text describes a “demoniac woman” who was oppressed by Satan at nighttime. She is reported as not being able to wear clothing or stay put in a house and that neither chains nor straps could hold her. She threw stones at men and was mischievous to her friends. However, when Mary sees this woman, she pities her and Satan leaves the woman in the form of a young man saying, “Woe unto me from thee Mary, and from thy Son.”⁹ After the healing/exorcism, the woman leaves and tells her father what has happened, and since her family were elders of the city, they “entertained lady Mary and Joseph most honorably.”¹⁰

It is significant that this healing is done completely by Mary. The woman does not hold the infant Jesus or wash in his bathwater, but rather is healed fully by Mary’s pity. Satan also cries out while leaving the woman saying “Woe from Mary” first, then woe from her son, implying that Mary is the most prominent source of power. Lastly, Mary is named first when the

⁹ Cowper, “The Arabic Gospel of the Infancy,” 181.

¹⁰ Cowper, 181.

honorable entertainment is described, not Joseph, further elevating Mary's status as healer and her divine intervention in the possessed woman's story.

Another example of divine healing takes place on the holy family's journey from Egypt where they encounter a bride rendered mute and deaf from the "arts of cursed Satan and the work of the enchanters."¹¹ Mary enters the town carrying the infant Jesus and when the mute bride sees them, she stretches out her arms to hold the baby. She embraces the baby, kissing and rocking him and instantly the "bond of her tongue was loosed and her ears were opened."¹² Following the miracle, she praises and gives thanks to God for her healing, and all her community praised God for they supposed that God and his angels had come down to them.

Though it may appear at first glance that the infant Jesus is the one healing this bride, I argue that Mary, the mother, and the unnamed bride have agency in this story. Mary is the one who enters the town with baby Jesus, not Joseph and his family or a caravan. When the bride sees Mary and Jesus, she is the one who stretches out her hands to them and takes the baby of her own accord. She does not ask for help or healing, nor does Mary simply give Jesus away to the bride in hopes he will heal her, but rather the bride acts and embraces the baby, instigating her own healing. When the unnamed bride takes the infant, kisses him, and rocks him, she directly contributes to the healing of her deafness and muteness. The townspeople say that Mary is an angel, and after they learn of this bride's healing, the townspeople praise God, thinking that God and his angels had come down to them. Mary's presence in this story and role in the bride's healing place her among God and the angels, showing her increased status in this text.

Instances of healing through the use of Jesus' bathwater take place in chapters 17, 31, and 32 of the *Arabic Infancy Gospel*. In chapter 17, a woman uses perfumed water to wash Jesus. She

¹¹ Cowper, 182.

¹² Cowper, 182.

then takes this bathwater and pours part of it on a girl in the town suffering with leprosy. Instantly, the young girl is healed. After this, Mary, Joseph, and Jesus are praised by the town, assumed to be gods rather than men. When they leave, the young girl healed of her leprosy begs them to take her with them. This woman healer coordinates the young girl's healing by seeking out Mary and Jesus, washing Jesus in the water, and then using the water to wash the leprosy girl. This healing also elevates the status of Mary with the townspeople likening her to God following this healing instance.

In chapter 31, a leprosy woman comes to Mary, seeking help. Mary asks this woman what kind of help she desires, whether monetary or to be healed from her leprosy. Mary's question of what kind of help the woman needs reveals that she is aware of her power to heal. Mary instructs the woman to wait until she has washed Jesus and put him to bed. The woman waits. After Mary finishes bathing the baby, she gives the woman a little of Jesus' bathwater, instructing her to pour it on her body. After doing so, the woman is healed of leprosy. Both women in this story play an active role in the healing. The leprosy woman seeks out Mary and the holy family and asks them directly for help. Mary knows of her status as healer and asks the woman what kind of help she seeks in order to determine if the woman is truly seeking her healing power. Mary instructs the woman what to do with this holy bathwater, sharing and proving her healing knowledge.

Shortly after this, in chapter 32, a third woman is cured of leprosy using Jesus' bathwater. The context of this story begins when an elder of the town married the daughter of another elder. But, when the elder saw the woman he married, the marriage was quickly dissolved and annulled because "he perceived between her eyes the mark of leprosy like a star."¹³ The woman healed

¹³ Cowper, 197.

from leprosy in chapter 31 sees the couple distraught over the annulment and asks them what the cause of their weeping is. The couple responds that they cannot reveal their trouble to anyone. The healed woman insists, suggesting that perhaps she could provide them the remedy to their problem. Reluctantly, the couple reveal the bride's leprosy in the shape of a star. The healed woman then explains that she also suffered from this condition before traveling to Bethlehem and meeting Mary, who gave her Jesus' bathwater in which to bathe. After hearing this, the leprosy bride asks the healed woman to journey with her to see Mary and ask for healing. They go to see Mary, bearing gifts, and introduce the leprosy woman. Mary tells the woman that the grace of the Lord is upon her and gives her some of Jesus' bathwater, instructing her to wash in it. When the woman washes in it, she is healed, her husband takes her back, and once again, everyone praises God for this healing.

This story presents an interesting example of gender roles because of the relationship present between the healed woman from chapter 31 and the leprosy bride from chapter 32. The healed woman from chapter 31 sees the struggle of the couple and seeks out the cause of it. At first, they do not want to reveal the cause for their struggles, but the healed woman convinces them when she claims that she may know a remedy for their suffering. When she discovers that the bride is leprosy, she connects with her over their shared illness and suffering and takes the bride to Mary to experience the same healing as she did. Once again, Mary recognizes her status as healer, giving the bride bathwater and instructing her to wash in it for healing. In this way, the *Arab. Gos. Inf.* elevates female relationships, connecting them through shared illnesses and the obtaining of healing from Mary. The bathwater also presents an interesting way for women to heal women because the infant Jesus is completely reliant upon a woman, his mother, for all things. Men (particularly the infant Jesus) play no active role in this healing. Mary washes Jesus

herself, then gives this bathwater to the women who seek healing as a way for them to heal themselves.

In a final example, we see healing take place through Jesus' swaddling clothes, while once again highlighting female relationships and allowing women to heal other women. In chapter thirty-three, a girl is tormented by Satan who appears to her in the form of a dragon, "preparing to swallow her up" and "sucking all of the blood out of her, so that she remained like a corpse."¹⁴ No one was able to deliver her from this dragon and so her parents and all the townspeople grieved for her. When the daughter of the prince (who happened to have been healed of leprosy by Mary) heard the tormented girl's cries she went up to see her and asked if her parents were alive. The mother of the tormented girl comes and speaks to the daughter of the prince who tells her that she was once a leper healed by Mary and begs her to keep this secret. The daughter of the prince instructs the tormented girl's mother to take her to Bethlehem and seek out Mary, the mother of Jesus, and she will be healed. The pair travels to visit Mary in Bethlehem, where Mary gives the tormented girl's mother some of Jesus' bathwater and instructs her to wash her daughter in it. Mary also gives her some of Jesus' swaddling clothes, which she instructs the tormented girl to show to the dragon whenever he appears.

When they return to their homeland and the dragon torments the young girl again, she takes the strip of Jesus' clothes given to her by Mary and places them on her head, showing them to the dragon. Flames and live coals dart from the clothes as she touches them to her head. While the dragon is being attacked, he cries out, "What have I to do with thee, O Jesus, son of Mary? Whither shall I flee from thee?"¹⁵ The dragon then turns his back on the girl and departs from her, never to bother her again. Once again, in this story the female relationships are highlighted.

¹⁴ Cowper, 198.

¹⁵ Cowper, 201.

Three vital relationships in this story are: the relationship between the daughter of the prince and the tormented girl, the mother/daughter relationship, and the relationship of healer Mary to the women healed by Mary. The previously healed daughter of the prince knows of Mary's healing power and encourages the dragon-tormented girl and her mother to seek out Mary's healing. Once sought out, Mary grants her healing power and instruction to the dragon-tormented girl out of pity and provides a way for the girl to take an active role in her healing - through the use of Jesus' swaddling clothes. Even while the dragon is being destroyed by fire he cries out and names Jesus as the son of Mary, not the son of God or Joseph, once again further elevating Mary's status.

Other aspects of these stories provide fascinating insight into the gender roles present. Joseph is absent and unnamed in every one of the above instances, though he is presumed to be traveling alongside his family. Joseph does not take an active role in any of the healing instances and is likely not even present to witness these healing miracles. However, Mary's status is significantly elevated throughout the text, with her healing, being aware of her healing power, and even being referred to as "Lady Mary" instead of simply "Mary" or "Mary, the mother of Jesus." While the status of women is certainly elevated in the *Arab. Gos. Inf.*, particularly Mary's status, the other women in this story remain unnamed, making it sometimes difficult to keep the women in this story straight. However, despite being unnamed, these women are still quite active in the text, especially as healers. In order to provide a contrasting view, I now turn to the *Infancy Gospel of Thomas* where I will exemplify the stories of healing and where the lack of female presence will be obvious.

The *Infancy Gospel of Thomas* is filled with examples of Jesus' supernatural feats – including healing. Many of these instances are different from the healing episodes in the

canonical gospels. While young Jesus heals the sick and raises the dead, he also heals injuries, bleeding, and snake bites. However, unlike the older Jesus in the canonical gospels, young Jesus in the *IGT* does not heal women. Rather, he confines his healing to the male gender, and the only woman in the text who is named is Mary, his mother. Excluding women from being healed or healing others in this text contributes to the marginalization of women and highlights male relationships and power within the text. I will now describe and analyze several of these healing stories, using my own translation of the Greek text A and tracking the gender dynamics in each of these stories.¹⁶

The first instance of healing is found in chapter nine, where Jesus raises a child, Zeno, from the dead after he fell from the rooftop:

Now after some days, Jesus was playing in the upper story of a house, and a child playing with him fell from the housetop and died. And when the other children saw it, they fled, but Jesus remained alone. ²And when the parents of the dead came and accused [him of throwing him down. Jesus said, “I never threw him down.” But they influenced him. ³Jesus jumped down from the roof and stood by the body of the child, and cried out with a loud voice and said, “Zeno” (for that is what he was called) “Rise up and tell me, did I throw you down?” And he rose up immediately and said, “No Lord, you did not throw me down, but raised me up.” And when they saw it, they were stunned. And the parents of the child glorified God for the sign that had happened and worshipped Jesus.

The story ends with all who witnessed this miracle being amazed and worshipping Jesus.

The inclusion of Zeno’s name but lack of specifically naming women in this episode highlights the relationship between Jesus and Zeno and erases the women who were likely present for this. The word τέκνα is not used to describe the group that Jesus was playing with, but rather Jesus is described as playing alone when the child Zeno fell from the roof and died.

Additionally, the lack of description of Zeno’s parents highlights male relationships. The family

¹⁶ There are many different manuscript versions, alternate forms, and translations of the *Infancy Gospel of Thomas*; there are three principal forms: the Greek text A, the Greek text B, and Latin. The Greek text A is the most well-known form of the text and longer of the two Greek versions. For this paper, I used the Greek text prepared by Craig A. Evans available on *Accordance Bible Software* (OakTree Software, Inc. 2009).

of Zeno is described as “γονεῖς τοῦ τεθνεῶτος” or “parents of the dead.” One can assume this to include a male father and a female mother, but it is not specifically stated. The parents of Zeno are described as showing no grief for their son, only anger and accusation at young Jesus, but the grieving emotions of the parents are not described. Using feminist hermeneutical imagination, I imagine that Zeno’s mother grieved at the sight of her young child, questioned God, and perhaps even reprimanded Zeno for playing on a roof once he was resurrected, although none of this is seen in the text.¹⁷ However, when she sees her son raised from the dead, she praises Jesus who she had just recently accused. Christopher Frilingos brings up another interesting question in his analysis of this scene: where were Jesus’ parents during this scene?¹⁸ What would Mary have said? Would she have defended Jesus? Would she have reprimanded Jesus - in public? Or privately? Leaving out the women in this story leaves a gaping hole in how the story ends and continues.

Perhaps one of the most fascinating stories of healing is found in *IGT* 14-15, in which Jesus strikes his teacher dead and then heals him of the death he caused himself. Jesus goes to this (male) teacher to be taught the alphabet—first Greek, then Hebrew. The teacher recognizes Jesus’ power and knowledge and is afraid of what he possesses at such a young age. When Jesus challenges the teacher, asking him to “Tell me about the Alpha and I will tell you about the Beta,” the teacher bitterly strikes Jesus. Jesus curses the teacher and he falls on his face, dead. Following this instance is one of the only scenes in *IGT* where Mary is mentioned as doing something related to Jesus’ rearing. Joseph instructs her to keep him at home, “for everyone who angers him dies.” Important to note is that Mary is not named in this chapter, simply referred to

¹⁷ Feminist hermeneutical imagination is outlined and described in the work of Elisabeth Schüssler Fiorenza. See: *Wisdom Ways: Introducing Feminist Biblical Interpretation*.

¹⁸ Frilingos, *Jesus, Mary, and Joseph: Family Trouble in the Infancy Gospels*, 52.

as “μητρι αυτου” meaning “mother of him” or “his mother.” Furthermore, Mary does not act of her own accord in this story but follows the instruction of Joseph when he commands her not to let Jesus out of the house. Mary is not described as seeking education for her child, or reprimanding him when he strikes the teacher dead, but rather she is confined to her household space and instructed to keep Jesus confined with her. Mary also makes no contact with the deceased teacher that we know of, something drastically different from the healing scenes in the *Arabic Infancy Gospel*.

Another instance of healing is found in *IGT* 16. Joseph sends his son James, Jesus’ brother, out to bind wood and bring it into the house. While James is collecting this wood, he gets bitten on the hand by a snake. As he lays there, approaching death, Jesus takes James’ hand, simply breathes on the snake bite, and at once the bite is healed and the snake is destroyed. Once again, women, and more specifically, Mary, are absent from this story. Mary is not reported to have run outside when she learns of James’ injury nor to have taken care of James when he comes back inside to rest after the attack. Rather, Jesus, heals James of his wound and destroys the culprit of the attack, while Mary and any other women healers are completely left out of the narrative. After reading the healing stories from the *Arabic Infancy Gospel*, the absence of Mary and other women appears stark.

By comparing different pericopae from these two texts using a feminist hermeneutic, it can be seen that the *Arabic Infancy Gospel* affirms the status of women as healers, emphasizes female relationships in the text, and elevates the status of Mary, whereas the *Infancy Gospel of Thomas* marginalizes women and highlights male relationships through female exclusion. By focusing on the women in these texts, one can give a new voice and perspective to these historically marginalized characters and discover new perspectives about Jesus and Mary in these

two infancy gospels. Perhaps Mary had more to do with the healing ministry of Jesus than has previously been thought? Perhaps the women healed by Jesus have more agency in their stories than historically given to them? As Ally Kateusz' research suggests, some Christians viewed Mary as a liturgical leader who "healed with her hands," and the *Arabic Infancy Gospel* provides textual support for this view.¹⁹ As this paper has shown, the *Arabic Infancy Gospel* includes stories where women facilitate healing through items but also through their own agency as healing. In this way, this text could provide inspiration for women readers of the *Arabic Infancy Gospel*, to pursue an identity as a healer in the early Christian church.

¹⁹ Kateusz, *Mary and Early Christian Women: Hidden Leadership*, 9.

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The Importance of Motherhood as Exemplified by Sarah, Hagar, and Mary the Mother

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ABSTRACT

Motherhood during the biblical period was an important aspect of a woman's identity. The relationship between mother and son was notable because a woman was able to establish greater social standing by proxy of her son's legacy. The stories of three biblical matriarchs, Sarah, Hagar, and Mary the Mother of Jesus, exemplify the importance of motherhood through their diverse struggles of fertility, experiences of sexual agency (or lack thereof), and their statuses as women who mothered notable children in the Israelite and Jewish communities. Barrenness, virginity, and the agency given to women by fertility in each of these narratives express the power of these women to carry out covenantal promises from the LORD. Even though women's socio-economic roles during the biblical period heavily depended upon their ability to marry and procreate, the biblical narrative emphasizes the necessity of women in familial, communal, and faith life. In this paper, I argue this by illuminating the divine pressure that each of these women experienced to conceive a child of the LORD's covenants, their responses to this pressure, and their exclusive ability to fulfill these covenants. These narratives represent the divine connections and promises that the LORD has with many mothers, giving them a unique status of divinity that exemplifies the agency and purpose of women both in contrast and congruence with the shortcomings of their male counterparts. Finally, this paper argues that women are an essential part of the biblical narrative because the divinity of motherhood expressed by Sarah, Hagar, and Mary shows readers the necessary partnership between men and women in the holy mission of the LORD.

In the biblical period, motherhood was an important aspect of a woman's social, cultural, and spiritual identity. The relationship between mother and child is exemplified in this culture, especially between bonds of mother and son, because for a woman to fulfill her legacy in the Ancient Near East (where the biblical narrative is set), she often depended upon her ability to be a mother (De-Whyte 24). Many mothers of the Bible carry out this social longing for motherhood as they seek the opportunity to bear a son who might carry on a great legacy to which they can be the matriarch. However, many of the biblical narratives of motherhood begin

with stories of struggle, barrenness, virginity, and other situations that make it difficult for these women to deliver children for the future of the Israelite and Jewish communities.

Sarah¹, Hagar, and Mary the Mother of Christ are perhaps three of the most prominent mothers of the biblical narrative. Each of these mothers experienced struggles of some sort during their pregnancy, yet also received promises from the LORD. As the narrative in Genesis notes, Sarai began her journey to motherhood following a covenant between the LORD and her husband (Abram) proclaiming that she would bear a child who would bring a multitude of descendants to the Israelite nation (Gen. 15:5). However, it is also made clear that Sarai is barren and has been unable to produce offspring, despite the LORD's promise that she soon will. This barrenness leads her, in the next chapter, to instruct her husband to take her slave Hagar "as his wife" (Gen. 16:3), so that she might conceive a child to fulfill the promise of this covenantal pregnancy. Despite this forced conception between Hagar and Abram, Sarah is still expected to be the matriarch of the LORD's covenant and must overcome her barrenness to fulfill her duties of divine motherhood. Yet, also Hagar's experience as a mother is vital to the narrative of Genesis, even as she did not initially choose to conceive her child, Ishmael, but engages in motherhood through maternal experiences as God is revealed to her and protects her and her child. The significance of motherhood in the biblical narrative is further exemplified in the New Testament when Mary, the Mother of Christ, is asked by the Angel Gabriel to "conceive and bear a son named Jesus" (Luke 1:26-38), despite her status as a virgin. In verse 38 of Luke's gospel account, Mary consents to this pregnancy, and becomes the virgin mother of Christ for the future of her Jewish² community. It is clear throughout these narratives that these three mothers become

¹ This essay will include a discussion of Sarah (the mother of Isaac) both prior to and following her name-change from Sarai, as well as Abram's name-change to Abraham. This occurs in Genesis 17.

² At this time, the community/religion in which Jesus was entering was not yet called Christianity, thus Mary's conception of Christ is impactful on the existing Jewish faith of her period.

agents in the biblical narrative and play an imperative role in the divine purpose of the LORD through their status as mothers. In this essay, I will argue for the importance of motherhood and fertility in each of these women's alternative pregnancy narratives, as well as their sexual agency (or lack thereof), and experiences as women who mothered important children of the Israelite and Jewish communities.

Barrenness, virginity, and the struggle of fertility in the biblical narrative are much more than a coincidental aspect of life for these women. Within Sarah's narrative, the aspect of barrenness is especially important in relation to the covenant between God and Abram. Although the promise is spoken to Abraham and concerns the birth of a male son who will be the father of a great nation, the women of this narrative are the only ones who hold the power to fulfill it. This, of course, is because Abram is (biologically) unable to bear a child, so he is dependent upon a woman to fulfill his promise with the LORD. In this way, Sarah is able to participate, "genuinely in the covenant" (NIB;I 459). Even if she is not the one directly given the promise from the LORD, Sarah must play an essential maternal role in the covenant which cannot be fulfilled by any man. Therefore, although barrenness is often viewed as a setback in the ancient woman's journey to motherhood and social gain, the biblical narrative utilizes it to express the necessity of women in the promises of the LORD (Havrelock 154) and ensure the covenantal relationship that exists directly between these women and the LORD.

In a similar way, the virginity that the biblical narrative claims when describing Mary emphasizes the importance of her role of motherhood in the biblical narrative. Mary's virginal status (as well as her status of betrothal) creates a unique situation of pregnancy and motherhood. She consents to the responsibility of bearing the child of God despite her virginity, which is an impossible task without divine intervention. Therefore, the reader must assume that Mary has a

divine and essential role in the biblical narrative, and that she is vital to the future of the Jewish community (and later, the Jesus Movement). The reader must also consider Mary's relationship with "her husband Joseph" (Matthew 1:19), who is described in secondary terms as if he is submitting to Mary's divine call from the LORD despite the social consequences it may bring. The Matthean narrative depicts Joseph wrestling with the possibility of divorce after learning of her extra-marital pregnancy, nearly choosing to leave Mary quietly, but ultimately submitting to her holy pregnancy when the LORD assures him of Mary's purity. However, it is clear throughout the entire narrative that Joseph is utterly respectful and careful of *Mary's* reputation and livelihood, such as when he chooses not to publicly shame her for pregnancy. This is an interesting reversal of gender roles in the biblical text which further exemplifies the essential role of women in the promises of the LORD, in which men must simply accept their wife's divine purpose amid their inabilities and shortcomings.

This clear divine relationship between the LORD and these women, although it is very well exemplified by their barrenness, virginity, and ability to attain motherhood status, often accompanies a narrative in which there is divine pressure to conceive. Both Sarai and Mary begin their motherhood journeys with a promise from the LORD indicating that a son must be born. While their narratives record that both Sarai and Mary longed for the conception of a child or obediently submitted to the LORD's wishes to fulfill their covenantal duty, the reader must also consider the divine pressure that these women were facing when presented with an ultimatum regarding their ability to enter motherhood at the command of their LORD. In other words, how could Mary or Sarai have declined God's request to utilize their wombs for the future of the Israelite and Jewish people? This pressure is evident in Sarai's motherhood journey when it leads her to "compensate for her barrenness" (James 51) by giving Hagar to Abram as a surrogate,

who certainly had no agency as a slave to decline her owner's request of conception. Yet another bout of divine pressure causes Mary to put her life and social status at risk when she accepts a virginal pregnancy from the LORD. Without the voices or personal narrative of Mary, Sarai, or Hagar firsthand, the reader cannot assume the presence or lack of consent in these biblical texts, yet the divine pressure to conceive may have been a factor in the agency of their decisions to enter motherhood.

Despite this pressure, each woman continued her journey to motherhood and by proxy of their alternative pregnancy statuses, attained a unique relationship with the LORD that was specific to divine motherhood. When Sarah conceives and gives birth to Isaac, she is able to experience the "divine creativity" (NIB;I 486) that allows her to participate intimately in a partnership with the LORD and His holy covenant. Her pregnancy in Genesis 17 establishes her individual importance in the biblical narrative. Abraham and Sarah are both immediately changed by her ability to bear children (as indicated by their name change from Abram and Sarai). Additionally, the LORD tells Abraham that "*she* shall give rise to nations; kings of peoples shall come from *her*" (Gen. 17:16), indicating that, despite the fact that the covenant was spoken between Abram and the LORD (without Sarai's consent), God recognizes that Sarah is the only agent of the narrative that is capable of harnessing the maternal divinity and power to carry it out. This forces Abraham to submit not only to the will of the LORD's covenant, but to his wife's divinity, further exemplifying the importance of women in the holy mission.

Hagar's narrative, on the other hand, begins with a more tragic insight on the reality of motherhood for some ancient women. Her womb is used for the intention of surrogacy during Sarai's efforts to produce a child of the LORD's covenant; however, her pregnancy "somehow diminishes Sarai's status in view of her new place as mother-to-be of Abram's child" (NIB;I

452). Hagar's sudden change in relational status threatens Sarai and leads to Hagar being cast into the wilderness by Sarai. However, it is clear in the biblical narrative that Hagar's status as a mother-to-be has given her a divine relationship with the LORD that cannot be cast away. One can see this when God speaks to her in Genesis 16, calling her by name, responding to her affliction, and promising the future of her child (NIB;I 452-453). Hagar's divine status as a covenantal mother even leads her to name God "El-roi," which means the God who sees (Gen. 16:13).³ This interaction with the LORD, although He sends her back to Sarai's abusive household (where she will eventually be cast away once more) is an expression of their divine relationship; the LORD calls Hagar to return to her oppressors because the matter of her pregnancy "needs to be resolved" (NIB;I 453). I argue that the moment that Hagar decides to accept the LORD's covenantal pregnancy and decides to return to this abusive household, she chooses divine motherhood. This faith that the LORD will protect and provide for her further expresses and strengthens their divine connection, allowing God to fulfill his promise to bless Ishmael with a plentiful future⁴.

The most recognized expression of divinity in motherhood is found in Mary the mother of Christ. Although she does not appear many times throughout the gospel narratives, Mary is essential to the prophecy that affects Judaism in her period. She is the agent through which Jesus enters human history. Part of what makes her journey to motherhood mystical and divine is that unlike any other woman in history, some non-canonical Christian texts, as well as some Christian authors, hold that "Mary remains a virgin before, during, and after Jesus' birth" (Wilson 513).

³ Even though Hagar's motherhood is not intended in the initial covenant, her pregnancy is a part of the covenantal effort to produce a divine child.

⁴ Ishmael goes on to live until he is 137, with twelve princes as sons (with tribes) Gen.25; Esau marries one of his daughters in Gen.28, so Ishmael's lineage remains somewhat connected to Israel, but still on the side of the "less than" brother; God does, however, keep His promise of providing for Ishmael in the future

This belief identifies Mary with a unique and perpetual purity, and although many Protestants suspect that Mary and Joseph had children after Jesus, her virginal pregnancy still uplifts her status as a covenantal mother. This means that there is an undoubtedly divine relationship between Mary and the LORD which allowed her to bear this child. Her unique status as the virgin-mother-of-Christ indicates that she was chosen by God to bear a divine child and was necessary to the covenant which allowed him to be born. Thus, Mary accepts the call to mother this child, much like Sarah and Hagar.

While divine motherhood expresses the connection between these chosen mothers and the LORD, all three of these narratives also depict the hardships that they face as mothers of boys who faced and defeated death because of their chosenness. In Sarah's narrative, her son's near-death experience occurs separately from her maternal voice and influence. Rather, "God commands Abraham not to kill or murder his son, but to present him 'on the altar' as a burnt offering to God" (NIB;I 495) in Genesis chapter 22. This entire chapter excludes Sarah as it focuses on Abraham's ability to follow the commands of the LORD and implies that this sacrificial experience was never intended to result in the death of her holy child. Isaac's survival of this near-death experience (as well as the LORD's intention to save him) thus further exemplifies the purpose and importance of Sarah's divine motherhood, proving to the readers of this narrative that even in the face of death, Sarah's work to fulfill the holy covenant cannot be destroyed.

Genesis 21 depicts Hagar and Ishmael's near-death experience when they are cast into the wilderness for a second time. Unlike Sarah, Hagar is fully involved in this experience, believing that death is upon them both when their water supply runs out. However, Hagar's maternal divinity is once again reassured when the LORD speaks to her, promising to "make a

great nation of him” (Gen. 21:18) and providing water for Hagar and Ishmael. Her story of motherhood represents the divinity of her love and passion for her son, her God, and the future nation that is promised to come of her divine child. Hagar represents the experience of “exile for the sake of God” (James 52) and exemplifies the divine connection and promise that the LORD has for many mothers, including those who are outside of the traditional view of His covenant. Essentially, the suffering and deliverance of her maternal narrative is an exhibition of God’s divine plans for Hagar and her son.

Unlike Sarah and Hagar’s divine stories of motherhood, Mary’s narrative truly includes the death of her son, who then miraculously resurrects days later. Mary’s conception of Jesus as a betrothed virgin was considered in the biblical period a “most grievous transgression” to commit against one’s husband (Efird 14). Readers of her narrative might assume that because of her divine connection with God (and Joseph’s submission to this connection), Mary escapes the possibility of being punished by death for this extramarital pregnancy. This divine connection to the LORD is further expressed when Jesus defeats death by resurrecting after experiencing crucifixion and later being assumed into heaven. The gospel of John states that Mary, in her endless pursuit of motherhood, was present at Jesus’ crucifixion (John 19:25). Additionally, some modern readers of Mary’s maternal narrative believe the ideology coined by Pope Pius XII which states that Mary (like Jesus) experienced a bodily assumption into heaven because of her maternal divinity as the holy mother of Christ (Wilson 515). Therefore, because of the extensive influence and congruence between Mary’s journey of motherhood and the life of Jesus, readers may interpret her maternal divinity as “representing the sweep of Jesus’ incarnate ministry from beginning to end” (NIB;IX 832).

As the reader analyzes these narratives, it is increasingly clear that the motherhood journeys of Sarah, Hagar, and Mary the Mother of Christ are products of divine relationships with the LORD. These mothers are put under the same divine pressure to fulfill the LORD's covenants and prophecies for the future of the Israelite and Jewish nations: the pressure to conceive a divine child. This responsibility exemplifies their extreme importance in the biblical narrative. Without Sarah, Hagar, and Mary's acceptance of their calls to holy motherhood, the LORD's covenants and prophecies could not have been fulfilled. Therefore, while it may seem as though these women are simply subject to the divine pressure to conceive because of the LORD's interactions with and plans for their husbands and sons, a closer reading of the text makes clear the imperative and unique role that women play in God's holy plan, especially amid the shortcomings of their male counterparts.

Sarah and Hagar, in their complex and intertwined journeys to motherhood, both experience exceptional interactions with and blessings from the LORD. The "divine creativity that makes Sarah's pregnancy possible" allows her to remain relevant and necessary throughout the entire birth narrative as the mother who fulfilled God's holy covenant (NIB;I 486). Hagar's strength and faith throughout her divine pregnancy allowed her to be the only person in the entire biblical canon to both see and name God (Gafney 43). Mary's role as the virgin mother of Christ expresses the agency that women are capable of. Her journey to motherhood brings the biblical narrative full circle, showing that, "A barren woman can bear a child. A virgin can conceive. The Lord can enter into human history as a child. From a tomb can come resurrection, and the Holy Spirit can empower the church" (NIB;IX 52).

Divine motherhood within the biblical text is often overlooked; however, it is imperative that the reader understands the role that women like Sarah, Hagar, and Mary had in the covenants

and prophecies of the LORD. Their narratives include subjects of fertility, barrenness, and virginity as divine intervention brings forth exceptional circumstances for the future of the Israelite and Jewish communities. These women, despite the struggles of their alternative motherhood stories, exemplify women's importance in congruence with their male counterparts. Sarah, Hagar, and Mary's divinity calls to attention the agency that women are capable of holding in the holy plan of the LORD, and "makes clear that women will continue to play a significant role in the church's mission to the end of the earth" (NIB;X 44). Overall, all three of these women's narratives show how women can utilize motherhood and sexuality as liberating aspects of themselves as vital members of God's covenant.

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The Impact of Federal Cannabis Legalization on State Excise Taxes

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ABSTRACT

Cannabis is illegal federally in America, but roughly a quarter of states have rejected federal policy and legalized the recreational use and possession of cannabis for adults. The effects of such policies are multi-faceted, but this study aims to measure how one economic variable — excise tax revenue — is impacted by cannabis legalization in specific states. California, Colorado, Nevada, Oregon, and Washington had sufficient data regarding cannabis taxation revenues. Comparative data on alcohol and tobacco was also collected. This study found that in all five states, cannabis excise tax revenues have surpassed alcohol excise tax revenues. Additionally, in two of the five states, cannabis excise tax revenues have also surpassed those of tobacco. The proportion of cannabis excise taxes in relation to total excise taxes has generally increased year after year for all five states as well. If cannabis were to be legalized federally in America, states should expect to see economic benefit from the tax revenue, given all other variables remain constant. Users could substitute tobacco for cannabis, in which case, states would see less of an economic gain. Additionally, if state policymakers decide to cut taxes elsewhere, the taxation gains sought from cannabis legalization may be counteracted.

BACKGROUND

The legalization of recreational cannabis has been a longstanding debate in the United States.¹ Federal law currently prohibits the use or possession of cannabis, but as of today, eleven states have gone against federal regulation and legalized cannabis recreationally. These include: Alaska, California, Colorado, Illinois, Maine, Massachusetts, Michigan, Nevada, Oregon, Vermont, and Washington (Barcott & Whitney, 2019). In the recent November 2020 election, four new states — Arizona, Montana, New Jersey, and South Dakota — voted to legalize cannabis recreationally (Wallace, 2020). As more and more individual states decide to legalize

¹ I would like to give special thanks to Dr. Kristin Stowe, Dr. Chelsea Kaufman, and Dr. Joseph Ellis for advising me throughout the research process.

cannabis, attention is turned to the federal government to see if it will do the same. Recreational cannabis is often debated on the grounds of public health, personal liberty, or social and moral implications, while the economics of the issue typically go unnoticed. Tax revenue, industry job creation, and prohibition enforcement costs are just a few of the many economic factors that play a role in a state's decision to legalize recreational cannabis. This leaves one to wonder how those factors would affect the national economy if recreational cannabis was legalized federally.

LITERATURE REVIEW

Cannabis Tax Revenue

Tax revenue is one important economic factor in cannabis legalization. In states where cannabis is legalized recreationally, there is an excise tax — sometimes referred to as a sin tax — mandated for every sale. Cannabis is not the only product that faces an excise tax; alcohol and tobacco do as well (Carnevale et al., 2017). However, cannabis taxes are fairly high — typically 10-37% above the local sales tax (Barcott & Whitney, 2019). When a state generates revenue from cannabis excise taxes, it is free to apply this money wherever it sees fit, since there are no federal regulations. For example, Colorado applies this revenue to education and schools, substance use disorder prevention and treatment, and public safety (Todd, 2018). Some other states use income from cannabis excise taxes for school construction and medical research (Barcott & Whitney, 2019).

Since cannabis is not yet legalized federally and each state handles this revenue differently, it is difficult to determine how much the entire United States would generate from cannabis excise taxes. Some conservative figures estimate the country would generate \$6.8 billion per year (Todd, 2018). More generous estimates determine an \$8.7 billion annual revenue from cannabis excise taxes nationwide (Evans, 2013).

Other Economic Implications

Several other factors impact the economy following recreational cannabis legalization. These topics are worth noting, but they will not be analyzed in this study due to the limited amount of data accessible online. Two of these factors are industry job creation and prohibition enforcement costs.

The legalization of recreational cannabis has created hundreds of thousands of jobs across the country. According to a special report by Leafly, 243,700 people were employed full-time in the cannabis industry as of early 2020 (Barcott et al., 2020). The legalization of recreational cannabis in Arizona, Montana, New Jersey, and South Dakota will play a role in expanding the cannabis industry, and thus, industry job creation. Further expanding the job market in the cannabis industry helps improve the unemployment rates and GDP in states where cannabis is legalized.

In addition, states also benefit from reduced prohibition enforcement costs when legalizing recreational cannabis. Law enforcement, court systems, legal fees, and correctional programs, like incarceration, parole, and probation, are some of the areas in which a state could save money by legalizing cannabis (Bates, 2004). With all these factors taken into account, the prohibition of cannabis is much more costly than most people realize. Federally, the prohibition of cannabis is estimated to cost \$3.6 billion annually (Todd, 2018). Additionally, 40% of drug arrests in the United States in 2018 were for cannabis violations (Grimlich, 2020). Therefore, legalizing cannabis would help cut law enforcement costs associated with drug arrests.

HYPOTHESIS

This study predicts that cannabis legalization would have a positive benefit on state tax revenue.

H1: Tax revenue from cannabis sales affects the economy, such that states see an increase in excise tax revenue following the legalization of cannabis.

METHODOLOGY

Originally, this study was focused on three economic categories associated with the legalization of recreational cannabis — excise tax revenue, cost of cannabis possession enforcement, and industry job creation. After compiling data, California, Colorado, Nevada, Oregon, and Washington had sufficient data on these variables easily accessible online. From there, the decision was made to focus on one variable — excise tax revenue — in more depth. This variable yielded the most available data online and allowed the study to have a clear focal point, rather than a broad overview of several factors that contribute to the changing economy after recreational cannabis legalization.

After collecting the excise tax revenues generated from cannabis sales, more research was conducted on other excise taxes collected by states. Data was also collected for alcohol and tobacco excise tax revenues from the five aforementioned states. This allows cannabis tax revenues to be compared to similar state revenues in order to analyze how the legalization of recreational cannabis impacts a state's economy. In addition, this would allow for an analysis of the impact of cannabis sales on the sales of alcohol and tobacco to be conducted.

For California, both the cannabis and tobacco excise tax revenues were collected from the California Department of Tax and Fee Administration's website. Data for alcohol tax revenue was collected from the U.S. Census Bureau's Annual Survey of State Government Tax Collections. For Colorado, most of the data was collected from three different sources — one for each of the three substances — within the Colorado General Assembly website. However, for the two most recent years, the tax revenue for alcohol was missing, so that was supplemented with

data from the U.S. Census Bureau's Annual Survey of State Government Tax Collections. For Nevada, all data was collected from the annual reports on the State of Nevada's Department of Taxation website. For Oregon, cannabis tax revenue was collected from Oregon's Department of Revenue website. Alcohol and tobacco tax revenue was collected from the U.S. Census Bureau's Annual Survey of State Government Tax Collections. For Washington, all data was collected from the state's Department of Revenue website, under its annual tax statistics reports.

DATA ANALYSIS

Each state had a different year it began collecting tax revenue on legal cannabis sales. An additional measure titled "Years from Legalization" was added, which allowed for results to be compared between states appropriately, rather than by varying calendar years. The time between Year -1 and Year 1 is assumed to be when cannabis legalization occurred. Therefore, every positive value is the number of years after legalization and every negative value is the number of years before legalization.

Nevada was unique. For two years, the state collected tax revenue on medical cannabis sales, but not recreational, unlike any of the four other states. Since the taxation of medical cannabis played very little effect in the state's excise totals and proportions, the two years of solely medical cannabis tax revenue were included as years before legalization.

Figure 1

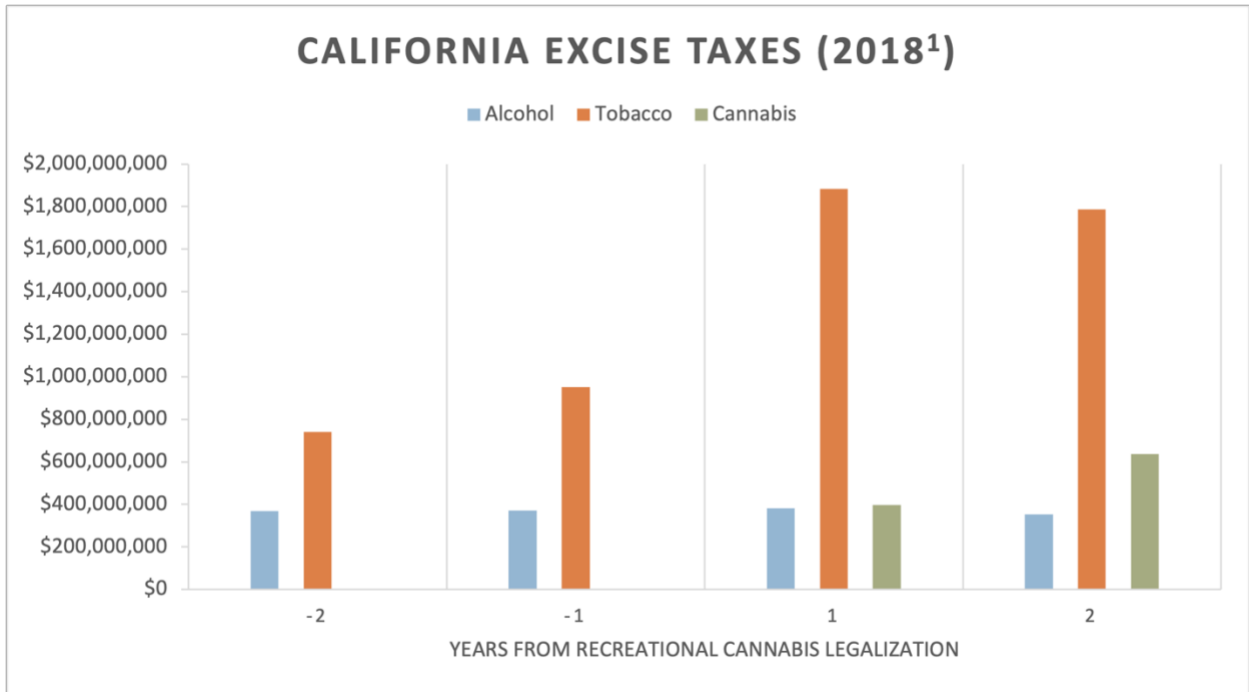
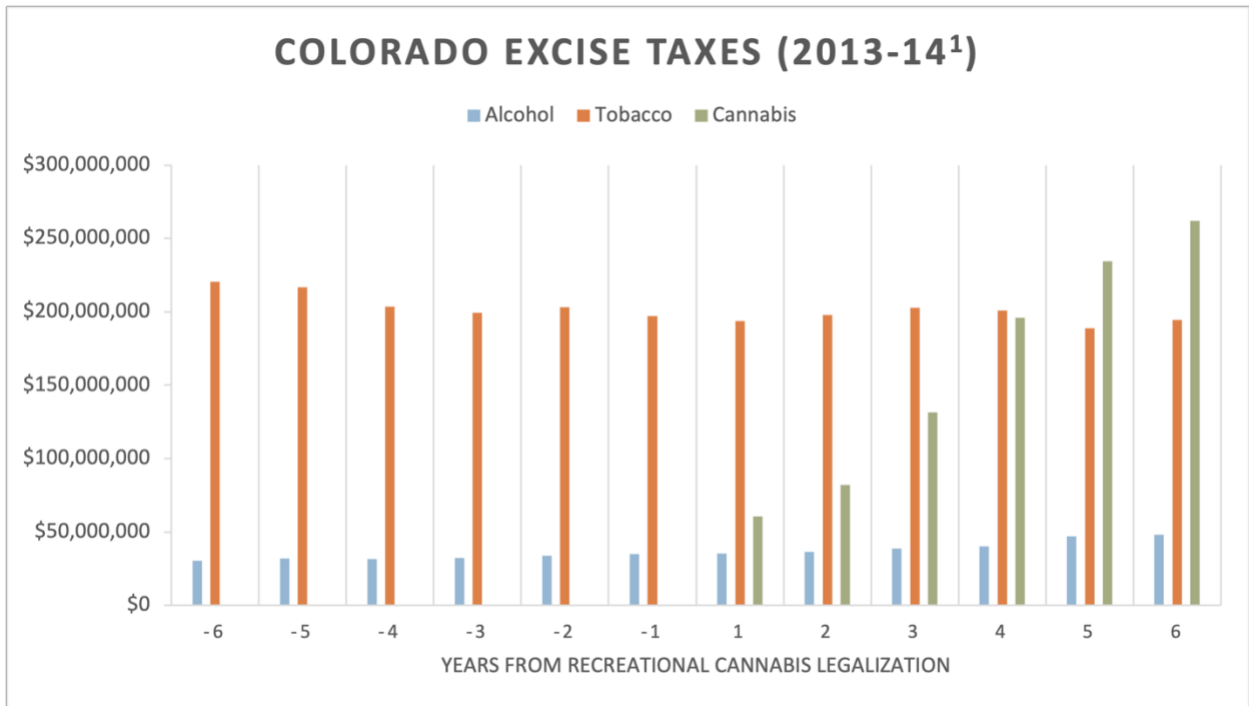


Figure 2



¹Indicates first year of recreational cannabis tax collection by state

Figure 3

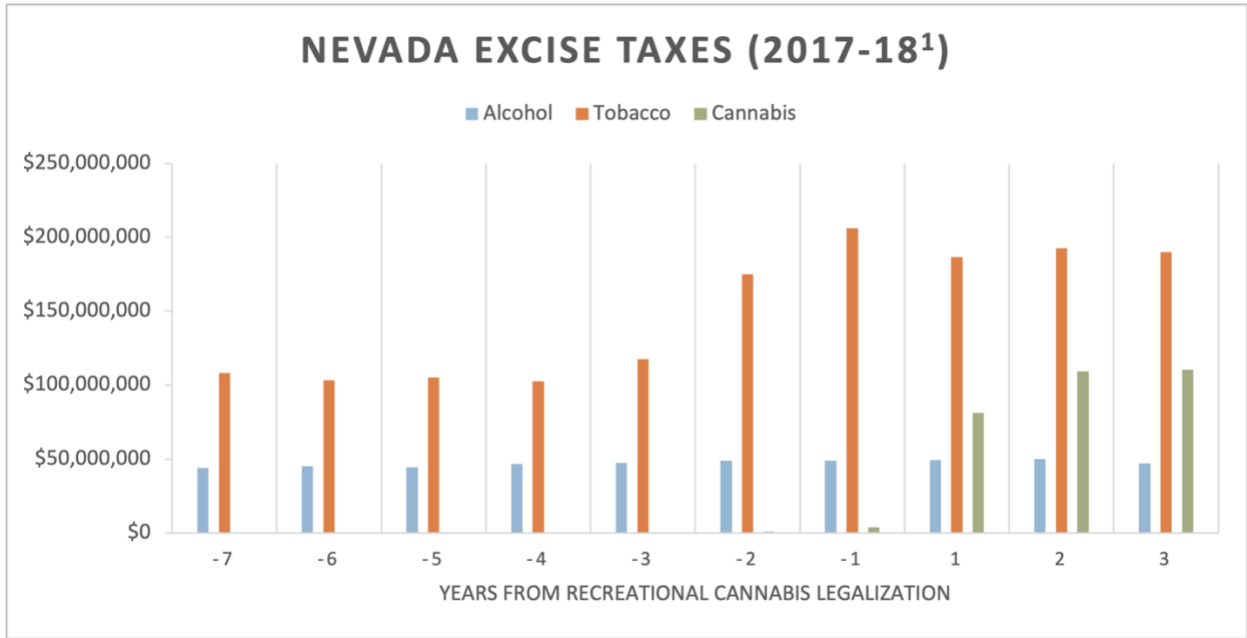


Figure 4

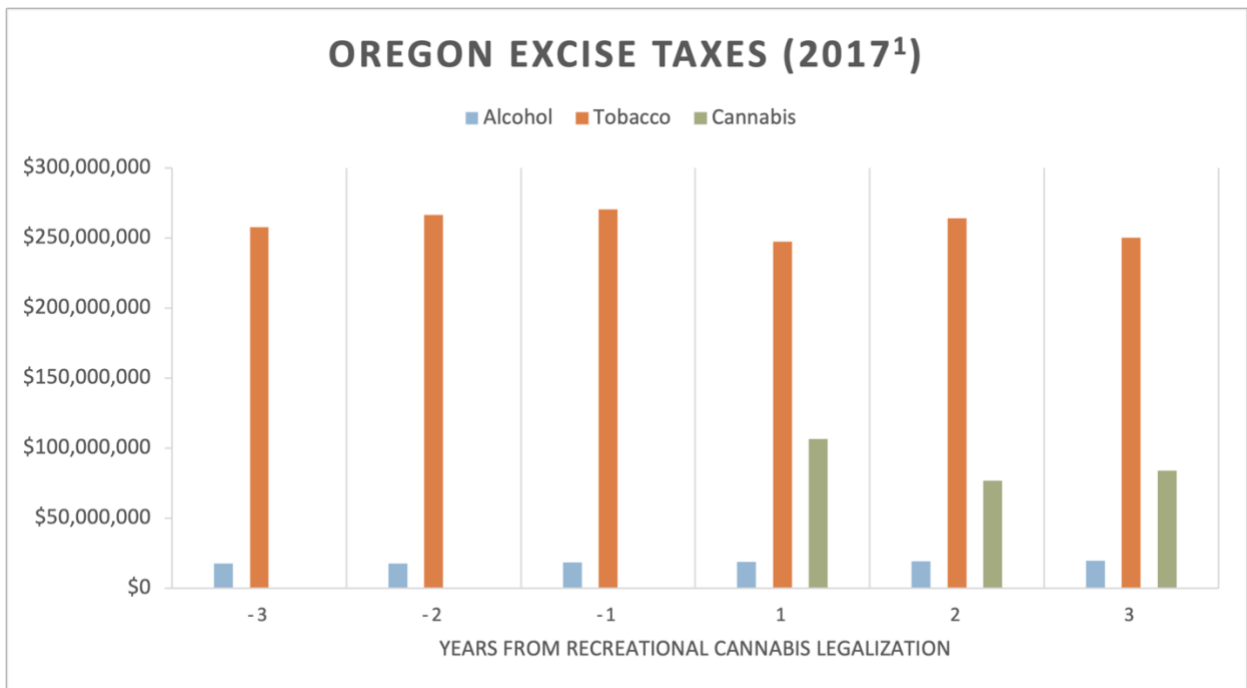
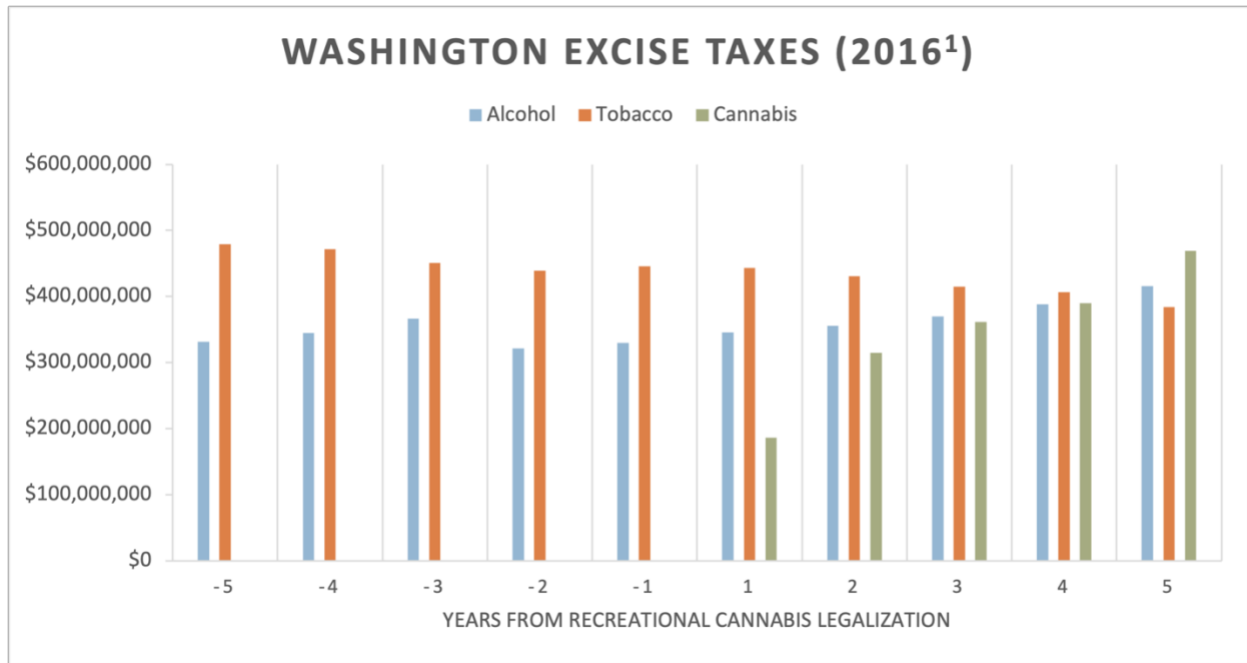


Figure 5



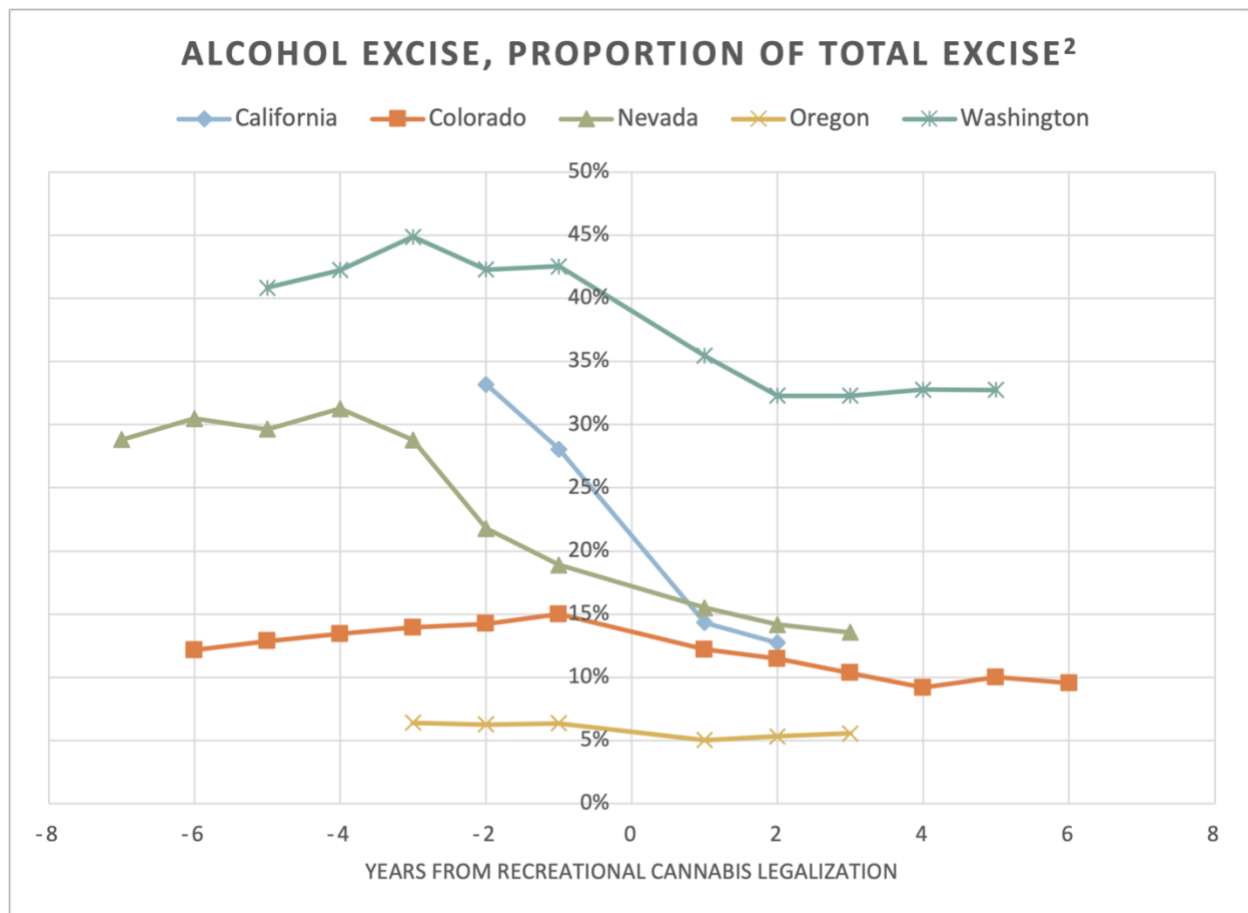
Total Tax Revenue

Figures 1-5 show the excise tax revenues from alcohol, tobacco, and cannabis in each of the states examined for available years before and after the legalization of recreational cannabis. In all five states, cannabis excise tax revenues have surpassed alcohol tax revenues. Additionally, shown in Figures 2 and 5, cannabis excise tax revenues have also surpassed tobacco tax revenues in both Colorado and Washington. Recreational cannabis has been legalized in these two states longer than any of the others studied, so more states may follow this trend of cannabis excise tax revenues surpassing, not only alcohol, but also tobacco. Total excise tax revenue has more than doubled in California, Colorado, and Nevada from Year -1 to present day as well. Data from all five states prove how influential cannabis legalization can be in a state’s economy, even after only a few years.

Table 1

Year	Alcohol Excise, Proportion of Total Excise				
	California	Colorado	Nevada	Oregon	Washington
-7			28.81%		
-6		12.15%	30.48%		
-5		12.87%	29.64%		40.85%
-4		13.44%	31.27%		42.24%
-3		13.95%	28.79%	6.40%	44.86%
-2	33.20%	14.24%	21.78%	6.270%	42.28%
-1	28.05%	15.00%	18.89%	6.368%	42.53%
1	14.34%	12.19%	15.51%	5.04%	35.45%
2	12.72%	11.48%	14.19%	5.34%	32.30%
3		10.35%	13.55%	5.56%	32.29%
4		9.18%			32.77%
5		9.99%			32.76%
6		9.54%			

Figure 6

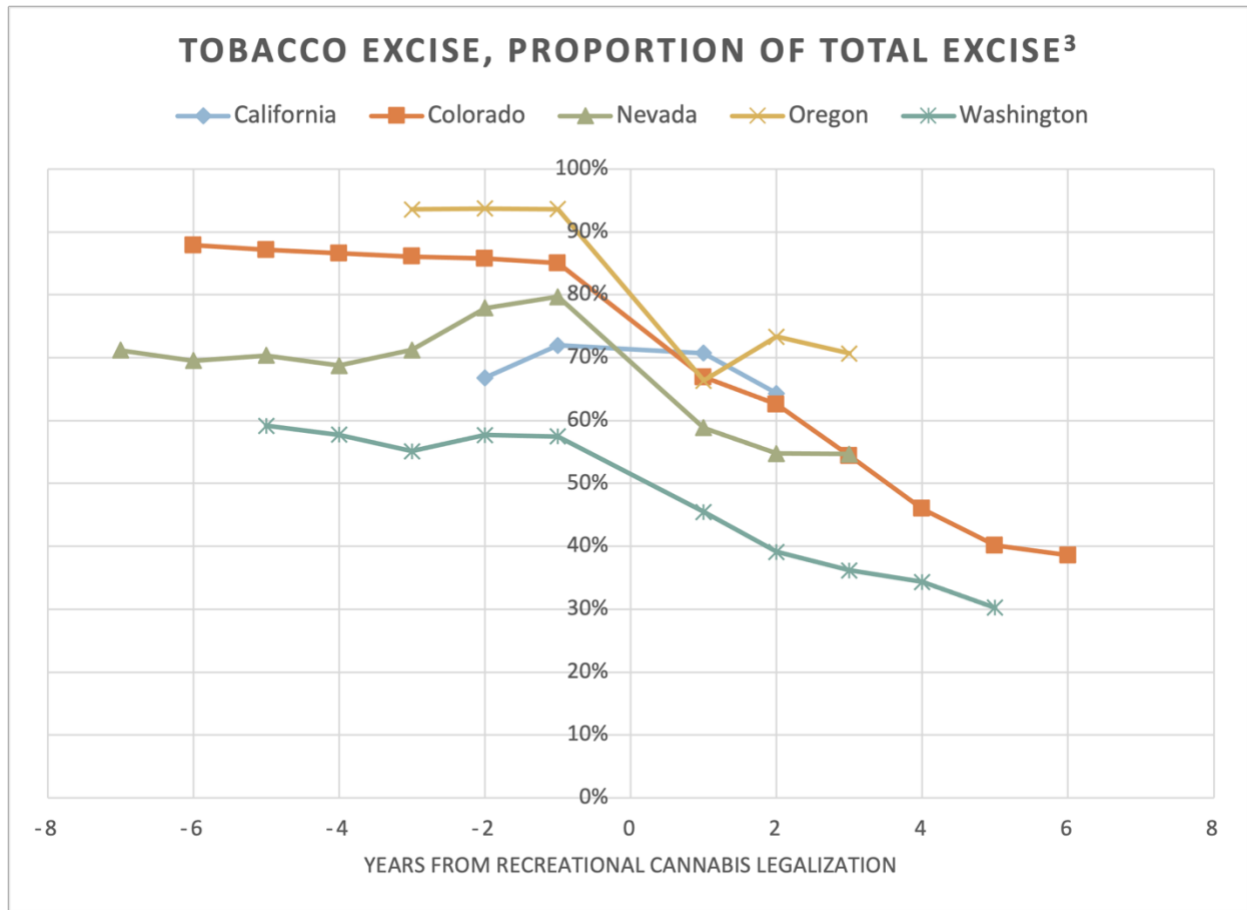


²Most recent tax rates (\$/gal): CA – \$3.30 (liquor), \$0.20 (wine and beer); CO – \$2.28 (liquor), \$0.28 (wine), \$0.08 (beer); NV – \$3.60 (liquor), \$0.70 (wine), \$0.16 (beer); OR – no liquor tax {sales controlled by state}, \$0.67 (wine), \$0.08 (beer); WA – \$14.27 (liquor), \$0.87 (wine), \$0.26 (beer) (Tax Rates, 2021)

Table 2

Tobacco Excise, Proportion of Total Excise					
Year	California	Colorado	Nevada	Oregon	Washington
-7			71.19%		
-6		87.85%	69.52%		
-5		87.13%	70.36%		59.15%
-4		86.56%	68.73%		57.76%
-3		86.05%	71.21%	93.60%	55.14%
-2	66.80%	85.76%	77.89%	93.73%	57.72%
-1	71.95%	85.00%	79.68%	93.63%	57.47%
1	70.73%	66.91%	58.86%	66.35%	45.48%
2	64.33%	62.59%	54.75%	73.35%	39.12%
3		54.40%	54.66%	70.67%	36.18%
4		45.97%			34.32%
5		40.13%			30.26%
6		38.54%			

Figure 7

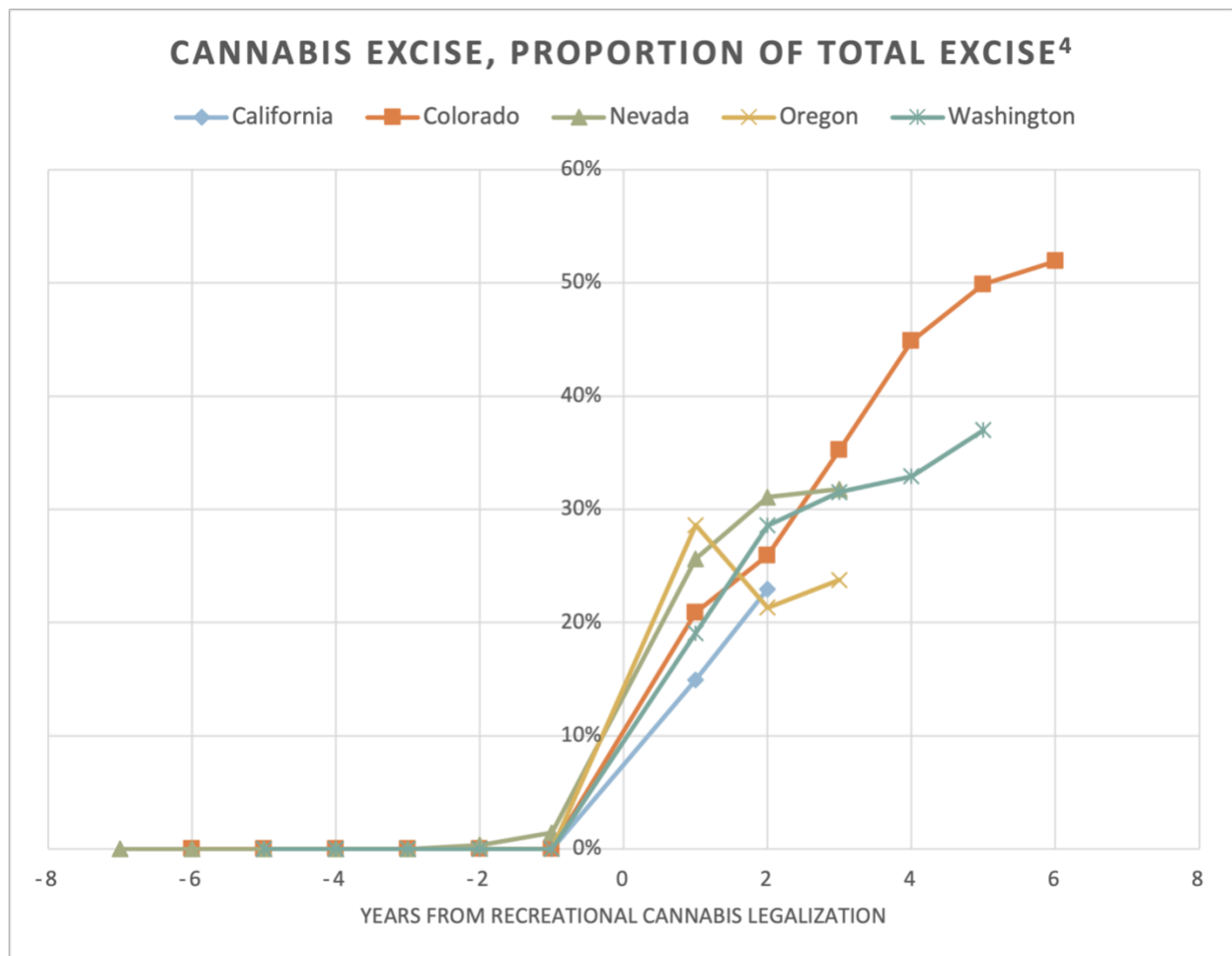


³Most recent tax rates (\$/per pack of cigarettes): **CA** – \$2.87 {increased from \$0.87 in April 2017}, 59.93% (e-cigarettes); **CO** – \$1.94, 30% (e-cigarettes); **NV** – \$1.80, 30% (e-cigarettes); **OR** – \$3.33, 65% (e-cigarettes); **WA** – \$3.025, 9¢/ml (open e-cigarettes), 27¢/cartridge (closed e-cigarettes) (Tax Rates, 2021)

Table 3

Cannabis Excise, Proportion of Total Excise					
Year	California	Colorado	Nevada	Oregon	Washington
-7			0%		
-6		0%	0%		
-5		0%	0%		0%
-4		0%	0%		0%
-3		0%	0%	0%	0%
-2	0%	0%	0.34%	0%	0%
-1	0%	0%	1.44%	0%	0%
1	14.93%	20.90%	25.64%	28.61%	19.07%
2	22.95%	25.93%	31.06%	21.31%	28.59%
3		35.25%	31.79%	23.77%	31.52%
4		44.85%			32.91%
5		49.87%			36.98%
6		51.91%			

Figure 8



⁴Most recent tax rates: CA – 15%; CO – 15%; NV – 10%; OR – 17%; WA – 37% (Tax Rates, 2021)

Proportion of Tax Revenue

After analyzing and comparing excise tax dollar amounts, proportions of total excise for each substance for all five states were calculated using Excel. Tables 1-3 and Figures 6-8 show the proportion of total excise tax revenues for alcohol, tobacco, and cannabis, respectively, in each of the states examined for available years before and after the legalization of recreational cannabis. Due to the very nature of proportions, one can assume the proportional share of alcohol and tobacco excise tax revenues should decrease with the introduction of cannabis excise tax, which the data supports.

In addition, and perhaps more interestingly, the figures show the relationship between cannabis, alcohol, and tobacco tax revenues. In Figure 8, the proportion of cannabis excise tax revenue is represented. This proportion is 0% (except for Nevada, where medical cannabis was taxed) before Year 1 since the states did not generate any revenue from cannabis sales before recreational legalization. In every state, other than Oregon, cannabis excise tax proportions have continually increased every year since legalization in Year 1. It is worth noting that, although Year 4 data was not yet available for alcohol and tobacco for Oregon, the cannabis tax excise revenue has increased to \$142,328,158, which is well above the revenue generated from cannabis tax in any of the previous years. Therefore, in all five of the states studied, the proportion of cannabis excise tax has generally increased year after year.

While the proportion of cannabis excise tax has increased over the years following recreational legalization, alcohol excise is a different story. Again, due to the nature of proportions, we know the proportion of alcohol excise revenue will decrease with the introduction of cannabis, as showcased in Figure 6. There was an initial drop in the proportion of alcohol excise between Years -1 and 1, when recreational cannabis was legalized. However,

since recreational legalization, despite the constant increase in the proportion of cannabis excise, alcohol excise has remained relatively constant. This is very different than the proportion of tobacco excise taxes. Figure 7 shows that, like alcohol, tobacco proportions take an initial hit in Year 1 with the introduction of cannabis. However, unlike alcohol, tobacco proportions continually decrease year after year following cannabis legalization. The only exception to this is Oregon, where tobacco excise tax proportions increased from Year 1 to Year 2. However, this is the same year as the outlier with the cannabis excise tax proportions in Figure 8, so there may be some outside factors causing this to occur.

One of the most compelling trends in these graphs is the relationship between cannabis and tobacco tax proportions. As the proportion of cannabis excise tax has increased — unlike the proportion of alcohol excise tax, which has remained fairly consistent — the proportion of tobacco excise tax has decreased. This could indicate that cannabis is an economic substitute for tobacco products. Comparison to tobacco trends in states where cannabis is not legalized would help further prove or disprove this notion.

LIMITATIONS

Although there is evidence the legalization of cannabis impacts the makeup of a state's excise tax profile and their total excise tax revenue, there are still some limitations with this study. Even if states legalize cannabis and gain revenue from its taxation, they can still run budget deficits. Legislators may still decide to cut taxes in other areas of the budget, thus counteracting the positive economic benefits from cannabis legalization. This question could be studied by other researchers by comparing total tax revenues for the entire state, rather than simply excise taxes.

Additionally, in December 2019, the United States federal government passed “Tobacco 21”, which raised the federal minimum age to purchase tobacco or e-cigarette products from 18 to 21 immediately (Tobacco, 2021). Downtrends found in tobacco excise proportions were already occurring before the passage of Tobacco 21, but this downtrend could have also been intensified by the new legislation. This question could be studied by other researchers by comparing states with legalized cannabis to states without legalized cannabis and see how tobacco trends compare.

It is worth noting the social implications of cannabis legalization. Cannabis, like alcohol and tobacco, can be a dangerous substance if not consumed responsibly. The morality of a state’s budget depending on people to purchase and consume potentially harmful substances is worthy of consideration as well. Ultimately, however, there is precedent. States already depend on alcohol and tobacco tax revenue, whether it is morally acceptable or not. Additionally, people will still consume cannabis whether it is legal or not, so from an economic standpoint, cannabis legalization is one way to ensure the state gains a portion of the profits.

CONCLUSION

Taking into consideration the results of the data analysis on cannabis taxation revenue, as well as the limitations of the study, recreational cannabis legalization would result in increased tax revenue to state economies, if managed properly. In theory, according to the data studied, states should see a substantial increase in total excise tax revenue following the legalization of cannabis, which confirms Hypothesis 1. Three of the states have seen their excise tax totals double since legalizing cannabis. Additionally, cannabis is contributing to a large share of excise tax revenue totals in the states studied, surpassing alcohol tax revenues in three states and surpassing both alcohol and tobacco tax revenues in the other two. In the few short years

cannabis has been legalized, it is already making a difference in the excise tax revenues in California, Colorado, Nevada, Oregon, and Washington.

However, even though excise tax revenues are on the rise, it does not mean states will have booming economies. If legislators cut taxes in other areas, it could offset the positive economic benefits seen from cannabis. These funds must be allocated properly for the effects found in this study to be valid. Possible uses for these funds include funding social programs, education, and infrastructure.

In addition to the benefits from increased excise tax revenue, states see other economic benefits from legalizing cannabis, such as increased industry job creation and decreased prohibition enforcement costs, as discussed in the Literature Review. Combining all these factors, this study recommends the legalization of cannabis on the federal level in the United States for the economic benefits of each individual state.

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Sixty Years of Sanctions

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ABSTRACT

It has been sixty years since the United States placed economic sanctions on Cuba, making them by far the longest sanctions the U.S. has persisted in against any country. With the sanctions remaining in place for so long and with very little to arguably no progress between the two countries being made, many people have questioned why the sanctions have lasted so long. This paper aims to answer that question. Research in this paper includes voting trends and ideological views among Cuban-Americans, prominent political actors and their role in this issue, and legislation important to this topic. I suggest that because of the importance of Cuban-American votes, political figures put legislation in place that not only gained Cuban-American support but prevents the sanctions from being lifted until the U.S. Congress votes to do so.

INTRODUCTION

On October 19, 2020, sixty years passed since the United States placed economic sanctions on Cuba, making them by far the longest sanctions the U.S. has persisted in against any country. In March of 1958, the U.S. imposed an embargo on the sale of arms to Cuba. On October 19, 1960, the U.S. placed an embargo on all exports to Cuba except for food and medicine (Hufbauer, et al. 2011). Lastly, on February 7, 1962, the Kennedy administration extended the embargo to include all exports with the exception of humanitarian aid and food (Hufbauer, et al. 2011). The embargo is still controversial today, as there has not been much improvement between the two countries since the sanctions were put in place. Many people question why the embargo has lasted so long, arguing that it is outdated, has proven to be unsuccessful, and should be lifted, while there are also many who argue that the embargo is necessary and should be maintained.

The embargo has significant impacts on human security and the international economy, making it an issue that all should be concerned about (Pepper 2009). Citizens in both countries,

not just the governments, are impacted by the sanctions. Cuba has made many medical breakthroughs such as developing the following: the first Meningitis B vaccine, a therapeutic vaccine for lung cancer, an effective cholesterol-reducing medicine, and a preservative for unrefrigerated milk (Pepper 2009). Because of the sanctions the U.S. has put on Cuba and travel restrictions that have come with it, U.S. citizens cannot quickly or directly access benefits such as those—the governments of the two countries must first work together and come to an agreement before U.S. citizens can access various medical breakthroughs themselves. If there were not an embargo in place, it might be possible for citizens within the U.S. to have direct opportunities to get access to various life changing medical breakthroughs.

Economically, both the U.S. and Cuba suffer because of the embargo. The embargo costs the U.S. more money, but Cuba has suffered a bigger hit due to its size and resources (Pepper 2009). Representatives of a dozen leading U.S. business organizations, including the Chamber of Commerce, found that the hit to the U.S. economy is \$1.2 billion a year and the Cuban government estimates their loss to be about \$685 million yearly. The U.S. government also spent \$27 million annually for many years to broadcast radio and television to Cuba even though the signal was heavily blocked by the Cuban government, which has cost U.S. taxpayers half a billion dollars over the last 20 years (Pepper 2009).

This raises an important question: why exactly has the U.S. persisted in sixty years of sanctions against Cuba? There are many reasons, some including Cuban-American support for the embargo or a lack of trust among U.S. presidential administrations. After conducting research about the embargo and the relationship between Cuba and the U.S. during the sixty years of it, I suggest that the most logical reason that the U.S. has persisted in so many decades of sanctions is that the Cuban-American vote in U.S. elections matters. Because of this, there was an act

codified into law called the Helms-Burton Act—also known as the Cuban Liberty and Democratic Solidarity Act of 1996—which not only strengthened and continues the embargo against Cuba, but stripped every president beginning with Bill Clinton from having the power to lift the sanctions. Prior to this act, any president could have lifted the embargo without assistance from the U.S. Congress, but since the act codified the embargo into law, only Congress can repeal the restrictions, which means the majority of Congress would have to vote in favor of lifting the sanctions.

BACKGROUND CONTEXT

In 1953, Fidel Castro led an unsuccessful revolt against the regime led by Fulgencio Batista, the president of Cuba at that time (BBC News 2012). Batista served as the elected president of Cuba from 1940 to 1944, and then served as a U.S. supported military dictator from 1952 to 1959 (Minster 2019). In 1956, Fidel Castro was aided by Che Guevara, and together they waged a guerilla war in the Sierra Maestra mountains located in eastern Cuba. As a result of this, in 1958, the U.S. withdrew military aid from the regime (BBC News 2012). The U.S. also imposed their first sanction on Cuba on March 14, 1958, which was an embargo on the sale of arms. In 1959, Castro led a 9,000-member guerilla army into Havana which forced Batista into fleeing. Castro had successfully revolted against Batista and became Prime Minister, establishing a socialist state in Cuba, and he began strengthening relations with the Soviet Union (Council on Foreign Relations 2021).

On October 19, 1960, nearly two years after the diminish of the Batista regime, the U.S. placed an embargo on exports to Cuba except for food and medication because Cuba had nationalized American-owned Cuban oil refineries without compensation, along with every foreign asset in Cuba (Hufbauer, et al. 2011). Castro also raised taxes on U.S. imports and

established trade deals with the Soviet Union. As a result of this, President Dwight D. Eisenhower cut the import quota for Cuban sugar, froze Cuban assets in the U.S., imposed a near-full trade embargo, and cut off diplomatic ties with the Castro government (Hufbauer, et al. 2011). In 1961, John F. Kennedy deployed a brigade of 1,400 CIA-sponsored Cuban exiles to overthrow Fidel Castro, but this was unsuccessful, as the Cuban military defeated this force within three days (Council on Foreign Relations 2021). On February 7, 1962, the Kennedy administration extended the embargo to include almost all exports except the trade of humanitarian supplies and food (Hufbauer, et al. 2011).

Since 1959, when Castro overthrew the U.S. backed Batista regime, there have been many hidden negotiations made between the U.S. and Cuba which were made through means of backchannel diplomacy (LeoGrande and Kornbluh 2015). Negotiations between the two countries have taken place throughout every presidency since Eisenhower, and each administration has handled relations with Cuba differently (LeoGrande and Kornbluh 2015). In recent years there has been some progress with relations between Cuba and the U.S.. In 2006, due to an illness that forced Fidel Castro to undergo surgery, he transferred power to his brother Raul (Council on Foreign Relations 2021). In 2008, while campaigning for the presidency, Barack Obama stated, “If the Cuban leadership begins opening Cuba to meaningful democratic change, the U.S. must be prepared to begin taking steps to normalize relations and to ease the embargo of the last five decades.” In 2009, even though the trade embargo was still placed on Cuba, Obama eased travel and remittances restrictions which allowed Cuban-Americans to send unlimited funds to Cuba and for U.S. citizens to travel to Cuba for educational and religious purposes. In 2014, Obama and Raul Castro announced that they planned on restoring full diplomatic ties after the exchange of a jailed U.S. intelligence officer along with three other

prisoners. Obama stated that the U.S. planned on reopening the embassy in Havana, but members of the Republican controlled Congress vowed to still uphold the economic embargo. Cuba and the U.S. reopened embassies in July of 2015. In more recent years, President Donald Trump in 2018 reinstated restrictions on Americans traveling to Cuba and U.S. business dealings but said he did not plan on breaking diplomatic relations. President Trump stated that the Obama administration's loosened restrictions "do not help the Cuban people—they only enrich the Cuban regime," adding that the U.S. sanctions would not be lifted until Cuba released all of its political prisoners, began respecting freedoms of expression and assembly, legalized opposition parties, and scheduled fair and free elections (Council on Foreign Relations 2021).

LITERATURE REVIEW

When looking at research regarding the U.S. sanctions on Cuba, there are various ideas as to why the U.S. has persisted in sanctions for so long. This paper will focus on four ideas. The first popular belief as to why the country has experienced sanctions for so long is that the embargo allows the U.S. government to apply pressure on the Cuban government in order to get the country to improve human rights. The second explanation is that many Cuban-Americans living within the U.S. support the embargo, and because of that, people believe that the United States should continue to sanction Cuba. The third explanation is that many U.S. presidential administrations have viewed and treated Cuba differently, creating a lack of patterns and consistency when it came to the relationship between the countries, often times resulting in distrust, leaving leaders unsure of which path to go when it came to keeping, lifting, or easing the sanctions. The fourth explanation is that the Cuban-American vote in U.S. elections—particularly in the swing state of Florida—and there were actions put into place by politicians

hoping to secure that vote that prevented future administrations from being able to simply lift the embargo if desired.

Many people believe the sanctions against Cuba are justified and should remain in place because of how the Cuban government has treated its citizens. The concern about the treatment of Cuban citizens is even listed in statutes regarding the sanctions. The Cuban embargo is enforced primarily through six statutes, one of them being the Cuban Democracy Act of 1992 (Amnesty International 2009). The purpose of the Cuban Democracy Act of 1992 is to keep sanctions on Cuba in place until the Cuban government shifts towards democratization and improving human rights within their country (U.S. Department of State Archive 1992). Before this act was put into place, Congress found that the Castro-led government demonstrated patterns of disregard for international standards of human rights along with disregard for democratic values. The government of Cuba has restricted Cuban people's freedom of assembly, press, and speech, along with other rights that the General Assembly of the United Nations adopted with their Universal Declaration of Human Rights (U.S. Department of State Archive 1992). At the time of the act, Cuban people expressed their opposition of the Castro-led government and expressed their want for freedoms that people of other countries such as the U.S. enjoyed (Amnesty International 2009).

New Jersey Senator Robert Menendez is a Cuban-American citizen who was born in the United States (Mahanta 2016). His family moved to the U.S. in the 1950s. In 2016, when Fidel Castro passed away, Menendez saw many people celebrating his life. Menendez did not agree with those celebrating, stating, "Too many families have been torn apart. Too many killed and imprisoned. Too many tortured, too many hungry, a nation destroyed and millions enslaved. A Castro [Raul, Fidel's brother] still rules 11 million Cubans with an Iron fist. Time has made

Americans numb to those harsh realities. But for the people of Cuba, they are the nightmare they live every day.” When the Obama administration’s December 2014 decision to be more open with Cuba was announced, Menendez believed that the U.S. offered too much to Cuba, who had not offered enough in return when it came to the lives of its citizens (Mahanta 2016). Many people share this belief.

Menendez went on to state that the Cuban regime has the attitude of “we only care about doing business. We don’t care about human rights and democracy because we hardly talk anymore. Cubans feel, in that sense, abandoned” (Mahanta 2016). Even though the sanctions have not accomplished an improvement in the way that Cuba treats its citizens, if the U.S. were to lift the embargo, they would have nothing to pressure Cuba into treating their citizens better and more democratically. As long as the U.S. maintains the sanctions it has placed on Cuba, it can hold the country to meeting those standards and hope that one day Cuba will start making more drastic steps needed to improve human rights and the treatment of the citizens in their country.

Although there are people who argue for the maintaining of the embargo to encourage better treatment of citizens, many different human rights groups have been critical of the embargo such as Amnesty International, Human Rights Watch, and the Inter-American Commission on Human Rights. People within these groups believe that the embargo actually hurts the citizens of Cuba, and even if the Cuban government treated their citizens better and practiced free democratic elections, the impacts of the embargo target hurt Cuban citizens more so than it does the government, which is something that is counterproductive when it comes to what the U.S. claims to want (Amnesty International 2009).

The second explanation as to why the U.S. has persisted in keeping sanctions on Cuba for the last sixty years is that an overwhelming amount of Cuban-Americans actually support the embargo (Florida International University 2011). Former U.S. Representative, Ileana Ros-Lehtinen, is a Cuban-American who has been a long-time supporter of the embargo, stating, “In addition to imposing economic pressure on the Castro regime and holding it accountable for actions against U.S. interests, the embargo is a moral stance against the brutal dictatorship. Over the last 50 years, the embargo has served as a constant form of solidarity with the Cuban people” (Heinrich, et al. 2012). Support of the embargo among Cuban-Americans has waned over the years, but there is a slight majority of Cuban-Americans who still support the embargo. In 1991, polls found that 87% of Cuban-Americans in Miami supported the embargo, while polls conducted in 2011 show that 53% of Cuban-Americans still support keeping the embargo in place, even if they do not see benefits of the embargo, because of the principle that the embargo should be in place until the government changes the treatment of the citizens and gives them more freedoms (Florida International University 2011).

The third reason as to why the U.S. has persisted in sanctions on Cuba for the past sixty years is that each administration since the embargo began has dealt with Cuba differently, has developed different relationships with the country, and hold different viewpoints towards the country and the embargo. Each administration has viewed Cuba and the issue of the embargo differently. Although there is more knowledge available today about the relationship between the United States and Cuba, it does not offer many answers or explanations on how to fix the issue at hand—the relationship between Cuba and the U.S. remains as confusing and arguably as poor as it was when the sanctions were first put into place six decades ago (LeoGrande and Kornbluh 2015). During the sixty years of sanctions, there have been countless amounts of contact and

negotiations made throughout every presidency by means of back channel diplomacy (LeoGrande and Kornbluh 2015). Due to the differing attitudes between administrations of both governments and other factors such as public opinion, each presidential administration dealt with Cuba differently and so far there have not been many things that each administration agreed on wholeheartedly.

Take recent administrations for example— Barack Obama was elected president in 2008. In 2009, he fulfilled his pledge to lift travel and remittance restrictions on Cuban Americans and authorized U.S. telecommunications companies to contract with Cuba to provide improved television, internet access, radio, and telephone access to the people of Cuba (LeoGrande and Kornbluh 2015). When Obama won reelection in 2012, hope was high among Cuban-Americans but eighteen months into his presidency, Cuban-U.S. relations were not very different from the ten administrations that came before him (LeoGrande and Kornbluh 2015). In 2018, President Donald Trump announced that he would reinstate restrictions on Americans traveling to Cuba and U.S. business dealings with a military-run conglomerate—though he did not plan on breaking diplomatic relations (Council on Foreign Relations 2021). President Trump added that the U.S. would not lift sanctions on Cuba until the country completes requirements set by the U.S. in order to lift it. As a candidate, Joe Biden pledged to reverse Trump’s policies on Cuba. Since taking office, the Biden administration affirmed its commitment to reverse Trump’s policies on Cuba, but the White House has stated that reorienting U.S. policy toward Cuba is not among President Biden’s highest priorities. (Council on Foreign Relations 2021). Lack of consistency, where there is a presidential election every four years in the U.S. and the Castro brothers have ruled Cuba for sixty years, combined with the fact that each presidential administration has differing views on Cuba and values could explain that the U.S. has not lifted

the embargo due to there not being enough meaningful interactions between the two countries or there not being enough trust to lift the sanctions.

The last explanation as to why the U.S. has persisted in sixty years of sanctions against Cuba is that the Cuban-American vote in U.S. elections—particularly the swing state of Florida—are vital to elections and certain politicians took actions to secure them. This is primarily shown through many events that happened during the time Bill Clinton was campaigning to become president and throughout his presidency. Similar to administrations before Clinton's, Clinton communicated with Cuba through means of back channel diplomacy but did not publicly talk much about normalizing relations with Cuba because he wanted to secure Cuban-American votes in the presidential election of 1992 with hopes that it would help him win the state of Florida (LeoGrande and Kornbluh 2015). When it came to Cuba, Clinton was willing to use soft-power rather than hard-power such as economic sanctions against Cuba, and was open to the idea of using interpersonal communication for the first time since the 1970s. Clinton wanted to improve the relationship between the United States and Cuba (LeoGrande and Kornbluh 2015).

In 1992, the electoral college road to win the White House was important in the swing state of Florida, and Clinton thought that if he could connect with the primarily conservative Republican Cuban-American community, he might be able to win Florida (LeoGrande and Kornbluh 2015). Clinton won the presidential election of 1992 but did not win Florida. He did win 22% of the Cuban-American vote, which was more than any other Democratic candidate since Jimmy Carter. He did end up winning Florida during the 1996 presidential election.

In 1992, while attending a fundraiser in Little Havana in Miami, Florida, Clinton spoke about the Torricelli-Graham bill, which was written in 1991, and is also known as the Cuban

Democracy Act. The purpose of the act was to tighten the embargo at a time when the Cuban economy was unsteady due to the collapse of the Soviet Union. Because of how close the United States and Cuba are, Cuba became an important ally to the Soviets during the Cold War.

Toricelli, Clinton's top campaign advisor on Latin America, said the intention of the act was to bring Castro to his knees. While referring to this act, Clinton stated to hundreds of Miami's wealthiest Cubans who were ready to supply campaign funds, "I think [the George H. W. Bush] administration has missed a big opportunity to put the hammer down on Fidel Castro and Cuba." Many of the conservative Cuban-Americans enjoyed hearing that, as they held hardline beliefs towards Cuba and were very anti-Communist and anti-Castro. Clinton had some focus of normalization for the U.S. and Cuba but he was very focused on securing the Cuban-American vote. National Security Council official Richard Feinberg stated in regard to Clinton's view on Cuban relations, "It was just very clear that the political direction from the White House was that we don't want to be out front on this issue, and that we are very responsive to the Cuban-Americans... Clinton really wanted to carry Florida. That's what's driving this. That was numero uno" (LeoGrande and Kornbluh 2015).

As tensions grew between the U.S. and Cuba from Cuban citizens suffering due to the lack of funding from the Soviets, many citizens were struggling and wanting to escape Cuba. Many of those that did flee the country did so in dangerous ways such as tying floats to old cars or using makeshift rafts in hopes of making it to Florida (LeoGrande and Kornbluh 2015). The U.S. knew that they had to address this issue, and National Security Advisor Anthony Lake was ready to speak out about how it might be time for the U.S. to consider more proactive measures to aid its relationship with Cuba and to help Cuban people. Lake was going to give his speech in October of 1994, but that never happened. Instead, Lake was advised that it was not good for the

speech to be announced so close to the elections and was told that he could give it sometime afterward. That did not happen either.

In November of 1994, the Republicans won both the House and the Senate. Jesse Helms, a conservative Republican Senator from North Carolina took over the position of the chair of the Senate Foreign Relations Committee, and fellow conservative Dan Burton became chair of the House Subcommittee on Western Hemisphere affairs. Together, they started drafting pieces of legislation that were designed to globalize the trade embargo which would further punish Cuba and block Clinton from being able to do anything about it. The legislation is known as the Helms-Burton Act, and at first, Clinton did not support it and had no plans of signing it (LeoGrande and Kornbluh 2015).

In February of 1996, an event took place that almost immediately changed Clinton's stance on the act. Castro ordered two small planes off the Cuban Coast to be shot down (LeoGrande and Kornbluh 2015). The people flying those planes were known as Brothers to the Rescue. Since 1991, they had been flying on missions searching for Cubans fleeing the country in boats and rafts, and they alerted the U.S. Coast Guard whenever someone needed to be rescued. As a result of Castro's decision to shoot down the planes, Clinton signed the Helms-Burton Act into law on March 12, 1996, in what seemed to be an act of haste. Not only did it tighten the embargo, but it also changed the relationship with Cuba for every future U.S. presidential administration (LeoGrande and Kornbluh 2015). Before signing the act into law, any president could have lifted the embargo on their own. After the act got codified into law, all the power to lift the sanctions were placed in the hands of the U.S. Congress (Dunning 1998).

ANALYSIS

Although there are many explanations as to why sanctions have lasted so long, after conducting research about the embargo and the relationship between the U.S. and Cuba, I suggest that the most logical reason as to why there has been sixty years of sanctions is that the Cuban-American vote has and will continue to matter to U.S. politicians, primarily Republicans, who are looking to secure their votes in hopes to win elections. Because of that, legislation that attracted conservative and Republican Cuban-Americans was put into place and not only did the legislation attract Cuban-American voters and tighten the embargo, it took away any chance that a U.S. president had in lifting it.

To further understand this, it is important to look at information about Cuban-Americans residing within the U.S. and their voting patterns along with their political ideologies. It is also important to look some Electoral College details. In 2004, there were roughly 1.4 million Cubans living within the U.S. (Pew Research Center 2006). Although the numbers have slightly raised since 2004, the data is still fairly similar to trends seen in recent years. More than two-thirds of Cubans live in Florida, making the population at nearly 1 million in 2004. In 2004, New Jersey had roughly 81,000 Cubans, New York roughly 78,000, California 74,000, and Texas nearly 34,000 (Pew Research Center 2006). Out of those States, Florida is the only one that has consistently remained a swing state (Silver 2016). This is important because either the Democrats or Republicans have a chance at winning in a swing state—the state does not typically vote the same way for every election. An example of this is when Republican President George H.W. Bush won the state of Florida in 1992, and four years later Democratic candidate Bill Clinton won the state of Florida.

On top of being a swing state, Florida is worth 29 electoral college points. It is one of the six states with the most electoral college points and is in fourth place of states with the most points. If a candidate secures Florida, with that state alone they have nearly 11% of the points needed to win the election. Voting patterns among Cuban-Americans have importance as well. Overall, Cuban-Americans are heavily Republican (Man 2019). Research found that voter registration among Cuban-Americans is 54% Republican, 19% Democratic, and 26% Independent. When looking specifically into differences among demographics within the community, Cubans who came to the United States before 1980 are 72% Republican, 11% Democratic, and 17% Independent. Seniors aged 76 and older are 76% Republican, 7% Democrat, and 17% Independent. Among Cuban-Americans who were not born in Cuba, 41% are Republican, 28% are Democratic, and 29% have no party affiliation. Cuban-Americans from ages 18 to 39 are 35% Republican, 23% Democratic, and 40% Independent. When it comes to support for the embargo, in 1997, 78% of Cuban-Americans supported maintaining it and in 2018, 51% said they were still in favor of maintaining it (Man 2019). The fact that Cubans have remained primarily Republican throughout the decades is important when it comes to political figures trying to secure their votes in hopes to win elections, and legislation such as the Helms-Burton Act.

Large-scale migration from Cuba to the U.S. started as a result of the Cuban Revolution in 1959, when Castro began a Communist takeover of the country. Many Cubans became anti-Communist and anti-Castro and felt that because of actions he had taken against Cuban citizens, the U.S. should take more of a hardline approach to him. This approach was offered by many Republicans, a particularly important one being North Carolina Senator Jesse Helms. As mentioned before, Senator Helms was one of two authors of the Helms-Burton Act. On top of the

support he received from Cubans because of his anti-Communist and anti-Castro beliefs, one thing within the Helms-Burton Act that gathered a lot of support was that the act included details of penalizing foreign firms and families of their employees for using land within Cuba that was taken from U.S. citizens or Cubans (Driscoll 1995). He gained a lot of support with this from South Florida's Cuban-American community. Not only did Cubans support Senator Helms on the Helms-Burton Act, he also gained funding from Cuban-Americans for things such as his 1996 re-election campaign in which he was running to get re-elected as a North Carolina Senator (Driscoll 1995).

The Cuban-American support for the Helms-Burton Act and the desire of U.S. politicians to try to secure not only Cuban-American support but also the Cuban-American vote created the perfect environment for the Helms-Burton Act to be put in place. President Clinton had originally shut down the idea of signing the Helms-Burton Act, but in an act of haste to respond to the shooting of two planes off of the Cuban coast in February of 1996, he signed the Helms-Burton Act which enabled Congress to codify the act into law (LeoGrande and Kornbluh 2015). Clinton understood the complications of the embargo, and stated that, "Anybody with half a brain could see the embargo was counterproductive... It defied wiser policy engagement that we had pursued with some Communist countries even at the height of the Cold War," yet he still enabled the Helms-Burton Act to be signed into law. Clinton later went on to write in his 2004 autobiography, *My Life*, that, "Supporting the bill was good-election year politics in Florida, but it undermined whatever chance I might have had if I won a second term to lift the embargo in return for positive changes within Cuba" (LeoGrande and Kornbluh 2015).

When the Helms-Burton Act was codified into law, President Clinton not only gave up his presidential authority to make policy change towards Cuba, but he also signed away the

authority of any president that would come after him (LeoGrande and Kornbluh 2015). To lift the embargo, the majority of Congress has to vote to lift it. From the years of 1995 to 2021, there are 26 years that cover Congress from the 104th Congress to the 116th Congress. During those 26 years, eight Congresses were Republican, two were Democratic but not by an overwhelming majority, and three were split. Given the fact that Cuban-Americans are primarily Republican, it is not likely that the Cuban embargo will be lifted until there is a Congress that has an overwhelming majority of Democrats who support lifting the embargo, and even then, political desire might still get in the way. Take President Clinton, for example, who allowed the Helms-Burton Act to be codified into law because in his words, it was good for politics during an election year. If enough Democrats see a way to harbor political gain through maintaining the embargo, there is a chance that they may choose to maintain it.

CONCLUSION

The sixty years of sanctions that the U.S. has persisted in against Cuba not only has an impact on Cubans, but U.S. citizens as well. Impacts range from human security issues to economic issues. It is important for civilians to be concerned with this controversial issue because many people believe that the sanctions only impact the government of each country involved, but that is not the case. The sanctions impact every citizen within each country either directly or indirectly. Sixty years of sanctions has passed, and the embargo has not accomplished many of the goals it was put in place to accomplish, but it has caused many hardships on people within Cuba and it has costed both the Cuban and American governments massive amounts of money. The topic of research I was interested in was exactly why the United States has persisted in sixty years of sanctions, especially when one considers the fact the sanctions have not accomplished much of what they were designed to. From my research I was able to conclude that

because of United States politicians' desire to secure support, money, and votes from Cuban-Americans primarily living within the swing state of Florida—not only a swing state but a state worth 29 electoral college points—that legislation was put into place that now prevents presidents from being able to lift the economic sanctions placed upon Cuba. Every president since John F. Kennedy up until Bill Clinton had the power to lift the sanctions against Cuba. When Bill Clinton signed the Helms-Burton act and it was codified into law, that power was taken away and placed upon Congress, and the sanctions will remain in place until there is a Congress with enough support and desire to lift the sanctions.

With this research, I hope that more people become aware of just what it takes to end the sixty year embargo against Cuba, and I hope to encourage more people to pay close attention to what politicians within their countries are doing, as politicians' actions may help them gain something quickly, but the benefits or consequences may not turn out to be the best scenario for all, including mere citizens, in the long-run. Before conducting my research, I thought lifting the embargo was as simple as the president saying, "It's over," but I have realized just what it will take to lift the embargo and it is not something that will happen overnight - it will take time. I would recommend those who are concerned about the Cuban embargo to research more into it, and I would also encourage those who want to see real change to bring it up to politicians whenever they can and look for politicians who speak realistically in regard to the embargo. If a politician states that they solely can end the embargo, they are wrong. It will take not only the majority of members of Congress to do so but support from many United States citizens as well. I believe that lifting the embargo is more beneficial than maintaining it, but the issue of it being lifted is not that simple. It is important for citizens and fellow politicians to support and encourage members of congress to lift the embargo on a large-scale platform.

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The Characterization of Pyrene Degrading Indigenous Bacterial Species

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ABSTRACT

Polycyclic aromatic hydrocarbons (PAH) are dangerous micropollutants that can be found in many environments, including soil. The degradation of these contaminants using microorganisms is a promising method for their remediation. The focus of this study was to isolate and characterize indigenous bacteria capable of degrading the PAH, pyrene, which was presumed present in soil located near a residential grilling site in Wingate, North Carolina. Collected soil was spiked with 0.3, 1.5, 3, and 6 mg/g pyrene, and bacteria were isolated through an enrichment method that utilized a minimal medium supplemented with pyrene. Twenty-eight isolates were grouped in 6 morphotypes and representatives purified and identified based on 16S rRNA phylogeny and biochemical characterization. Presumed pyrene degrading bacterial isolates were present in the soil at an average of 1.71×10^6 CFUs/g; control soils (no pyrene supplementation) had comparable bacterial population sizes which indicate the presence of lithotrophs. The morphotypes included species of the genera *Arthrobacter*, *Methylobacterium*, *Rhodococcus*, *Streptomyces*, and *Terrabacter*. Classic microbiological tests confirmed their physiological and morphological characteristics were comparable to their identified taxonomic groups. In addition, to confirm pyrene degrading pathways in the genome, targeted PCR using primers specific for such genes was attempted however, results were inconclusive.

INTRODUCTION

The contamination of soil by a variety of hazardous pollutants is a common and growing problem. One type of pollutant that is becoming increasingly concerning are the hydrophobic Polycyclic Aromatic Hydrocarbons (PAHs). These compounds are organic, composed of fused aromatic rings, and often occur in nature due to incomplete combustion of organic and other matter, as well as through industrial and natural emissions^{14, 18}. PAHs naturally arise from sources like volcanic eruptions and forest fires, while artificial sources can include home heating, residential wood burning, traffic emissions, the incineration of waste, and many others. PAHs in their solid phase pose a threat to the environment and humans because of their low solubility, toxic, carcinogenic, and mutagenic properties^{7, 18}. These compounds persist in natural

ecosystems and the organisms within them, eventually becoming harmful to humans as they persist within food chains. While low-molecular-weight PAHs (3 or less fused rings) are easily degraded, high-molecular-weight PAHs (4 or more fused rings) are not, and their low aqueous solubility and high solid water distribution (*i.e.* high absorption rates on soil particles) result in their accumulation in large amounts in soils. The rings that compose PAHs make them resistant to nucleophilic degradation and in terrestrial soils the metabolic abilities of localized organisms that break down the PAHs to CO₂ and water is key to detoxification of the environment ⁷. Bacterial species have been isolated and found to be able to transform, degrade, and utilize the high-molecular-weight PAHs as carbon and energy sources but many have not yet been identified ¹⁸.

Pyrene is a common PAH and the focus of the present study. It has a symmetrical structure, is composed of four rings, and is considered a dangerous pollutant (ranked in the top 129 pollutants by the United States Environmental Protection Agency) with high persistence in the environment due to its recalcitrant nature¹³. One solution to the buildup of pyrene in the soil is bioremediation, the utilization of the metabolic potential of microorganisms to clean up contaminated environments. Many inorganic and organic chemical pollutants, including PAHs, are metabolized by different species of bacteria who play crucial roles in the bioremediation process. One example of a pyrene degrading soil bacterium is *Mycobacterium* sp. strain KR2¹⁷, the inspiration of the present study, which aims to isolate and identify pyrene-degrading soil bacteria which could potentially be of use in bioremediation practices that could safely and effectively reduce its toxicity in the environment.

It was hypothesized that in the soil near a residential grilling site, indigenous pyrene-degrading bacteria would be present. To investigate this, the soil collected was filtered and

spiked with solid pyrene in various concentrations. Bacteria obtained from the soil were cultured on both liquid and solid pyrene-enriched minimal media (MM). The chosen isolates were purified and characterized through morphological, biochemical, and phylogenetic analysis. It was predicted that bacteria from the genus *Mycobacterium* would be identified among the pyrene-degrading isolates in the soil ¹⁷.

METHODS

Chemicals, Stock Solutions, and media

All chemicals and reagents used (including pyrene and acetone) were reagent grade or better and purchased from Sigma Aldrich Corp. (Missouri, USA). Pyrene spiked minimal media (MM) was composed of 1g of NH₄NO₃, 1g of KH₂PO₄, 0.1g of MgSO₄·8H₂O, 0.1g of FeCl₃·6H₂O, and 0.01g of CaCl₂·2H₂O per liter of broth. The pH of the medium was adjusted to 7.00 using sodium hydroxide before sterilization. Broth and solid forms of MM media were used, and solid media plates were prepared using 2.0% Bacto agar (Becton-Dickinson, New Jersey, USA). To spike the media, pyrene was dissolved in acetone at a concentration of 500mg/L; 1mL of the pyrene solution (500mg/L) was added per 50mL of MM broth whereas for the solid media, 100μL of the solution was aseptically spread on top of each agar plate.

Collection of soil samples and soil characterization

The soil was collected from a residential grilling location near a lake at Wingate University, Wingate, NC (34.9874685, -80.4306706) in September 2020. At the time of sampling, the temperature was 19°C, the UV index was 2, and the humidity 82%.

Approximately 2kg of surface soil was collected from two locations in close proximity to each other. After collection, a 3mm mesh was used to filter plant material, rock, and any other debris in the soil. Approximately 0.5kg of soil was put aside to analyze the chemical composition and

another 160g of soil was dried (uncovered) for 24 hours at 30°C then stored at 5°C for 48 hours. The chemical composition of the soil was determined by measuring soil pH, water holding capacity, and detecting levels of nitrate, magnesium, and sulfate ions using the Exploring Soils: Chemical compositions kit from Carolina Biological Supply Company© (North Carolina, USA).

Preparation of pyrene-spiked soil

Preparation of pyrene-spiked soil and handling of samples followed the protocols of Hamdi *et al.*, 2006⁸ with modifications. After drying and brief storage, the soil was reweighed, rewet to 15% of its original moisture content then incubated at room temperature for 5 days. Following the incubation period, five-gram portions of soil were added to 12 sealed Tupperware® containers (1/2 cup volume). 2 sets of 4 containers of soil samples had pure solid pyrene added in increasing amounts equivalent to 0.3, 1.5, 3, and 6 mg/g of pyrene to dry soil. Soil and pyrene were then mixed, the containers were left closed for 5 minutes, re-opened, and left to evaporate for the next 16 hours. A third set of containers were used for the control group and after the 5g of soil was added to each container they were left opened to evaporate for 16 hours. Post-evaporation, 15g of soil was added to each of the twelve containers, including the control group, lightly misted with water, and incubated at 20°C for 7 days.

Isolation of pyrene degrading microbes

After 7 days, 0.5g of soil from each of the soil samples was added to 50 mL of MM broth spiked with 500mg/L of pyrene/acetone solution in a 200mL Erlenmeyer flask to enrich for pyrene degrading bacteria. The flasks were then shaken at a speed of 100 rpm in the dark for 4 weeks. The enriched broths were serially diluted to 10⁻⁶ using 900µL of MM broth blanks and 100µL of the enriched broth (or previously diluted broth). Pyrene was supplemented onto the MM agar plates by uniformly spreading 100µL of pyrene/acetone (500mg/L) solution aseptically

onto each plate followed by 100 μ L of the enriched broth dilution. The plates were incubated at 30°C in the dark until growth was observed after approximately 3 days. Presumed pyrene degrading colonies that appeared on the agar plates were counted to estimate the bacterial population in CFUs/g and morphological characteristics of the colonies were recorded. The colonies with the most efficient growth were selected and re-streaked using the quadrant streak method for further purification.

Using the same technique to supplement the plates with pyrene, additional MM agar plates were inoculated with pyrene-spiked (and control) soil samples. This was done by adding 0.5g of the soil to 1mL MM broth, vortexing briefly, and aseptically inoculating 100 μ L uniformly across pyrene-supplemented MM agar plates which were incubated at 30°C in the dark until growth was seen. Purification of presumed pyrene degrading bacterial isolates were acquired by re-streaking the isolates numerous times over the next few weeks on sterile pyrene supplemented MM agar plates. Once the isolates were considered pure, they were Gram-stained to confirm purity and to observe cellular morphology and Gram reaction. The isolates were then morphotyped based on Gram stain and similar cellular and colonial (how they appeared on the MM agar plates) characteristics. 28 isolates were categorized into morphotypes and 6 isolates chosen as representatives for identification and characterization. The representative isolates were named based on whether they were cultured from the first (1) set of samples, second (2) set of samples, or the control (C) group, the amount of pyrene added (15, 75, 150, 300mg), and the dilution (10^{-x}).

Identification of pyrene degrading strains

The six representatives were cultured in Tryptic Soy Broth (TSB) medium (Becton-Dickinson, New Jersey, USA) to acquire more confluent growth. DNA was extracted from 48hr

TSB cultures using the DNeasy® UltraClean® Microbial kit (Qiagen, Maryland, USA) following its Quick-start protocol. After the DNA was extracted, 5µl of DNA and 1µl of 6X purple loading dye (New England Biolabs Inc. (NEB), Massachusetts, USA) was mixed and loaded into the wells of a 1X Sodium Borate 1% agarose gel (Seakem LE Agarose, Lonza-Rockland Inc., Maryland, USA) which contained 10% GelRed ® nucleic acid stain (Biotium Inc., California, USA) along with a 1kb DNA ladder (NEB). The agarose gel was electrophoresed for 60 mins at 60 volts and illuminated at 365nm of ultraviolet light on a transilluminator to view the extracted DNA.

The pure isolates were identified by 16S rRNA gene sequences which were first amplified by Polymerase Chain Reaction (PCR). The PCR parameters used were an initial denaturation of 94°C for 10 mins, followed by 30 cycles of 30 seconds denaturation at 94 °C, 30 seconds annealing at 58°C, and 1 minute and 45 seconds elongation at 72°C, with a final elongation for 7 mins at 72°C. PCR steps were completed in a T100™ Thermal Cycler from Bio-Rad (Bio-Rad Laboratories Inc, California, USA) with 1.25units of OneTaq® HotStart DNA polymerase (NEB) per reaction and 10µM universal bacterial high degeneracy primers 27FHT (AGRGTTTGATYMTGGCTCAG) and 1492RHT (GGYTACCTTGTTACGACTT) acquired from Integrated DNA Technologies (IDT, Iowa, USA). To confirm PCR success, 5µL of the PCR amplicon was mixed with 1µL of 6X purple loading dye (NEB) loaded in a 1% agarose gel along with 100bp DNA ladder (NEB) in its own lane and electrophoresed as described previously.

Successfully amplified 16S rRNA gene sequences were sequenced on an ABI 3730xl DNA Sequencer using the Sanger sequencing method (Eton BioScience, North Carolina, USA). The gene sequences were aligned and edited in BioEdit software⁹; the completed sequences

were uploaded into BLASTn (Basic Local Alignment Search Tool, nucleotide; ¹⁶for comparison with known 16S rRNA gene sequences in the NCBI GenBank database ¹. Analysis of the phylogenetic relationships of the presumed pyrene degrading isolates, and their close relatives using their 16S rRNA sequences was conducted in MegaX software ¹³. A neighbor-joining phylogenetic tree ¹⁹ was created with the sequences, 1000 bootstraps, phylogenetic distances calculated by the Jukes-Cantor method ¹¹, and with all ambiguous positions removed for each sequence pair. The 16SrRNA gene sequence of the bacterium, *Staphylococcus aureus* ATCC 12600 strain, was used to root the tree.

Primers for pyrene degradation genes

To detect pyrene degrading abilities within the genome of the bacterial isolates, the primer sets *nidA*, PAH-RHD-GN, and PAH-RHD-GP were applied to target specific DNA sequences of PAH-degrading strains (see table 1 for sequences). *nidA* primers encode for the α -subunits of PAH-ring hydroxylation dioxygenase (PAH-RHD) that add hydroxyl groups to carbons 4 and 5 of pyrene during its degradation. Gram-negative (PAH-RHD-GN) and Gram-positive (PAH-RHD-GP) specific PAH-RHD primers target functional markers encoding for the α subunits within these groups of PAH degrading microbial populations ³.

Table 1: Primer sequences for pyrene degrading genes ³.

Primer	Sequence
<i>nidA</i> -F	5' TTCCCGAGTACGAGGGGATAC 3'
<i>nidA</i> -R	5' TCACGTTGATGAACGACAAA 3'
PAH-RHD-GN-F	5' GAGATGCATACCACGTKGGTTGGA 3'
PAH-RHD-GN-R	5'AGCTGTTGTTCGGGAAGAYWGTG CMGTT 3'
PAH-RHD-GP-F	5' CGGCGCCGACAAYYTYGTNGG 3'

PAH-RHD-GP-R	5' GGGGAACACGGTGCCRTGDATRAA 3'
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Identification of PAH degrading strains

PCR amplification using the *nidA* primers at a concentration of 10 μ M was performed in the T100™ thermal cycler with 1.25 μ M OneTaq® HotStart DNA polymerase (NEB) per 50 μ L reaction. The thermocycling parameters were denaturation at 95°C for 15 minutes, followed by 40 cycles of denaturation at 94°C for 15 seconds, annealing at 56°C for 30 seconds, elongation at 72°C for 30 seconds, and final elongation for 7 minutes at 72°C. Due to spurious banding or amplification failure, the *nidA* PCR was repeated with different annealing temperatures (54–58°C). Both PAH-RHD-GN and PAH-RHD-GP primers (10 μ M) were used in 50 μ L PCR reactions. The parameters were denaturation at 95°C for 5 minutes, 30 cycles of denaturation at 95°C for 30 seconds, annealing at 54°C for GN, and 56°C for GP for 30 seconds, and elongation at 72°C for 30 seconds, and then further elongated at 72°C for 7 minutes. Due to failed PCR amplification, the reaction was repeated raising the annealing temperature by 1°C, increasing the time to 45 seconds for each step, and increasing the number of cycles to 35. Agarose gel electrophoresis was conducted as previously described to confirm PCR success; however, 3% agarose gels and the low molecular weight DNA ladder (NEB) were used.

Biochemical characterization of isolates

The 6 representative isolates were characterized based on their biochemical capabilities. Cultures were incubated for 48hrs at 30°C until the temperature optima were determined (described below) then all incubations were conducted at optimal temperatures. To determine the oxygen requirements of each isolate they were inoculated in a thioglycolate semisolid medium. Optimal temperature points were determined by inoculating Tryptic Soy Agar (TSA) plates and

incubating them at 20°C, 30°C, 35°C, and 45°C. The optimum pH requirement of the morphotypes was determined by inoculating TSBs with varying pH levels: 2, 4, 7, 8, and 10. The ability to produce enzymes required for respiration such as oxidase and catalase was investigated. The test reagent tetra-methyl-p-phenylenediamine (Carolina Biological Supply Co.) was added to the culture and observing for an immediate color change to confirm oxidase production. If bubbling occurred when 1-2 drops of 3% H₂O₂ was added to the bacterial culture, catalase production was confirmed. Isolates capable of respiring anaerobically using nitrate as an alternative electron acceptor resulted in a red color change when cultivated in nitrate broth then adding 5 drops each of sulfanilic acid and dimethyl- α -naphthylamine. To confirm complete denitrification, zinc was added when no color change was observed after the addition of aforementioned reagents.

Starch, tributyrin (lipid), casein milk protein, and gelatin media were inoculated to confirm the isolates' ability to produce hydrolytic enzymes. After incubation, starch agar plates were flooded with 2% iodine (Carolina Biological Supply Co.) and gelatin semisolids were refrigerated for 15 minutes to confirm hydrolysis. Isolates that produced urease enzyme were identified when inoculated urea broth changed color after incubation. To determine which carbohydrates the isolates can utilize, simple sugars, disaccharides and glucose, lactose, maltose, mannitol, and sucrose, were added to fermentation broths used to cultivate the bacteria. Fermentation of these carbohydrates was confirmed by observing the broths for color changes and possible gas production after 24 and 48hrs. The ability of the isolates to decarboxylate amino acids was investigated by cultivating the organisms in decarboxylase nutrient media that contained glucose and an amino acid substrate (arginine, lysine, or ornithine) and observing at 24 and 48 hours for a color change.

The utilization of citrate as a sole energy source was determined by inoculating isolates in Simmons citrate media and observing for growth and color change. Glucose fermentation can occur via several pathways including the mixed acid pathway where a high concentration of organic acids is produced, or the products can be converted to non-acidic end products by the butanediol pathway. To confirm which glucose fermentation pathway the isolates used they were cultivated in Methyl Red-Voges Proskauer broths then split into two halves. The methyl red test was conducted to one half to determine if the bacteria produce high concentrations of organic acids. The Voges-Proskauer test was conducted by adding Barritt's reagent A (α -naphthol) and Barritt's reagent B (40% potassium hydroxide) to the other half to detect non-acidic end products. Sulfur-indole-motility agar deeps were inoculated to determine if the bacteria were motile, produced cysteine desulfurase, and/or tryptophanase which required adding Kovac's reagent (Carolina Biological Supply Co.) and documenting any color changes that appeared. Finally, to determine the isolate's ability to grow in the presence of the poison cyanide, the bacteria were inoculated in a nutrient broth that contained 0.5% potassium cyanide and observed for growth.

RESULTS

Sample site and soil composition

The soil contained high levels of magnesium with no nitrate or sulfate, however, the pH was 6 and it was well-drained (Table 2). The bacteria population was estimated to be approximately 1.71×10^6 CFUs/g.



Figure 1: Soil sample site at the residential grilling site in Wingate, NC. The soil was collected in close proximity to a discarded mass of charcoal. Photo by Sydney Smith.

Soil Parameter	Value
pH (pH strip)	6
Water holding capacity (g)	4.4
Nitrate (test strip)	No nitrate present
Magnesium (test strip)	High levels present
Sulfate (ppm)	0

Table 2: Soil chemistry components and their measurements.

Presumed pyrene degrading bacteria isolation and characterization

After 4 weeks of shaking in the dark, 28 presumed pyrene degrading colonies were isolated from the spiked MM broth and agar plates. Based on morphological characteristics, 6 representatives were chosen: C-3-10⁻², 1-150-10⁻², 2-300-10⁻⁵, 2-75, 2-75-10⁻² and C-3-10⁻⁴. DNA extractions were successful and 16S rRNA gene sequences were obtained for all 6.



Figure 2: The 12 soil samples in their Tupperware® containers. Photo by: Sydney Smith.



Figure 3: Serial dilutions of the spiked liquid MM broth from 10^{-1} to 10^{-6} . Additionally, the MM plates can be seen and the pyrene that was used to spike the plates. Photo credit: Sydney Smith.

Isolate C-3-10⁻² is a motile Gram-positive bacillus, a facultative anaerobe that produces catalase but not oxidase, cannot grow in the presence of cyanide and grows best at a temperature of 30°C and a pH of 8. The isolate utilizes citrate, hydrolyzes starch but not gelatin or lipid, and anaerobically respire nitrate. The bacterium decarboxylated all 3 amino acids (arginine, lysine, and ornithine); however, it does not degrade tryptophan, produce urease or ferment any of the carbohydrates tested and therefore, had negative results for glucose fermentation pathways in the methyl red and Voges-Proskauer tests. When its 16S rRNA gene sequence was compared with other sequences within GenBank it showed a high similarity (99.78%) to a strain from the genus *Arthrobacter*, accession number KC764990.1.

The isolate 1-150-10⁻² is a Gram-positive coccus, facultative anaerobe, and does not produce catalase nor oxidase enzymes. The bacterium utilizes citrate but did not appear to

degrade tryptophan, produce urease, or ferment any of the carbohydrates supplied. Glucose fermenting pathways were not employed by the bacterium as there were negative results for both the Voges-Proskauer and methyl-red tests. Additionally, it did not grow in the presence of cyanide, nor did it hydrolyze gelatin or decarboxylate any of the 3 amino acids. The bacterium did anaerobically respire nitrate, hydrolyze lipids and starch, and is motile. It grows best at 30°C and a pH of 8, and by comparison, using its 16S rRNA sequence is closely related to *Terrabacter* sp. (accession number MH671503.1) with a similarity of 99.21%.

The Gram-positive bacillus, isolate 2-300-10⁻⁵, is a strict aerobe that is motile, grows best at 35°C and a pH of 7, and produces catalase enzyme but not oxidase in this study. The bacterium did not ferment any of the carbohydrates or urea, degrade any macromolecules, or grow in the presence of cyanide. The bacterium did degrade tryptophan and decarboxylate ornithine but none of the other amino acids and can use nitrate for anaerobic respiration. It has 99.48% similarity to the 16S rRNA sequence of *Methylobacterium* sp. (accession number KM016536). Also motile, Gram-positive, and bacillus shaped is isolate 2-75; however, it is a facultative anaerobe that produces catalase but not oxidase, and while it grows best at 35°C, prefers a pH of 8. It does ferment glucose only, employing both butanediol and mixed acid fermentation pathways for the sugar as both Voges-Proskauer and methyl-red tests were positive. The bacterium can hydrolyze starch and lipids but not gelatin and it is unable to degrade any of the amino acids in decarboxylase or SIM media. Isolate 2-75 does not anaerobically respire nitrate, grow in the presence of cyanide, or produce urease. Upon comparing it with other 16S rRNA sequences, it shared a similarity of 99.71% to the sequence of *Streptomyces* sp. (accession number MF536528.1).

Isolate 2-75-10⁻² is also Gram-positive but coccus-shaped, motile, a facultative anaerobe, and a producer of catalase but not oxidase enzymes. The bacterium can use nitrate for anaerobic respiration and hydrolyze starch but no other large molecules. The isolate degraded urea, utilized citrate, and decarboxylated ornithine, lysine, and arginine. The bacterium did not degrade tryptophan or cysteine nor ferment any sugars tested. The temperature and pH optima were 30°C and 8, respectively. Comparison of its 16S rRNA sequence in GenBank indicated that its closest relative is *Rhodococcus erythropolis* (99.35%; accession number MN922941.1). Isolate C-3-10⁻⁴ also shared 99.78% sequence similarity with *Rhodococcus erythropolis* (accession number KC764993.1) and is therefore likely related to isolate 2-75-10⁻². As indicated by its sample name, this bacterium (C-3-10⁻⁴) was isolated from a control sample; it had identical biochemical characteristics as outlined for isolate 2-75-10⁻² except it preferred a pH of 7.

<i>Isolate sample</i>	<i>Closest Relative</i>	<i>Accession number</i>
2-75	<i>Streptomyces</i> sp.	MF536528.1
2-300-10 ⁻²	<i>Methylobacterium</i> sp.	KM016536.1
3-C-10 ⁻⁴	<i>Rhodococcus erythropolis</i>	KJ00934.1
2-C-10 ⁻²	<i>Arthrobacter</i> sp.	KX348457.1
1-150-10 ⁻²	<i>Terrabacter</i> sp.	MH671503.1
2-75-10 ⁻²	<i>Rhodococcus erythropolis</i>	MN922941.1

Table 3: Closest relatives and GenBank accession numbers of the 6 morphotypes using 16S rRNA gene sequence analysis.

Identification of pyrene degrading functional genes

When attempting to use PCR primers for *nidA*, PAH-RHD-GN, and PAH-RHD-GP to target functional genes that would provide the microorganisms with pyrene degrading abilities, they appeared to anneal in multiple locations within the genome. This resulted in multiple DNA fragments being amplified, most of which were the wrong size fragment (Figure 4). Despite many attempts to optimize parameters and reduce spurious annealing the PCR amplification of the desired portion of the genome was not successful.

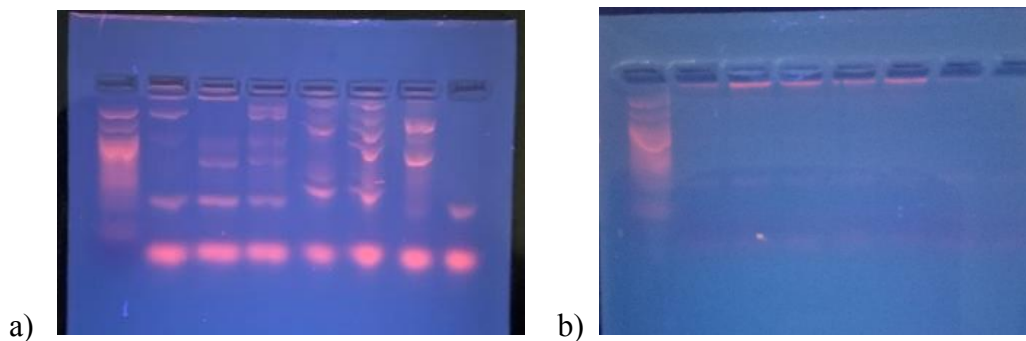


Figure 4: The images show agarose gels of PCR reactions containing PAH-RHD-GN (a) and *nidA* (b) primers. The agarose gels are 3% 1X SB agarose gels and Lane 1 (far left) has the NEB Low Molecular Weight DNA ladder, and Lanes 2-8 (left to right, to the right of the 1st lane) contain PCR reactions of the 6 isolates and a negative control in lane 8. Gel image a) shows an inconclusive PCR result due to excessive banding resulting in multiple fragments of different sizes due to the annealing of the primers in multiple areas of the genome. Gel image b) displays another unsuccessful PCR where there are no DNA fragments at all. Here the temperature attempted was too high for annealing by *nidA* primers to take place.

DISCUSSION AND CONCLUSION

Sample site and soil collection

The location where the soil was collected was chosen due to its proximity to a residential grilling site since wood burning is a known artificial source for PAH ⁶. Additionally, the soil that was taken from this sample site did not have any vegetation growing in it, meaning there is a higher chance of finding microorganisms that can survive on inorganic substrates or are enriched in this environment based on substrate availability. This prediction was reinforced when high levels of magnesium were detected in the chemical composition of the soil and the population estimates were within the range expected for soil samples ⁵. In addition, the soil that was collected was taken close to a discarded pile of used charcoal (Figure 1) and the sample site was predicted to be the optimal location to isolate microorganisms that can degrade pyrene.

PAH degrading abilities of isolated microbes

The media used in this experiment was a minimal broth and agar composed of only inorganic substrates, therefore the only microorganisms that could grow in it without it being supplemented with organic substrates are lithotrophs. The bacteria isolated from enriched samples that appeared in or on the media were either lithotrophs or using the pyrene that the media had been spiked with as their main energy source. Figure 5 shows that the bacteria isolated in this media are either closely related to or strains of species of the taxonomic groups identified through BLASTn analysis. Branches of the neighbor-joining tree and bootstrap analysis show while the 16S rRNA gene sequences are tightly clustered to reference sequences for isolates 300-10⁻², 2-75-10⁻², 2-C-10⁻², and 150-1-10⁻², there is enough evolutionary distance at either the reference sequence branch or the isolates, that rejects the possibility that the organisms are 100% identical. Isolates 2-75 and C-2-10⁻⁴ do fall in the genera of their closest relatives, but their species cannot be confirmed as they do not cluster with any of the reference sequences included.

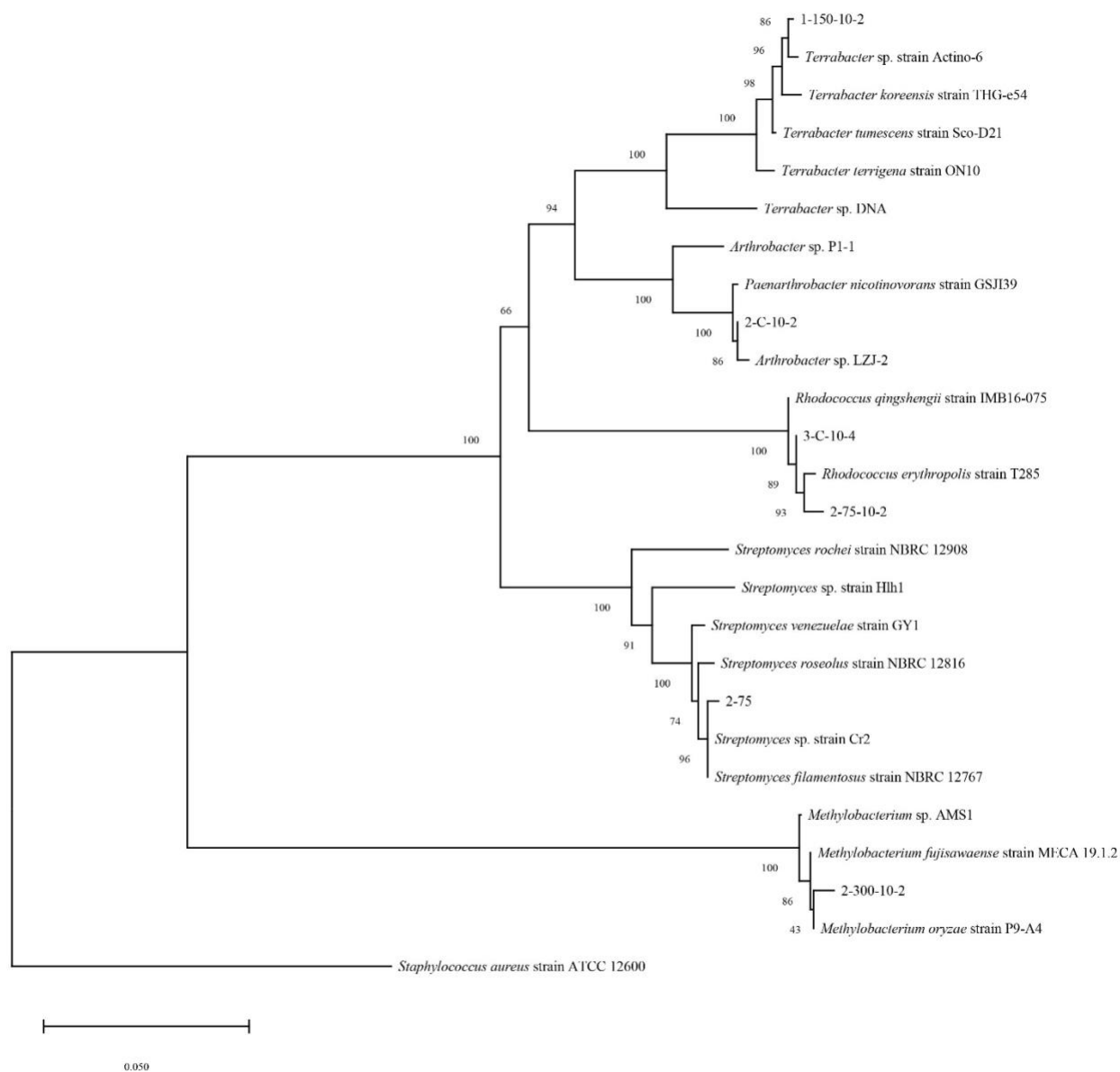


Figure 5: Neighbor-Joining phylogenetic tree of the 16S rRNA gene sequence for the 6 isolates and 20 reference species. The bootstrap values are indicated as percentages on the branches.

The 6 representative bacteria do belong to genera or strains of species that are known to be pyrene degraders or a known degrader of at least some other PAH. The isolate C-3-10⁻² belongs to the genus *Arthrobacter* and the organisms of this taxonomic group are known to be organoheterotrophs²¹. Isolate C-3-10⁻² is a mesophile, neutralophile, anaerobic respirer of

nitrate, and decarboxylases arginine, lysine, and ornithine with the production of ammonia. Strains of *Arthrobacter* sp. have been isolated from PAH contaminated locations and could effectively decompose the PAH phenanthrene within 7 days²⁰. As organisms of the genus *Arthrobacter* are not known to be lithotrophic and some species are known to degrade other PAHs, it can be assumed that the isolate from this study is likely using pyrene as a sole energy source and could be used for the bioremediation of pyrene contamination. The isolate 2-75 was identified as belonging to the genus *Streptomyces* which includes organisms that are lithotrophic² and PAH degraders⁸. The isolate from this study; however, is a mesophile, neutralophile, hydrolyzes lipids, and can ferment glucose with acid production. Biochemical analysis and morphological characterization of the isolate from this study indicates it is a heterotroph utilizing pyrene for its metabolism.

A species of the genus *Methylobacterium* was also isolated in this study (2-300-10⁻²); characteristics of this genus include that they are aerobic and facultative methylotrophs²². Isolate 2-300-10⁻² was determined to be a mesophile, neutralophile, can use nitrate for anaerobic respiration, degrades the amino acid tryptophan to indole, and can decarboxylate ornithine with the production of ammonia. *Methylobacterium* sp. are also known to have PAH degrading abilities and have been highlighted as candidates for bioremediation in other studies²³. The isolate 1-150-10⁻² is a member of the genus *Terrabacter* whose species are characterized as aerobic heterotrophs⁴ and some species have also been known to degrade the PAH phenanthrene and fluorine⁷. In this study, the isolate was a mesophilic neutralophile that uses nitrate for anaerobic respiration, hydrolyzes lipids and starch, and decarboxylates ornithine. The biochemical characteristics indicate that isolate 1-150-10⁻² is not a lithotroph and is likely metabolizing the supplemented pyrene.

Both isolates 2-75-10⁻² and 3-C-10⁻⁴ were determined to be close relatives to different strains of the species *Rhodococcus erythropolis*. The genus *Rhodococcus* are known to be chemolithotrophs meaning that there is a possibility that the isolates were utilizing the inorganic substrates in the media and not the pyrene¹⁴. The isolates of this study decarboxylated ornithine, lysine, and arginine, and utilized citrate, which are all organic substrates. Additionally, it can be seen on the phylogenetic tree (Figure 5) that C-2-10⁻⁴ is closely clustered to the species *Rhodococcus qingshengii* rather than *Rhodococcus erythropolis* which confirms that it is not the same species as 2-75-10⁻². It can be expected that isolate C-2-10⁻⁴ could be a lithotroph due to the fact it was isolated from the control soil that was not spiked with the pyrene. Isolate 2-75-10⁻² also did not cluster as tightly with *Rhodococcus erythropolis* (Figure 5), and while it is most likely closely related to the species, it may be a new strain. *R. erythropolis* has been utilized in the bioremediation of crude oil contaminations¹⁵. Isolate 2-75-10⁻² may be a novel strain of this rhodococcal species capable of metabolizing pyrene as seen when maintained on pyrene supplemented agar plates.

In conclusion, the hypothesis that soil near a residential grill at Wingate University would contain indigenous bacteria capable of degrading pyrene was accepted. Using pyrene-enriched MM agar, presumed pyrene-degrading isolates were isolated and characterized. Based on the biochemical characteristics, the 6 isolates were all confirmed as either facultative lithotrophs or organotrophs and metabolized pyrene as their primary energy source. The fact that almost all 6, except for 3-C-10⁻² or *Methylobacterium sp.*, grew easily on a general-purpose medium for heterotrophs (Tryptic Soy media) indicates their ability to utilize organic substrates. These microbes grew using pyrene as their main energy source even though pyrene is not expected to naturally be in the soil, except through contamination. With the further confirmation of their

capabilities, these isolates could be useful candidates for the bioremediation of pyrene-contaminated soil.

Limitations and future directions

The inconclusive results of the attempt to use primers to target pyrene degrading functional genes was a significant limitation and impacted the ability to make definitive conclusions to support the hypothesis. However, it is important to point out that the primers *nidA*, PAH-RHD-GN, and PAH-RHD-GP encode for the α -subunits of PAH-ring hydroxylation dioxygenase (RHD) which is highly conserved in *Mycobacterium* sp. pyrene degraders¹⁷. Though expected, none of the isolates characterized and identified were of the genus *Mycobacterium* sp., and this could be why the primers were not highly effective. It is possible there were not any functional gene markers in the microorganisms isolated; however, after a literature review of their taxonomic groups, this seems most unlikely. Further investigation will need to be done to find the optimal PCR parameters or more universal primers so that these genetic markers can be identified in the genomes of the isolates.

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Antibiotic Resistant Bacteria in Freshwater Ecosystems in the Agricultural Landscape of Wingate, North Carolina

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ABSTRACT

Antibiotics are continuously used in the livestock industry for the treatment of disease and as feed additives to increase the weight of livestock quickly. Overuse of these chemicals can lead to antibiotic pollution and consequently result in an increase in antibiotic-resistant microbial communities in the surrounding ecosystem. In this study, samples were obtained from three freshwater ecosystems in close geographical proximity to livestock farms in Wingate, NC. It was hypothesized that runoff from these farms would pollute these bodies of water resulting in antibiotic resistant communities. These bacterial communities were enumerated by inoculating serially diluted water samples onto 3 sets of Reasoner's 2 agar (R2A) plates, with no additives, a fluoroquinolone (Enrofloxacin) and a macrolide (Tilmicosin) antibiotic. Tilmicosin-resistant bacteria accounted for 45.8% of the total population, whereas enrofloxacin-resistant bacteria accounted for 1.8%. Eleven, mostly Gram-negative, antibiotic resistant isolates were chosen for identification through phylogenetic and biochemical characterization. Isolates were identified via their 16S rRNA gene sequence, and included pseudomonads and species of the genera *Brevundimonas*, *Iodobacter*, *Janthinobacterium*, *Novosphingobium*, *Pedobacter*, and *Rhizobium*. This short study confirmed the presence of antibiotic resistant bacterial communities in Wingate, NC freshwater systems and provides a baseline for the monitoring of agricultural antibiotic resistant bacteria.

INTRODUCTION

The Egyptians, Greeks, and Chinese have been using techniques to treat infectious diseases since ancient times; however, Alexander Fleming's discovery of penicillin heralded the modern practice of antibiotic use (Ventola 2015). Since this discovery, the lifespan and wellbeing of humans and animals alike has expanded, while at the same time, bacteria have been forming defense strategies against these chemical compounds. Mechanisms of antibiotic resistance include forming an impermeable membrane, producing enzymes that inactivate antibiotics, or even changing the antibiotic cellular target. These characteristics are often found in transferable genes held in plasmid DNA which can be shared between bacterial organisms

quickly resulting in increasing the number of antibiotic resistant organisms in a community (Duc *et al.* 2020). Human and animal pathogens that acquire these resistance mechanisms via gene transfer often result in infections that are difficult to terminate (Kraemer *et al.* 2019). This phenotypic benefit does not only help bacteria in an active infection; microbes themselves produce their own antibiotics and resistance mechanisms can give them the competitive advantage within their communities.

Antibiotic pollution occurs regularly within the agricultural landscape as most are water-soluble and poorly absorbed in the gut of the animal, causing them to be excreted into the environment. In fact, 90% of the antibiotics given to livestock are excreted into the environment via urine/stool, resulting in the pollution of the groundwater and freshwater systems that are within and near these agricultural areas (Duc *et al.* 2020 and Zhao *et al.* 2010). Antibiotic usage dominates the livestock industry as they are used as growth factors and protect the animals from spreading bacterial diseases, thereby increasing livestock yield (Duc *et al.* 2020). However, an increased number of potentially pathogenic bacteria that resist livestock antibiotics can be detrimental to the agricultural industry. As resistance escalates and it becomes increasingly harder to fight pathogenic bacteria among livestock, economic problems such as increased pricing for meat and dairy products and higher drug prices could occur. Proper management of antibiotics or researching new ways to fight bacteria are necessary (Kraemer *et al.* 2019).

This study focused on two commonly used livestock antibiotics that are expected to be present in Wingate, NC freshwater ecosystems. Tilmicosin is a 16-membered macrolide antibiotic that is quickly absorbed after oral administration and used to treat bovine respiratory disease (Kanfer *et al.* 1998). Fluoroquinolones are another group of antibiotics widely used in veterinary medicine (Schulz *et al.* 2018); one example of a fluoroquinolone is enrofloxacin,

which is used to treat a wide number of bacterial infections in livestock (Blaney 2015). It was hypothesized that runoff of livestock antimicrobials (specifically enrofloxacin and tilmicosin) used in farms are present in groundwater and nearby freshwater bodies in Wingate and result in antibiotic resistant freshwater bacteria.

METHODOLOGY

Sample Site Location

Three freshwater locations were chosen within the Wingate University, North Carolina agricultural landscape (Figure 1). Meadow Branch ($34^{\circ}59'11.9''\text{N}$ $80^{\circ}26'01.6''\text{W}$) in Union County, NC is a tributary which opens in Wingate, NC and flows north-northwest towards Richardson Creek (Topozone 2021). The Meadow Branch watershed includes livestock farms and distributaries such as Smith Street ($34^{\circ}59'23.5''\text{N}$ $80^{\circ}26'09.0''\text{W}$) which flows right below a street overpass and along a residential area. The third location was Campus Lake ($34^{\circ}59'09.8''\text{N}$ $80^{\circ}25'44.3''\text{W}$), on the campus of Wingate University.



Figure 1: Sample site locations are indicated with stars; Meadow Branch, Smith Street distributary which runs into Meadow Branch and Wingate University Campus Lake (Google Maps 2021).

Sample Collection

The temperature of the water body was measured using a mercury thermometer and water samples were collected with three sterile 50 mL conical tubes per sample site; each tube was aseptically handled and labeled with site name, date of collection, and water temperature and stored at room temperature for 48 hours. Conical tubes (15 mL) were used to collect a sample of water to measure pH at each site. pH strips (LabRat Supplies Inc. North Carolina, USA) were placed in the samples and compared to a pH scale.

Media types and Plating

Three different types of R2A (Reasoner's 2 Agar; Hi-Media Laboratories, Pennsylvania, USA) media were used for the initial water samples. One R2A medium contained 1.6 μ g/mL of Tilmicosin, the other contained 16 μ g/mL of Enrofloxacin, and the last type had no added antibiotics. Phosphate Buffered Saline (PBS; 1X) was used to serially dilute each of the water samples in a 1:10 ratio to 10⁻¹; 0.1mL of each water sample and the dilution was aseptically spread plated onto all three types of R2A plates. All plates were incubated at room temperature for 48 hours.

CFU Count

Each individual colony (colony forming units; CFUs) that appeared on all plates were counted. Using the numbers from the R2A plates with no antibiotics the entire bacterial population was mathematically calculated (CFUs/mL = CFUs x dilution factor x volume plated) whereas the numbers from the R2A plates with antibiotics were used to calculate the antibiotic

resistant population size. Colony counts on plates that were below 30 and above 300 were not included in the population estimate.

Colony Morphology & 4-Way Streak

Unique isolates were identified on R2A media that contained Tilmicosin or Enrofloxacin using a colony morphology guide (Figure 2) that included colony form, elevation, margin, and colony surface appearance. To purify the chosen isolates, they were streaked onto individual sterile R2A plates using the 4-way technique (Figure 3); plates were incubated at room temperature for 48 hours.

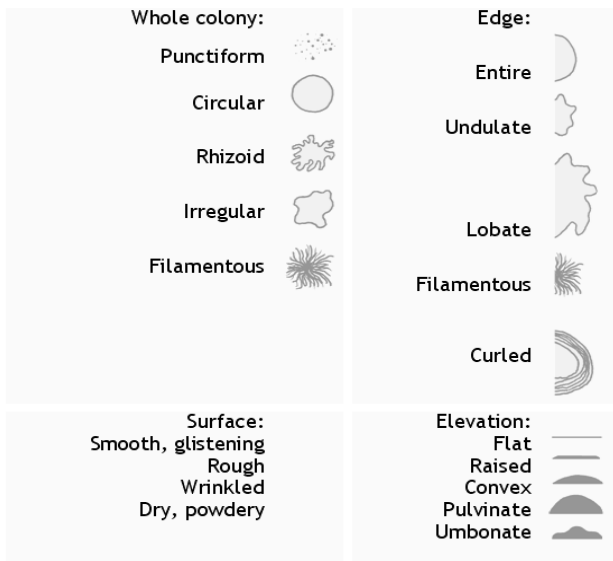


Figure 2: Colony morphology chart used to determine characteristics of a colony grown on solid media (Wikipedia 2021a).

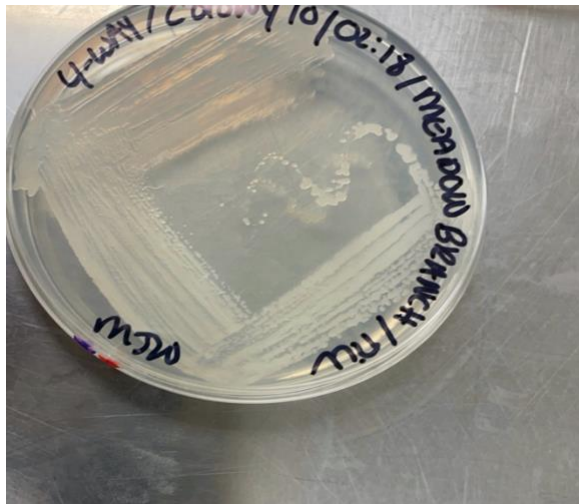


Figure 3: Steps of the 4-way streak method which requires frequent flaming of the loop after each streak to reduce the number of bacterial cells present in each quadrant (Image by author)

Gram Staining

Unknown isolates were Gram stained to determine Gram reaction and cellular morphology. Heat fixed bacterial smears were stained using reagents in the following order: the primary stain, Crystal Violet, flooded the smear for 1 minute, then was rinsed, followed by the mordant, Grams Iodine, which combined with the primary stain, fixing it in the bacterial cell wall and flooded the smear for 1 minute. Excess iodine was tapped off after 1 minute and the decolorizer, ethyl alcohol, which dissolves the lipids of the outer membrane of Gram negative bacteria and washes out the crystal violet-iodine complex, was added to the smear for 10-15 seconds and then immediately rinsed. The counterstain, Safranin, which directly stained the decolorized Gram-negative cells, flooded the smear for 1 minute and was then rinsed. All stained preparations were viewed using the immersion oil objective lens on a Leica DM500 compound microscope (Leica Camera AG, Wetzlar, Germany). Bacterial isolates were characterized as either Gram positive or negative and their cellular morphology (shape and arrangement) was determined using the guide in Figure 4.

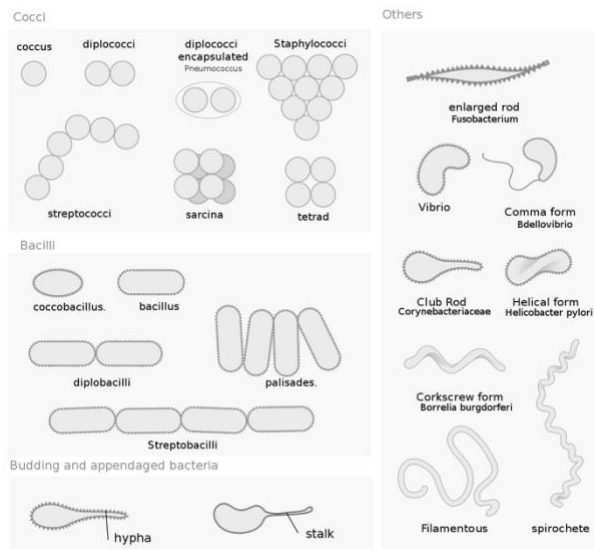


Figure 4: The guide of cell shape and arrangement used to characterize bacteria at a cellular level (Wikipedia 2021)

Environmental Requirements

To determine the cardinal temperature points for each isolate, they were inoculated onto R2A plates using the zig-zag method and incubated at eight different temperatures [4°C, 20°C, 25°C, 30°C, 35°C, 40°C, 45°C, and 60°C] for 48 hours. pH optima were determined by inoculating R2A broth at different pHs including pH 2, pH 4, pH 6, pH 7, pH 8, and pH 10. Bacteria were inoculated in fluid thioglycolate broths to determine the oxygen requirements of each isolate. The tubes were incubated at the previously determined optimal temperatures for 48 hours.

Biochemical Requirements

Biochemical analysis was performed using 13 tests that would give an overview of the enzymes and substrates the isolates were producing for respiration and metabolism. All tests were incubated at optimal temperatures for 24 – 48 hours. To determine if the isolates produced enzymes for aerobic respiration, a few drops of the test reagent tetra-methyl-p-phenylenediamine (Carolina Biology Supply Co, North Carolina, USA) were added to the culture and observed for a blue color change, indicating oxidase enzyme was produced. For catalase production, drops of 3% H₂O₂ were added to a small amount of culture on a glass slide; any observed bubbling indicated enzyme production. Utilization of nitrate as an alternative electron acceptor for respiration was determined by inoculating the organisms in nitrate broth. Post incubation reagents A (sulfanilic acid) and B (α-naphthylamine) were added; a color change indicated the production of nitrate reductase enzyme, which is necessary for this anaerobic respiration. If no color change was noticed after 30 – 60 seconds, a small amount of zinc was added to determine if the nitrate was reduced past nitrite to dinitrogen.

To investigate the production of hydrolytic enzymes that metabolized macromolecules, isolates were inoculated onto starch agar, tributyrin (lipid) agar, caesin milk agar, and in gelatin semisolid deeps. After incubation, 2% iodine (Carolina Biological Supply Co) was added to the medium to determine if the starch had been digested and gelatin tubes were placed in cold temperatures for 15 minutes to determine if the gelatin was digested and liquefied. For urease enzyme production, the isolates were inoculated in urea broth and observed for a color change to pink which indicated enzyme production. Isolates were inoculated onto the slants of Simmons Citrate agar media to determine if citrate was an organic substrate used by the organism by observation of growth and a color change from green to blue. Carbohydrate fermentation was investigated by providing 4 sugars: maltose, glucose, mannitol, and sucrose to the isolates in phenol red base broth (Hi-Media Labs). Color changes from red to yellow and possible gas collection in a smaller inner Durham tube were observed when the sugar in question was used for the metabolism.

The ability to ferment glucose and the pathway by which end products were synthesized was investigated by inoculating Methyl Red-Voges-Proskauer broths and separating the culture into two halves post incubation. To one half of the culture, 5 drops of methyl red were added and a red color change in the broth indicated that a high concentration of mixed acids were produced from glucose fermentation. For the Voges-Proskauer test, 10 drops each of α -naphthol and potassium hydroxide were added and a rose-pink color change indicated that the isolates used the butanediol pathway to produce non-acidic end products such as acetyl methyl carbinol, and 2, 3 butanediol. The isolates were tested for their ability to utilize amino acids cysteine and tryptophan for their metabolism by inoculating them in SIM (Sulphur-Indole-Motility) agar deeps. After incubation, the deeps were observed for the production of hydrogen sulfide as a

byproduct of cysteine metabolism, which appears as black coloration of the agar deep and for motility of the organism which appears as growth away from the line of inoculation. Tryptophan degradation is determined by detection of the byproduct indole by adding 5 drops of Kovac's reagent (Carolina Biological Supply Co.) to the surface of the agar deep which would elicit a red color change in the reagent layer.

Minimum Inhibition Concentration

Isolates were inoculated in R2A broth tubes containing various concentrations of antibiotics to determine which concentration would fully inhibit their growth. For Tilmicosin, the concentrations used were 1 µg/mL, 2.0 µg/mL, 3.0 µg/mL (concentration in agar plates), 4.0 µg/mL, 6.0 µg/mL, and 8.0 µg/mL. For Enrofloxacin, the concentrations included 14 µg/mL, 16 µg/mL (concentration in agar plates), 20 µg/mL, 40 µg/mL, 60 µg/mL, 80 µg/mL. The inoculated tubes were incubated at the isolates' optimal temperatures for 48 hours.

DNA Extraction & PCR

In preparation for DNA extraction of the genomes of each isolate, the samples were inoculated into R2A broth and shaken at 120 rpm at room temperature for 48 hours to ensure confluent growth. DNA was aseptically extracted using the DNeasy® UltraClean® Microbial Kit (Qiagen Sciences Inc. Maryland, USA) following the steps in the protocol. To confirm that the extraction was successful the DNA was electrophoresed in a 1% agarose gel (SeaKem LE agarose, Lonza-Rockland Inc, Maryland, USA) in 1X Sodium Borate buffer. The first agarose gel well contained 1KB DNA ladder (New England BioLabs Inc. [NEB], Massachusetts, USA) and 5µL of the extracted DNA mixed with 1µL of 6X purple loading dye (NEB) were added to the others. The agarose gel was electrophoresed at 60V for 60 minutes.

To identify the isolates (or their closest relatives) their 16S rRNA gene sequence was amplified using Polymerase Chain Reaction (PCR). PCR reactions were in 50µL volumes and contained 10µM of high degeneracy universal bacterial primers 27FHT (AGRGTTTGATYMTGGCTCAG) and 1492RHT (GGYTACCTTGTTACGACTT) obtained from Integrated DNA Technologies (Iowa, USA), 1.25 Units of OneTaq® HotStart DNA polymerase (NEB), 2 µL of extracted DNA and brought to volume with dH₂O. PCR was conducted in a thermocycler and the parameters of the reaction were an initial denaturation at 94°C for 10 min, 30 cycles of denaturation at 94°C for 30 sec, primer annealing at 58°C for 30 sec, extension at 72°C for 1 min and 45 sec, followed by a final extension step of 72°C for 7 min. Samples (5 µL) of the completed PCR reactions were electrophoresed in a 1X SB 1% agarose gel as described above except with the 100bp DNA ladder (NEB).

Phylogenetic analysis

Successfully amplified 16S rRNA gene sequences were sent to Eton Bioscience Inc. (North Carolina, USA) for sequencing on an ABI 3730xl DNA Sequencer. Abi chromatograms were viewed in 4peaks software (Nucleobytes BV, North Holland, Netherlands) and the Fasta format of the sequence was created. The sequences were further edited and aligned in BioEdit software (Hall, 1999); edited 16S rRNA sequences were uploaded in the BLASTn (Basic Local Alignment Search Tool, nucleotide; NCBI, 2021). In BLASTn the sequences are compared to sequences of known organisms in the GenBank Database (NCBI, 2021a) to identify taxonomic groups that the sequences are most similar to, as well as 18 reference 16S rRNA gene sequences. All 28 sequences were aligned and used to create a Neighbor-Joining phylogenetic tree (Saitou and Nei 1987) in MEGA-X software (Kumar *et al.* 2018), with 1000 bootstraps, and phylogenetic distances calculated by the Jukes-Cantor method (Jukes and Cantor 1996) and with

all ambiguous position removed for each sequence pair (Figure 8). The 16S rRNA sequence of the Gram-positive bacterium, *Bacillus cereus* ATCC 14579 strain, was used to root the tree.

RESULTS

At the time of sampling all 3 sites had cold steadily flowing water; however, the Smith Street location had the cloudiest water. The bacterial population counted on the R2A plates with no additives was approximated 1.0×10^4 CFUs/mL. The tilmicosin-resistant population was approximately 4.0×10^3 CFUs/mL and the enrofloxacin-resistant roughly 1.5×10^3 CFUs/mL. Therefore, when considering the proportions of each group that makes up the bacterial population, tilmicosin-resistant colonies accounted for 45.8% of the total bacterial population while enrofloxacin only accounted for 1.8%. Water samples collected from Smith Street had the highest number of bacteria, while samples collected from Meadow Branch contained the lowest number of bacteria. Bacteria resistant to both antibiotics were found in all 3 locations; however, isolates resistant to enrofloxacin (1 and 2) were chosen from plates inoculated with Smith Street water samples. Tilmicosin resistant bacteria (3 to 10) were isolated on plates inoculated with Meadow Branch and Campus Lake water samples. The colony morphologies for all isolates are listed in Table 1. Isolate 5 appeared to be a mixed colony, and therefore it was split into Isolates 5A and 5B. Water temperature was highest at Campus Lake at 7°C, whereas Smith Street's water temperature was 6°C, and Meadow Branch was 4°C. The pH of each sample site was near neutral at 7 except Smith Street which was 6.5. Isolates 2 through 10 were all Gram negative while isolate 1 was Gram positive; cell morphology of all isolates can be found in Table 1. Environmental requirements revealed all isolates optimum temperature ranged between 20°C to 35°C which classified them all as mesophiles. Isolates 1 and 6 had optimal growth in the pH

environment between 2 and 4 and are categorized as acidophiles, whereas isolates 3, 7, and 9 were categorized as alkaliphiles as their optimal growth occurred in the pH environment between 8 and 10. The other five isolates were neutralophiles as their optimum was pH 7. Most isolates were classified as obligate aerobes due to the location of their growth in the fluid thioglycolate tubes (Figure 6). However, isolate 1 grew near the anaerobic interface (bottom of the pink resazurin layer which indicates the depth of oxygen penetration) and was classified as microaerophile.

Isolate Number	Colony Morphology	Antibiotic Isolate exhibited Resistance to	Cell Morphology
1	Red; small; glossy; entire edge, circular; flat	Enrofloxacin	Gram Positive; Large, chunky bacilli, single/paired
2	Yellow; translucent/glossy, circular, mucus, convex	Enrofloxacin	Small, Gram Negative, streptobacillus
3	Purple with an irregular translucent edge, flat, glistening	Tilmicosin	Small, Gram Negative, Single bacilli, hairpin morphology
4	Yellow/beige with translucent entire edge, convex, glistening/viscous	Tilmicosin	Small, Rods, Gram Negative, bacillus
5A	Red, small, circular, entire edge, convex, glistening	Tilmicosin	Small, Gram Negative, streptobacillus
5B	Light/pale red, small, circular, entire edge, convex, glistening	Tilmicosin	Small, Gram Negative, streptobacillus
6	Bright yellow, small, entire edge, raised, glistening	Tilmicosin	Small, Gram Negative coccobacillus

Table 1: Colony and cell morphology, antibiotic resistance, and Gram reaction of unique isolates collected from the tilmicosin and enrofloxacin plates. Isolates differed in appearance from one another; colonies that appeared to have the same color were still different in colony margin and form, resulting in 10 morphologically different colonies.

Table 1 cont'd

Isolate Number	Colony Morphology	Antibiotic Isolate exhibited Resistance to	Cell Morphology
7	White with translucent halo, entire edge, flat, glistening	Tilmicosin	Rods, Gram Negative, diplobacillus
8	White, viscous, glistening, entire edge, swarming, convex	Tilmicosin	Small, Gram Negative, bacillus
9	White, small, growth slightly into media, irregular edge, convex.	Tilmicosin	Large, Single, Gram Negative, bacillus
10	Beige, mucus like, entire edge, flat, spreading over plate.	Tilmicosin	Very Small, Gram Negative bacillus

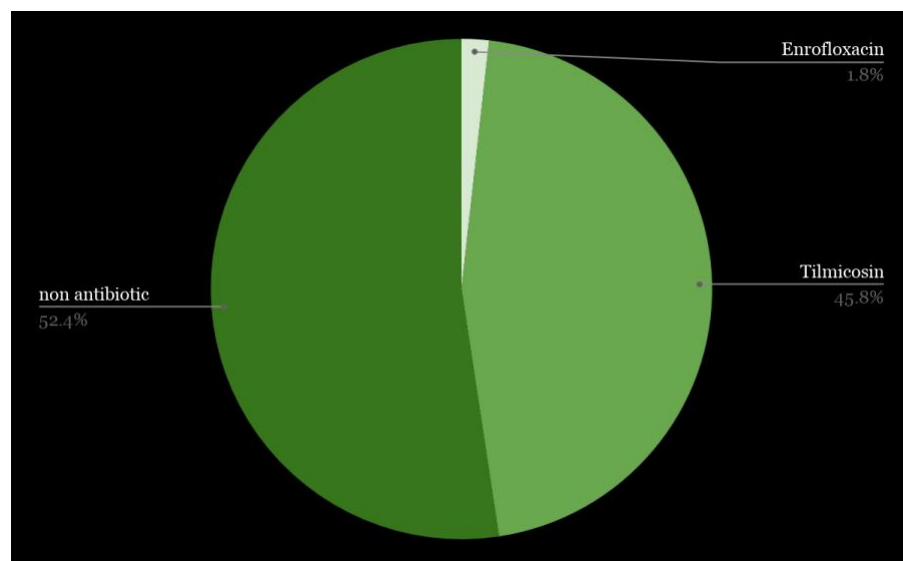


Figure 5: Comparison of the enrofloxacin and tilmicosin resistant, and non-antibiotic resistant populations within the total bacterial community across all water samples (Chart by author).

All biochemical test results are cumulated in tables 3 and 4. None of the isolates fermented urea, or any sugar other than glucose (isolates 3 and 8) which was not fermented via the butanediol pathway (VP test). The isolates did not degrade tryptophan (indole test) or cysteine (sulfur test). All other tests had variable results between the isolates. Only isolate 6 was negative for the catalase test whereas isolates 1, 3, 5A, 5B, 7, and 9 were negative for the oxidase test (Table 3). Minimum concentrations of 80µg/mL enrofloxacin and 6.0 to 8.0µg/mL of tilmicosin inhibited the growth of the unknown isolates (Tables 5 and 6) which is nearly 3 folds higher than the published minimum inhibition concentrations (Olofsson 2006).

Chemical Test	1	2	3	4	5A	5B	6	7	8	9	10
Starch hydrolysis	-	+	-	-	+	+	+	-	+	+	-
Tributylin hydrolysis	+	-	-	-	-	-	-	+	+	+	-
Caesin hydrolysis	-	-	+	+	+	+	-	-	+	-	-
Gelatin hydrolysis	-	-	-	+	-	-	-	+	+	-	-
MR test	-	-	+	-	-	-	-	-	-	-	-
VP test	-	-	-	-	-	-	-	-	-	-	-
H ₂ S production	-	-	-	-	-	-	-	-	-	-	-
Indole production	-	-	-	-	-	-	-	-	-	-	-
Motility	-	-	+	+	+	-	-	+	+	+	-
Catalase	+	+	+	+	+	+	-	+	+	+	+
Oxidase	-	+	-	+	-	-	+	-	+	-	+
Citrate utilization	-	-	-	+	-	-	-	-	+	+	-

Table 3: Results for the biochemical tests completed on all 11 isolates to determine the type of metabolic enzymes produced, substrates utilized, and motility. A (+) indicates a positive result, while a (-) indicates a negative result.

Table 3 cont'd

Chemical Test	1	2	3	4	5A	5B	6	7	8	9	10
24hr Maltose fermentation	-	-	-	-	-	-	-	-	-	-	-
24hr Mannitol fermentation	-	-	-	-	-	-	-	-	-	-	-
48hr Glucose fermentation	-	-	+ +	-	-	-	-	-	+	-	-
48hr Sucrose fermentation	-	-	-	-	-	-	-	-	-	-	-
48hr Maltose fermentation	-	-	-	-	-	-	-	-	-	-	-
48hr Mannitol fermentation	-	-	-	-	-	-	-	-	-	-	-
24hr Urease production	-	-	-	-	-	-	-	-	-	-	-
48hr Urease production	-	-	-	-	-	-	-	-	-	-	-

Isolate	1	2	3	4	5A	5B
Nitrate Reduction	Red	Red after Zinc	Red	Red	Red after Zn	Red after Zn
Isolate	6	7	8	9	10	
Nitrate Reduction	Red	No color change even after Zn	Red after Zn	No color change even after Zn	Red after Zn	

Table 4: Nitrate reduction results for all isolates; 5 isolates could not reduce nitrate. Isolates 7 and 9 fully reduced nitrates to N₂ (hence the lack of color change) and 4 other isolates could reduce nitrate to nitrite.

ISOLATE	0µg/mL	1.0µg/mL	2.0µg/mL	3.0µg/mL	4.0µg/mL	6.0µg/mL	8.0µg/mL
3	abundant	moderate	moderate	moderate	moderate	scant	no growth
4	abundant	moderate	moderate	moderate	moderate	moderate	scant
5A	moderate	moderate	moderate	scant	scant	scant	scant
5B	scant	scant	scant	scant	no growth	no growth	no growth
6	abundant	abundant	abundant	moderate	scant	scant	scant
7	abundant	moderate	moderate	moderate	scant	scant	no growth
8	abundant	moderate	moderate	moderate	scant	scant	no growth
9	abundant	scant	scant	scant	no growth	no growth	no growth
10	moderate	moderate	moderate	moderate	scant	no growth	no growth

Table 5: Minimum inhibition concentrations of tilmicosin for all isolates. All isolates were significantly inhibited, if not completely, at 8.0 µg/mL.

ISOLATE	0µg/mL	14µg/mL	16µg/mL	20µg/mL	40µg/mL	60µg/mL	80µg/mL
1	abundant	abundant	abundant	moderate	scant	scant	no growth
2	abundant	moderate	moderate	moderate	scant	scant	no growth

Table 6: Minimum inhibition concentrations of enrofloxacin for isolates. Concentration 40 µg/mL exhibited scant growth for both organisms.

DNA was successfully extracted and 16S rRNA gene sequences amplified by PCR for all organisms, however sequences were only obtained for 10 of the 11 as isolate 1 failed to sequence. The Neighbor-Joining phylogenetic tree (Figure 8) confirmed the evolutionary relationships between isolates and the reference sequences that were identified using BLASTn. Isolates 7 and 9 are closely related and belong to the genus *Janthinobacterium* despite the

differences in their morphological and biochemical characteristics. Isolates 4 and 8 are also closely related but belong to the genus *Pseudomonas*; each organism's DNA sequence clustered tightly with different species confirming the differences observed in their morphological and biochemical characteristics. Sequences for isolates 2, 3, 6, and 10 all clustered tightly with the species identified as closest relative and are likely strains of *Pedobacter humi*, *Iodobacter fluvaiaatillis*, *Novosphingobium fuchskuhlense*, and *Rhizobium impomoeae* respectively. Sequences of isolates 5A and 5B indicate these isolates are very closely related to each other and species of the genus *Brevundimonas* (Figure 8).

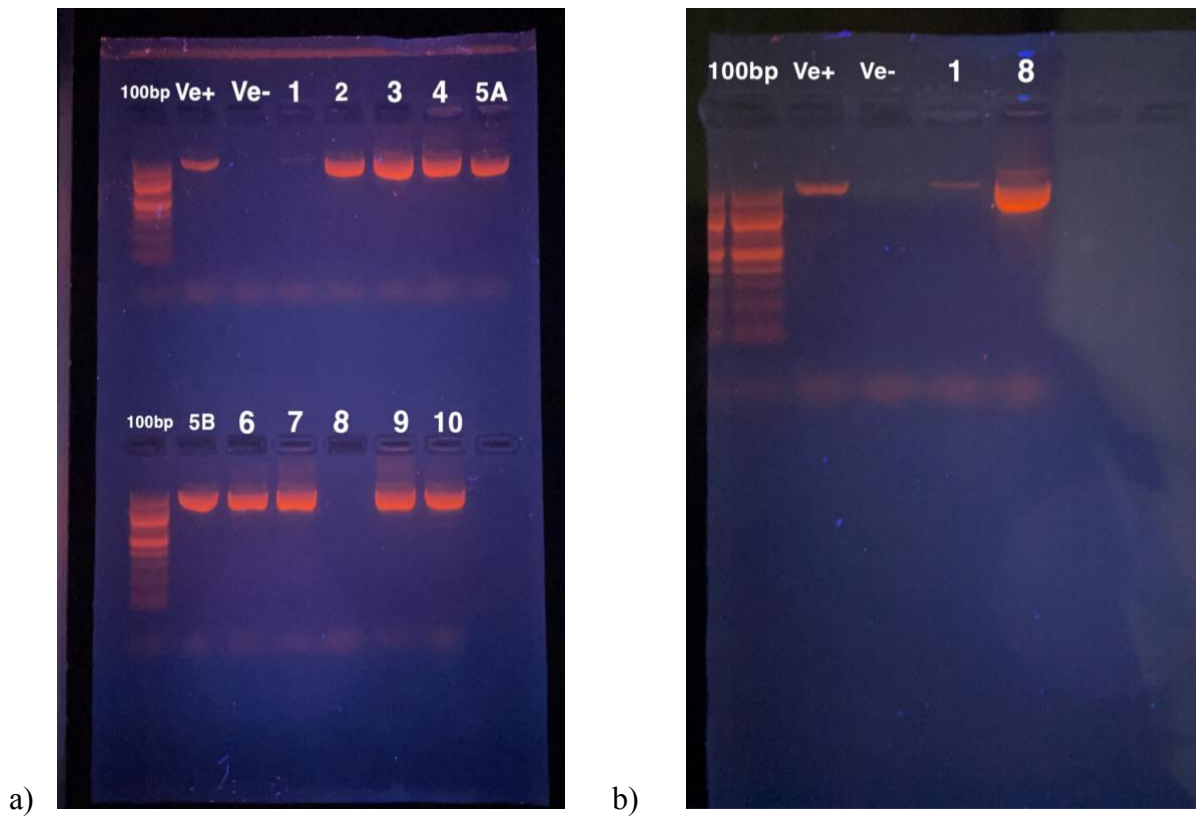


Figure 7: a) Agarose gel showing results of 16S rRNA PCR; isolate 1 showed a very faint band, while isolate 8 did not appear at all. b) PCR reactions for both isolates were repeated, and the agarose gel shows a wide, bright band for isolate 8, but a thin, faint band for isolate 1.

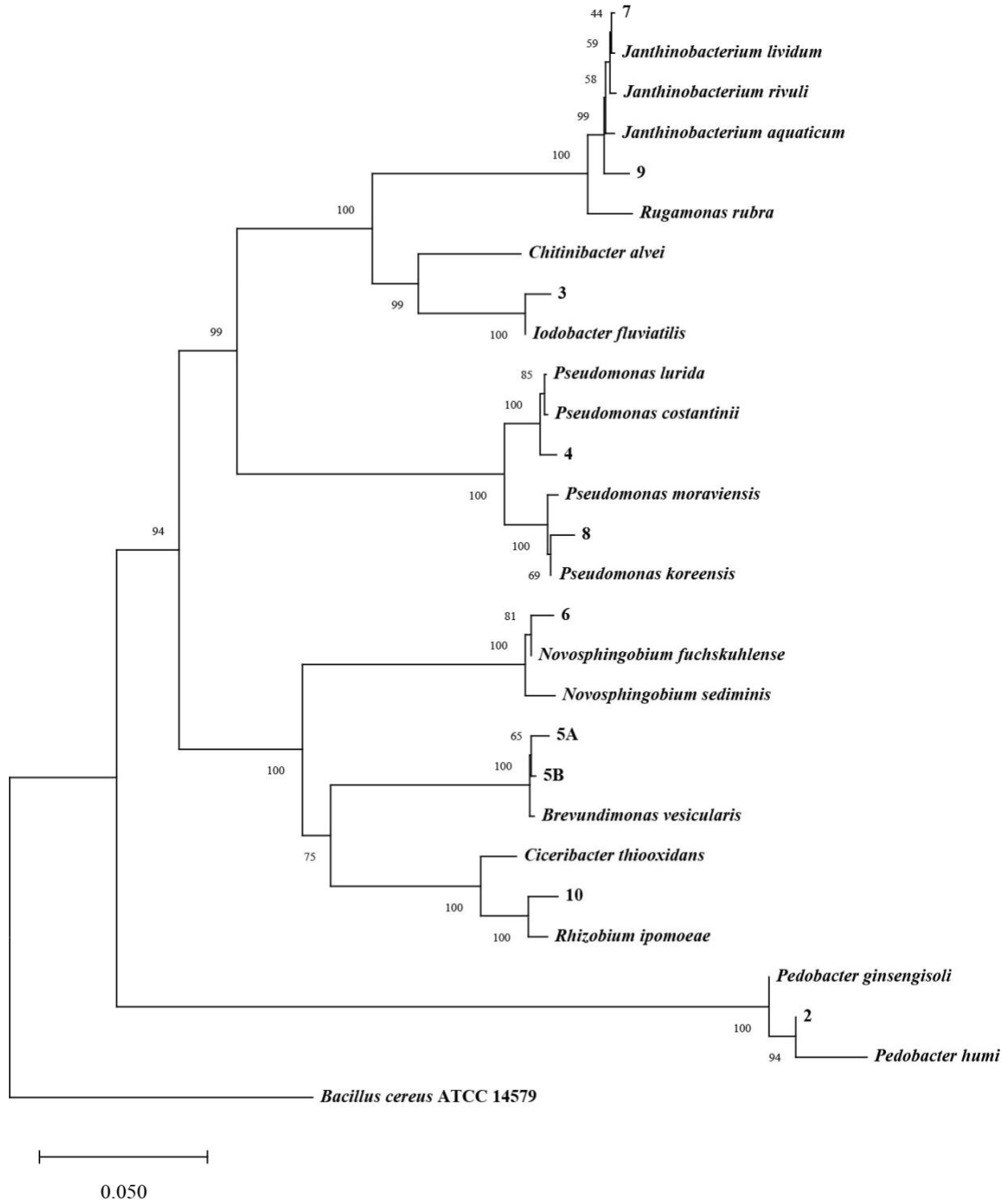


Figure 8: Neighbor Joining phylogenetic tree created using the MEGA-X software, depicting the evolutionary relationships between sequences of 10 unknown isolates and 18 reference species.

Numbers on branches indicate bootstrap values.

DISCUSSION AND CONCLUSIONS

As predicted, a significant portion of the bacterial community isolated from the freshwater bodies of this study exhibited resistance toward two common livestock antibiotics, enrofloxacin and tilmicosin. This data supports the hypothesis that freshwater bacteria develop resistance to livestock antimicrobials used in nearby farms. Population estimates indicates that 47.6% of the entire bacterial population in the Meadow Branch watershed were resistant to livestock antibiotics. A large portion of these populations were found in the Smith Street distributary which flowed through a diverse ecosystem, rich in vegetation and nutrients, providing an optimal environment for bacterial growth (Maier and Pepper 2015).

While this study is based on only 11 unique isolates that have grown on these antibiotic plates, there could possibly be many more antibiotic resistant bacteria present in these freshwater ecosystems. Unfortunately, it is virtually impossible to isolate them all due the complex nature of facilitating bacterial growth under controlled laboratory conditions. Many times, solid media will not meet the requirements for nutrients or only the competitive microorganisms will grow as they compete for a limited amount of nutrients (Maier and Pepper 2015). There is a league of other veterinary antibiotics for livestock diseases that were not included in this study. A few of these include sulfamerazine and sulfachloropyridazine used to treat urinary tract infections, danofloxacin that is used to treat respiratory disease, and Chlorotetracycline for bacterial pneumonia (Zhao *et al* 2010). There could very well be many other antibiotic resistant bacteria

not considered in this study that are far more harmful than the bacteria isolated and characterized.

One serious limitation of this study was the inability to determine the exact level of antibiotic pollution in the water. Even though the isolates presented resistance toward the two antibiotics, which indirectly confirms their presence in these water systems, actual measurements of their concentration in these freshwater systems would have been indisputable. High Performance Liquid Chromatography (HPLC), which was unavailable to the research group, is one method that would have provided this information. While 11 unique isolates were purified and characterized, isolate 1, from the Smith Street sample, failed to sequence and was not included in the phylogenetic analysis. This bacterium was very unique in that it had red pigmentation within its colonies and was the only Gram-positive enrofloxacin resistant isolate. It would have been helpful to determine what taxonomic group it belonged to and further investigate any known resistance toward livestock antibiotics.

The *Brevundimonas* species, isolates 5A and 5B, are closely related but not identical (Figure 8). They are closely related to *B. vesicularis* which is a known opportunistic human pathogen that has exhibited some resistance to fluoroquinolone antibiotics (Ryan *et al.* 2018). In this study, however, these unknown *Brevundimonas* species are resistant to macrolide antibiotics which is new information and these may be new strains found in the freshwater bodies of the Meadow Branch watershed. Isolate 6 is likely a strain of the species *Novosphingobium fuchskuhlense*, which is not known to exhibit antibiotic resistance and this could possibly be a strain with new phenotypic characteristics (Glaeser *et al.* 2013). Other species in the genus that are known to be antibiotic resistant are not closely related to isolate 6. *Rhizobium ipomoeae* is very closely related to isolate 10, so much so, this isolate may be a strain of this species.

Rhizobium species are significant in the agricultural landscape as they are known for nodulations; these species form a symbiotic relationship with legumes fixing atmospheric nitrogen to nitrate which plants can easily use. It was suggested that adding antibiotics, ones to which the *Rhizobium* species are resistant, to the environment could help the bacterium outcompete other microorganisms, thereby increasing crop yield as the bacteria serve as plant growth promoters (Naamaala *et al.* 2015). *R. ipomoeae* has also shown resistance to sulfamethoxazole and trimethoprim, which are antibiotics commonly used in humans and livestock to treat a number of infectious diseases; however, the bacteria have no known virulence (Sheu *et al.* 2016).

Some species of the genus *Iodobacter* (Isolate 3) have been reported to exhibit resistance against fluoroquinolones; however, so far there are no reports of pathogenicity within this taxonomic group (Lee *et al.* 2019). Isolates 4 and 8 are pseudomonads and likely strains of *P. koreensis* (8) and closely related to *P. luridia* and *P. constantinii* (4). None of these species have been reported as pathogens of animals or humans or previously exhibited resistance toward fluoroquinolones and macrolides. However, there are some *Pseudomonas* species that are well known for their antibiotic resistance and pathogenic capabilities. *Pseudomonas aeruginosa*, for example, is a dangerous pathogen and highly virulent towards animals and humans, typically infecting immunocompromised patients causing a variety of systematic infections and is well known for its multidrug resistance (Driscoll *et al.* 2007). *Janthinobacterium* species (isolates 7 and 9) tend to be non-pathogenic towards livestock and humans, though aquatic organisms tend to be susceptible towards some species such as *J. lividium*, which has shown virulence towards rainbow trout. There have been reports that *J. lividium* is antagonistic towards various *Enterococcus* sp. and strains of *Staphylococcus* sp. that are associated with a wide range of

human infections (Baricz *et al.* 2018). Isolate 2, the strain of *Pedobacter humi*, is most likely not pathogenic towards animals or humans, as this bacterium is considered a novel organism (Trinh and Yi 2016) and this study is the first report of a species or strain exhibiting antibiotic resistance.

This was a short study conducted over 3 months and while it provided information indicating there is a need to monitor the development of antibiotic resistant bacteria in the freshwater bodies of Wingate, NC, there is still much more work to do. In addition to using HPLC to measure the concentration of antibiotics in these freshwater bodies adjacent to the livestock farms, metagenomic analysis of the water samples could aid in determining the full composition and extent of the diversity of the microbial communities in these ecosystems. So far, the antibiotic resistant isolates of this study do not include any species that are harmful to livestock. Identifying the composition of the entire population of antibiotic resistant bacteria in these water bodies can highlight the bacteria present that are already known to be resistant to macrolides and fluoroquinolones or any other livestock antibiotics that have been studied. In addition, any pathogens, eukaryotic and prokaryotic, that are being exposed to the antibiotic containing runoff in these water bodies should be monitored, as these organisms can easily develop antibiotic resistance through constant exposure. Such data, if obtained, could benefit current research being done to build supporting evidence on the need for regulation of antibiotic pollution within the agricultural landscape, particularly in the Wingate, NC area (Rastogi *et al.* 2011).

In conclusion, this small-scale culture dependent study identified 10 Gram negative bacteria of different taxonomic classifications that were resistant to antibiotics presumed to have polluted the water bodies of Wingate, NC. The results of this study indicate that there is a need

for further work to be done to gain a comprehensive picture of exactly how prevalent these antibiotic resistant organisms are in the freshwater bodies of this agricultural landscape. The future of the livestock industry in this area is dependent on knowing this information. The use of antibiotics in livestock is primarily to result in healthy livestock; however, if we do not regulate the pollution of these antibiotics (small or large scale) the next “superbug” could be in development in these freshwater bodies or in environments of the livestock farms.

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Neighborhood Racial Demographics in Relation to Home Tax Appraisals in Mecklenburg County, NC

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ABSTRACT

This study examines a discrepancy between the average home tax appraisal value of a home within a Black majority census tract versus a comparable white majority census tract based on median household income in Mecklenburg County, North Carolina. This paper describes and explains with evidence that a census tract's racial demographics influence the average tax appraisal of the homes within the census tract. Average tax appraisals can either be negatively or positively affected depending on the census tract's racial demographic breakdown. Individual data collected on more than 80 homes within Mecklenburg County, NC, within a total of 8 census tracts, concluded a statistically significant difference between the averages of two comparable white and Black census tracts. Inherent biases and neighborhood perceptions based on the neighborhoods' racial composition play a subliminal role in the tax appraisal of homes, as seen within the study's data analysis.

INTRODUCTION

This study aims to analyze if the racial composition of census tracts influence the tax appraisal values of homes. With the methodology and data in place, we are able to test our hypothesis which is that there is a significant difference between majority white and Black neighborhoods based on their home tax appraisals. There have been endless studies similar to this that have concluded that racialized preferences have played a role in the valuation of homes depending on neighborhoods' racial composition. Similar studies have held in larger cities throughout the United States. It is important to recreate a similar study within Charlotte, North Carolina, as it is a city of more than 500,000 residents, making it an optimal location for such studies about racial demographics and home valuations. The total population in Mecklenburg County, North Carolina, is 1,110,300. Mecklenburg County comprises 46% white residents, 31%

Black residents, 6% Asian residents, and 14% Hispanic residents. The average median household income is \$69,072.

The purpose of the study is to find the answer to the research question and provide suggestions for systemic improvement based on the results of the study and its data analysis. During great social movements such as Black Lives Matter, studies like this are relevant to the pursuit of equity for all people who have been systemically oppressed and devalued for many years. There is a societal duty to identify systemic injustices and create solutions to change our systems to provide everyone the same access to opportunities and value each human life. Homeownership plays a considerable role in this, as tax appraisals within an area dictate how much funding that area will receive. Low tax appraisals will underfund communities that may need more funding than an affluent community that collects higher taxes due to their higher home tax appraisals. A system like this may be flawed when racialized perceptions cause minority neighborhoods to be devalued, leading to underfunding from the misallocation of property taxes in these areas.

REVIEW OF LITERATURE

Homeownership in America is intertwined with the aspiration of the American Dream, and the American government has promoted homeownership intending to raise the homeownership rate. Americans from all backgrounds hope to one day become a homeowner themselves. Many services such as education and infrastructure maintenance rely on taxes tied to properties in particular areas. These taxes are utilized to support infrastructure and education in those particular areas, so higher property tax values contribute to those specific communities' well-being. Due to this, ongoing studies have looked into property tax values and factors that

influence property tax values and why racial residential segregation continues to persist even in 2021.

THE HISTORICAL ASPECT OF HOMEOWNERSHIP DISCRIMINATION

Before looking into the housing market's current situation, it is essential to look into the history of homeownership discrimination. Housing practices stem from historical practices that have since been outlawed but are still subtly influencing practices today within homeownership systems. Junia Howell and Elizabeth Korver-Glenn (2020) and Douglas Coate and Richard W. Schweser (2017) both focus partly on the housing market's historical aspect. Specifically, both studies look at racially coded maps used by appraisers until 1977, created by the Home Owners Loan Corporation (HOLC) (Howell & Korver-Glenn, 2020; Rutan & Glass, 2017). These maps classified neighborhoods into four distinct categories between First-Grade or the "best neighborhoods" up to Fourth Grade or the "hazardous" neighborhoods (Howell & Korver-Glenn, 2020). The Fourth-Grade neighborhoods were overwhelmingly Black and brown communities, whereas the most desirable neighborhoods were white communities (Howell & Korver-Glenn, 2020). Pittsburg's case study measures the long-term effects of neighborhood appraisal techniques in Pittsburg that were codified by Residential Security Maps (Rutan & Glass, 2017). Current conditions of Pittsburg's specific areas correspond with the security grades from the 1937 map (Rutan & Glass, 2017). The divisions created by this map influence appraisers' judgments about home values in certain areas and have led to underfunding specific communities through lower housing values and putting more resources in more affluent communities. Historic disparities have continued to influence the inheritance of wealth and neighborhood investment, as seen in Pittsburg, which is still influenced by a Depression-era version of itself (Rutan & Glass, 2017). In conclusion, although outlawed in 1977, these HOLC maps are still implicitly

part of the home valuation system. Both studies conclude that we must remove these racially coded maps in cities that influence home appraisals and start to consider Black and brown communities as equally desirable places to live in order to start equally valuing Black and brown communities as compared to white communities (Howell & Korver-Glenn, 2020; Rutan & Glass, 2017).

PERCEPTIONS OF NEIGHBORHOOD DEMOGRAPHICS AND HOME VALUATIONS

A significant factor affecting home valuations and how the systems within homeownership work are people's perceptions concerning neighborhood demographics. More specifically, the white community plays a significant role in deciding the values of homes in neighborhoods, and their preferences shape the housing market and tend to devalue communities of color. A study conducted analyzed the behavior of different racial groups, and the study concluded, "Traditionally, close proximity to Whites is associated with high quality neighborhood amenities, and close proximity to Blacks (and increasingly Latinos) with poor quality amenities and neighborhood decay" (Charles, 2000, p.382).

In Korver-Glenn's (2018) study of how inequalities compound with the housing exchange process, she also concludes that these perceptions tie to how white real estate agents create relationships with their clients. Through multiple interviews with real estate agents within a year, she noticed behaviors that indicate that real estate agents pick up racially coded cues and solidify these racially charged perceptions through their actions (Korver-Glenn, 2018). These perceptions influence almost every stage of the housing exchange, "white neighborhoods are viewed and treated as desirable by white and minority home buyers, real estate agents, and developers, whereas white buyers, agents, and developers rarely express interest in minority neighborhoods. This can contribute to lower competition for homes in minority neighborhoods"

(Korver-Glenn, 2018, p.651). Korver-Glenn (2018) concludes that the professionals involved with the housing industry apply stereotypes held by individuals and use them to interpret specific neighborhoods' desirability. Korver-Glenn's (2018) study directly refers to an interview she had with a white appraiser:

Similarly, Larry, a White appraiser, explained how neighborhood racial dynamics and demand were associated with home values. He stated that White homeowners would perceive an "influx of minorities" to a neighborhood as having a "negative impact," which would, in turn, lead to the departure of Whites from the area. (p. 483)

Korver-Glenn and Howell (2018) and Camille Zubrinsky Charles (2000) back up this conclusion. Their conclusions show that the racial compositions of neighborhoods influence the perceived attractiveness of neighborhoods. (Charles, 2000; Howell & Korver-Glenn, 2018). The racialized perceptions held by society then translate into professionals' actions within the housing market and therefore devalue minority neighborhoods.

THE CURRENT APPRAISAL PROCESS

It is essential to understand the historical aspect of home valuations and how racial demographics are perceived in order to study how the current appraisal process can be problematic. The appraisal process used is the sales comparison approach which replaced the racialized neighborhood rankings in 1977 but still encompasses some of the racialized aspects of the coded maps that were used for decades (Rutan & Glass, 2017). The process begins with certified appraisers taking photos of the home and visually inspecting the property. They then search for "comps" that are recently sold comparable homes to help them find the home's market value (Howell & Korver-Glenn, 2018, p.482). Korver-Glenn and Howell (2018) found that the home's market value also has a high positive correlation with the homes' tax appraisal value and, as we know, will play a role in the amount of property taxes collected. Although the appraisal process is a standard procedure, the process lacks standardization within finding good comps and

allows for each appraiser's discretion to find what they believe are adequate comps (Howell & Korver -Glenn, 2018). Due to this amount of discretion, it may lead to "racialized assumptions to influence the assessment of home values" as stated by Korver-Glenn and Howell (2018) (p.474). Korver-Glenn and Howell (2018) hone into the idea which prior studies have concluded about the racialized perceptions people have about specific neighborhoods. These perceptions will then either attract or deter buyers to a neighborhood. However, further in their study they conclude that "it was appraisers' racialized, assumed opinions concerning demand and buyer characteristics, not observed measures of demand or buyer characteristics, that determined community 'comparability' (p.485). This conclusion signifies that the racial composition becomes intertwined with home valuations, and historically Black and brown communities have been devalued. This current appraisal system allows those devaluations to continue by selecting comps for minority neighborhoods within other minority neighborhoods instead of selecting comps from white neighborhoods (Korver-Glenn, 2018, p.651). Without changing the system, the appraisal industry will continue to play a part in keeping these racialized perceptions of neighborhoods established which overall negatively impact minority communities.

IMPACT OF SYSTEMIC DISCRIMINATION IN HOMEOWNERSHIP SYSTEM

Systemic discrimination within homeownership processes stems not only from historical practices that have been outlawed but are still ingrained in our systems. It also stems from the preferences and prejudices that the white community has about communities of color. This leads to racial residential segregation that works against communities of color since minority neighborhoods are valued below white neighborhoods. These preferences and perceptions of neighborhoods then influence professionals' systemic practices within the homeownership process and therefore allow the preferences of people to be solidified by devaluing communities

of color, specifically Black communities. As an example, Korver-Glenn's and Howell's (2018) study found that:

Instead, our data illuminates that variation in comp selection provides ample room for neighborhood racial composition to become entangled in home value, in part through the (unconscious) racialized assumptions of appraisers and numerous other real estate stakeholders who attempt to influence home valuations. Thus, it is the system of appraisals that enables the stark racial inequality we observed in our quantitative data to persist...Specifically, we highlighted how the inconsistency in comp selection strategies enables appraisers to select comps based on their racialized assumptions about the comparability of communities, which in turn devalues communities of color, irrespective of actual demand. (p.485)

This impacts not only the home values of people of color but also, as previously mentioned, has a positive correlation with the tax value of homes. These tax valuations hold a significant role in the overall well-being of communities. Tax dollars coming from property taxes will be lower than tax dollars coming from white communities and therefore, funding for programs such as education and infrastructure will be lower in these communities. Black and brown communities are subject to derogatory racial views and are not desirable within the eyes of the white community, and the white community continues to benefit from the positive racial views of their group and will continue to do so unless there is change within our systems (Korver-Glenn, 2018, p.652).

METHODOLOGY

Census tracts represent small subdivisions within a county and are relatively homogenous concerning the area's demographics and economic environment. For this study's purpose, I looked at the census tracks of Mecklenburg County, North Carolina, when comparing different neighborhoods and the homes' tax values within the census tracts. Specifically, this study used data from the 2019 American Community Survey (ACS) from Mecklenburg County alongside Mecklenburg County, NC tax appraisal data. The study retrieved the census tract data from the

Charlotte Open Data Portal and the Census Reporter database. I focused on the census tracts' racial demographics and their racial composition since census tracts are comparable to individual neighborhoods. The ACS also provides detailed information on the population and median household income information and is composed of 5-year data. The study incorporated data from a Mecklenburg County, NC database, Polaris 3G, which provides detailed tax information for properties within the county. The database has information about homes in each census tract and their appraised tax value. Lastly, the high school for each census tract was identified to study whether or not the schools' quality in each census tract would play a role in the tax valuations.

In order to perform a statistical analysis to investigate whether there may be a difference between the average building appraisal per square foot between a white majority neighborhood versus a Black majority neighborhood, high income, middle income, and low-income tracts of each racial composition were analyzed. This allows a comparison of a Black majority neighborhood to a white majority neighborhood with similar income levels to reduce household income as an underlying factor if there is a statistically significant difference between tax appraisals per square foot. This was done by utilizing the database Census Tracker which provides the demographic compositions and median household incomes of each tract. Roughly 5-6 tracts were chosen for the white majority group and the Black majority group. Within each category, a low income, middle income, and high income tract was present to compare directly with the opposing groups and its comparable tract. The Polaris 3G database was used to choose comparable tracts and 10 homes within each tract. Data including the home's address, the building tax appraisal, and the home's square footage were collected. The homes were randomly selected within the tract and were chosen evenly throughout. In total, there were 8 tracts and 80 homes in the sample. The Charlotte Open Data Portal was explicitly used to help find the census

tracts on the Polaris 3G websites since street names were more clearly seen than in the Census Tracker map.

The average building tax appraisal per square foot of a tract and the average square footage of each home in a tract was calculated. A T-test was applied when comparing a tract from each category to find a statistically significant difference, meaning that the racial composition of a tract may play a significant role in the tax appraised values of homes within the specified census tracts. Before any data analysis, this study hypothesizes that tracts' racial compositions will be correlated with the tax assessment of homes within the census tract. We used the building tax appraisal instead of the total tax appraisal since land appraisals are highly correlated with the land location, and building tax appraisals are tied to the value of the actual building. In some cases, the land appraisal can be much higher than the building tax appraisal.

RESULTS

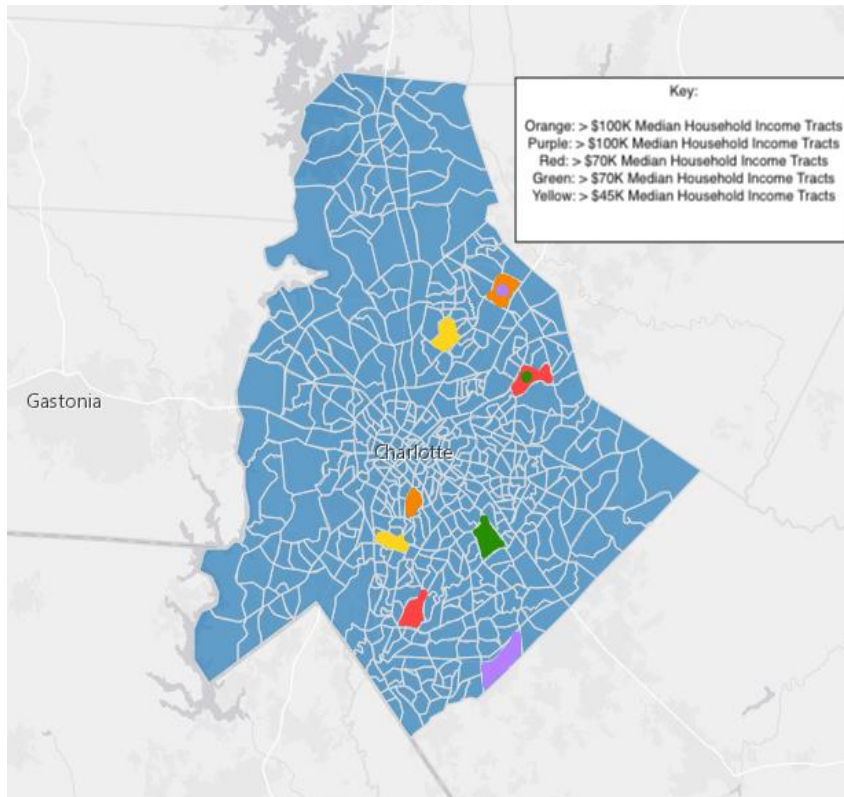


FIGURE 1. Mecklenburg County, NC Census Tracts

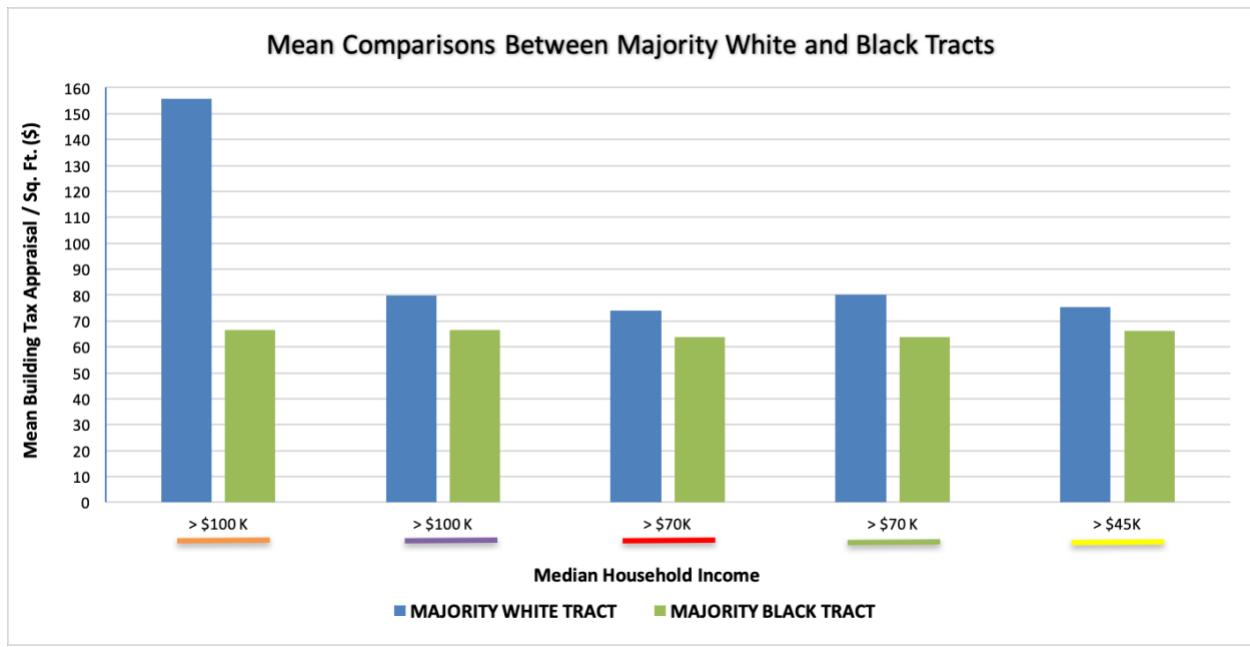


FIGURE 2. Mean comparisons between majority white and Black census tracts

TABLE 1. T-test comparing mean building tax appraisal per square foot between tracts

Significant difference at .05		MAJORITY WHITE TRACT: Mean Building Tax Appraisal/Sq.Ft.	MAJORITY BLACK TRACT: Mean Building Tax Appraisal/Sq.Ft.
> \$100K Median Household Income	Mean	\$155.61	\$66.41
	P(T<=t) one-tail	.001	
> \$100K Median Household Income	Mean	\$79.97	\$66.41
	P(T<=t) one-tail	.001	
> \$70K Median Household Income	Mean	\$73.98	\$63.90
	P(T<=t) one-tail	.015	
> \$70K Median Household Income	Mean	\$80.06	\$63.90
	P(T<=t) one-tail	.001	
> \$45 K Median Household Income	Mean	\$75.44	\$66.04
	P(T<=t) one-tail	.006	

For reference, Figure 1 shows all of the census tracts within Mecklenburg County, NC. The eight tracts used within this study are highlighted and labeled with their median household income. For this study’s purpose, I included two comparison groups for high income tracts, two comparison groups for middle income tracts, and one comparison group for low income tracts. The average building tax appraisal per square foot of a home in each census tract can be seen in Figure 2 and Table 1. As seen in Figure 2 and Table 1, the white majority tract has a higher average building tax appraisal per square foot for each comparison group. To test if this difference is statistically different, a two-sample T-test assuming equal variances (seen in Table 1) was conducted to compare each comparison group’s means. With the significant p-value set at .05, the low income, middle income, and high income groups all have a statistical difference meaning that the difference between the average building tax appraisal per square foot between the two groups is not attributed to chance. This concludes that the higher average in the white majority census tracts and the lower average in the Black majority tracts are attributed to a factor that causes this stark difference between the averages.

TABLE 2. Census Tract Home High School Rating

	Home High School	School Rating
> \$100K Median Household Income: White Majority Tract	Myers Park High School	6/10
> \$100K Median Household Income: Black Majority Tract	Mallard Creek High School	7/10
> \$100K Median Household Income: White Majority Tract	Providence High School	9/10
> \$100K Median Household Income: Black Majority Tract	Mallard Creek High School	7/10
> \$70K Median Household Income: White Majority Tract	South Mecklenburg High School	5/10
> \$70K Median Household Income: Black Majority Tract	Rocky River High School	3/10

> \$70K Median Household Income: White Majority Tract	East Mecklenburg High School	4/10
> \$70K Median Household Income: Black Majority Tract	Rocky River High School	3/10
> \$45 K Median Household Income: White Majority Tract	Myers Park High School	6/10
> \$45 K Median Household Income: Black Majority Tract	Mallard Creek High School	7/10

In each comparison between the white and Black majority tracts, there was a similar median household income. Thus, median household income can be less attributed to the difference between the average in the building tax appraised value per square foot. Furthermore, using the Charlotte Mecklenburg School finder, I located the home high school for each census tract and utilized the Great Schools rating system to compare whether or not the quality of high schools in each tract could factor to the statistical difference. Table 2 lists the home high school for each census tract and its Great Schools rating. Homebuyers and real estate agents use these ratings to gauge the value of a home. As seen in Table 2, all the higher income tracts have higher high school ratings than most of their lower income counterparts excluding in the last lower income census tract with Mallard Creek. Specifically, looking at the high income tracts' home high schools, they are all within the 6-9 rating range. In the first high income group, the high school ratings are off by one point, with Mallard Creek High school being the highest at 7/10 in the Black majority census tract. In the group comparisons, the home high school ratings are off by 1-2 points. This shows that high schools' ratings within the census tracts cannot be determined as significantly influencing the statistical difference between the average building tax appraisals per square foot between white and Black majority tracts.

The T-tests suggest that the difference in the two means is not caused by chance, and with our analysis of high school ratings and reducing the impact household income, it can be

deduced that the racial composition of the census tracts have a significant role in how the homes are appraised for tax purposes. In each case, the white majority tracts are appraised higher per square foot than those of similar income levels that happen to have a Black majority population, even if the high school ratings are similar or even less than the high school ratings in the Black majority census tract.

CONCLUSION

This study concludes that a statistically significant difference is proven by conducting a T-test on building tax appraisals per square foot between the majority white and Black census tracts groupings. All white census tracts had higher average building tax appraisals in each of the five comparisons, regardless of median household income or high school ratings in each tract. The specific methodology of this study reduced the influence that median household income had on this difference, and as seen previously, the ratings of the high schools did not seem to have a strong influence on why the majority white census tracts had higher tax values. In conclusion, census tracts' racial demographic compositions heavily influence the average building tax appraisals within the tract. While collecting the data used for this study, there were several observations to be made. While selecting comparable census tracts for majority white and Black tracts, it was more challenging to find census tracts of median household income in the middle income and high income class that was majority Black. Finding majority white census tracts with median household incomes of over \$100K was much easier. It was also much more challenging to find majority white census tracts with low income than finding low income Black census tracts. This observation alone suggests the systemic difference between white and Black communities' wealth that can be attributed to years of systemic injustice, especially for the Black community. For future studies, a qualitative aspect could be added. Interviewing professionals

within the housing system, such as tax appraisers, real estate agents, or recent home buyers and sellers, could provide a perspective on people's current behaviors and how their preferences and inherent biases impact the numbers seen in this study.

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Motivations for Thrift Shopping

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ABSTRACT

Shopping second hand has seen a rise in popularity among the younger generation. The purpose of this study was to analyze the motivations of shopping second hand which included price, environmental, treasure hunting, current trends, and income level. The data was collected using a survey that had multiple questions for each motivation with a scale from one to five to rate how much each statement applied to the participants. A chi-squared test for a contingency table was used for the statistical analysis. The results reveal that there are multiple motivations for thrift shopping, which include all of the categories except for current trends, with price being the strongest significance. There is no significance for motivation in regard to different income levels.

BACKGROUND

Thrift stores are defined as stores that sell used items, often clothing, that is donated, these are mainly operated by non-profit organizations. There are also consignment shops which can be considered more “high-end” than thrift stores; these are for profit and buy clothes directly from sellers instead of taking donations. Both are alternatives to buying new clothes and are typically considered to be for lower income people, which is a relevant motivation for second-hand shopping. The resale industry is a multi-billion-dollar industry that has been growing, on average, seven percent annually (NARTS, 2021). Recently, thrift-shopping has become trendy among Gen Z, potentially from the influence of social media, in fact, Gen Z shopped second-hand more than any other generation in 2019. The demand for second-hand shopping is growing and this market is expected to hit \$64 billion in the next five years, the online market is set to grow sixty-nine, percent whereas the retail sector is expected to shrink by fifteen percent (ThredUp, 2020). There are different reasons why thrift stores and consignment shops have been increasing in popularity. Often, the reason for shopping at thrift stores is due to environmental

factors. Additionally, the idea of sustainability is trending. Ballew et al. (2019) claim that younger Americans will grow up with more exposure to the effects of climate change than older generations. Thrift stores provide an alternative from purchasing fast fashion, which contributes significantly to pollution and related environmental problems. The second-hand market is expected to increase enough to surpass the fast fashion market by twice its size in 2029 (ThredUp, 2020). The thrill of finding a unique item is another reason why an individual might choose to shop at a thrift store. Additionally, some individuals shop at a thrift store especially for a trendy item.

PURPOSE

The purpose of this study is to analyze the motivations behind shopping at thrift stores. When looking at previous studies about motivations of second-hand shopping, the factor of income level is often not included. A person's income determines what kind of lifestyle and habits they can afford and clothing and shopping habits reflect this. Typically thrift stores and consignment shops offer more affordable clothing than name-brand clothing stores. Previous studies may have assumed the motivation for price or cheap finds would include the idea of lower income levels, but this study will see how strong the correlation is between income and other factors.

LITERATURE REVIEW

Generational Changes

Over the years, views of thrifting have changed and different generations have varied perceptions of shopping second-hand. Montgomery and Mitchell (2014) found that respondents 35 and older were significantly more likely to shop at thrift stores than respondents who were in the 18-34 age range. Recently, there has been a more positive attitude towards second-hand

shopping from younger generations. Researchers note some generational differences that may impact shopping behaviors:

For example, many young consumers must have the latest technology, fashion, etc., whereas, consumers from an older generation may not replace goods unless the old one is “wore-out” new alternatives notwithstanding. Consumers who replace goods with valuable life left may be more likely to donate to second-hand stores and buy the latest technologies and fashion at first-run stores. While second-hand chic may be increasing in frequency, younger people are still more likely to have their behavior shaped by social pressure, and thus, may be less likely to shop at Thrift Stores than their older counterparts. Moreover, younger respondents are more likely to engage in recycle behavior which means they may be more likely to give used goods to second-hand stores rather than throw them away. (Montgomery and Mitchell, 2014, 8).

Recently, there have been increasing trends of thrift shopping among the younger generations, potentially from influences of peers or social media. “The awareness of social and environmental welfare has increased among people and that this could be a reason for them to increase their shopping at second-hand stores” (Haraldsson and Peric, 2017, 33). Younger generations have grown up with internet and social media and have had easily assessable information at their fingertips, so they are easily made aware of many things such as: the unethical practices of fast fashion, the environmental impact of textile production, online shopping from many different kinds of retailers, and many other factors that could potentially influence shopping behavior.

Environment

The textiles and fashion industry has a big environmental impact and is one of the largest polluting industries, specifically fast fashion. Fast fashion is inexpensive, readily available clothing that keep pace with current fashion trends. The fashion industry as a whole produces ten percent of the total global carbon emissions. Additionally, the fashion industry uses large amounts of water resulting in river and stream pollution. The main processes that contribute to the global carbon emissions of this industry and have the highest impact on resource depletion

are dyeing and finishing, yarn preparation, and fiber production (Maiti, 2020). “With the rise of globalization and growth of a global economy, supply chains have become international, shifting the growth of fibers, the manufacturing of textiles, and the construction of garments to areas with cheaper labor.” (Bick et al., 2018, 1). Americans throw away about eighty-five percent of all textiles annually which go to landfills. Second-hand shopping is a sustainable practice, and some may consider these environmental impacts as important. Kiehn and Weller (2018) analyzed millennials and their engagement in reusing clothes. All of the participants in their study were aware of environmental issues in general and changed their views of clothing upon obtaining new information about the impact of the fashion industry, specifically fast fashion. Markova and Bayanduuren (2017) found that “overall consumers were familiar with sustainable consumer practices and product disposal habits as out of 263 respondents, ninety percent recycled on regular basis” (Markova and Bayanduuren, 2017, 2). However, only thirty percent actually consider the environment when shopping for clothes. Shopping for clothing now has an ethical viewpoint as people become aware of the negative effects of the clothing industry.

Value

Thrift stores offer second-hand merchandise at low prices making these items assessible to people who may not be able to afford new clothes or want to save money. Haraldsson and Peric (2017) discussed price with the interviewees of their study and many mentioned how price attracted them to shopping at second-hand stores. The interviewees mentioned the motivation of cheaper prices because they have less financial resources being a student or because they like to shop frequently. Another interviewee said they were initially attracted to the cheap prices but continued for other reasons, such as environmental concerns. Mitchell and Montgomery (2010) found that fifty-eight percent of respondents reported the reason for purchasing merchandise at a

thrift store was to save money. They also found that eighty-eight percent consider value, which is the cost and benefit of the product, as extremely important when they are purchasing items at a thrift store.

The motivation of price or value can be a personal choice or a result of an economic trend. In a study that looked at shopping behaviors post-2008 recession, it was noted that after the Great Recession, ninety percent of United States household reduced their spending. Although recessions usually result in negative impacts to businesses, thrift stores are considered “recession-proof” and often thrive in these economic downturns (Civi and Jolliffe, 2013). When there are economic troubles the motivation of price or value increases as people have less to spend.

According to IBIS World (2011), estimated revenue for Used Goods Stores has increased at an average annual rate of 6.2% to \$14.7 billion in the five years to 2011, with 1.9% growth from 2010 to 2011. As life expenses increased, unemployment rate climbed, savings accounts and retirement funds diminished, consumers cut back on discretionary spending and changed the way they shop (Civi and Jolliffe, 2013, 20).

Treasure Hunt

Kiehn and Weller (2018) describe treasure hunting as a leisure activity of browsing through the shelves when one does not necessarily have anything to buy, simply for personal enjoyment and potentially finding something unique. The interviewees view wearing second-hand clothing as a form of self-expression and noted that “It reflects the strong aim of individuality and to separate oneself from others, titling second-hand clothing as a medium to feel individual, but also to express this individuality to the world.” (Kiehn and Weller, 2018, 34). Part of the thrift shopping experience is that everything is different, and one may never know what they will find, so this motivation is not based on needs or ethics but is simply something enjoyable to do and produces a sense of individuality. Mitchell and Montgomery (2010)

analyzed the process by which thrift store shoppers purchase second-hand merchandise and thirty-one percent have an eccentric motivation, meaning they look for unusual items they couldn't find at a regular retail store and twenty-one percent look for unique items for collections. Sixty-eight percent consider uniqueness of merchandise is extremely important to their shopping experience (Mitchell and Montgomery, 2010).

METHODOLOGY & DATA COLLECTION

This study was conducted using a survey format. The population of this study consisted of students in the School of Business at Wingate University. The survey was sent as a mass email to 396 business student. The survey asked participants to answer questions about their shopping habits, the motivations behind their shopping, and indications of their income level. The questions aimed to identify the survey respondents' motivations for thrift shopping. Three questions for each motivation, price, environment, treasure hunt, trendy, and low income were in the survey and combined for the statistical analysis. There was a scale from one to five for each response, (1) meaning the statement does not apply and (5) meaning the statement applies the most. The questions on the survey can be found in the Appendix to this essay. The questionnaire was sent to 396 students and yielded a total of 42 usable responses giving a response rate of about 11%. A profile of the responses gender, age, and income level are presented in Table 1.

Item	Response	Count	Percent
Gender	Male	8	19.048
	Female	34	80.952
Age	18	3	7.143
	19	11	26.191
	20	10	23.810
	21	12	28.571
	22+	5	11.905
Income	Low Income	6	14.286
	Middle Income	23	54.762
	High Income	13	30.952

HYPOTHESIS

H1: The most significant factors of thrift shopping will be price and environmental concerns.

H2: The motivation of price will have a strong negative correlation to income level. This means as price is ranked higher, the income level will be lower.

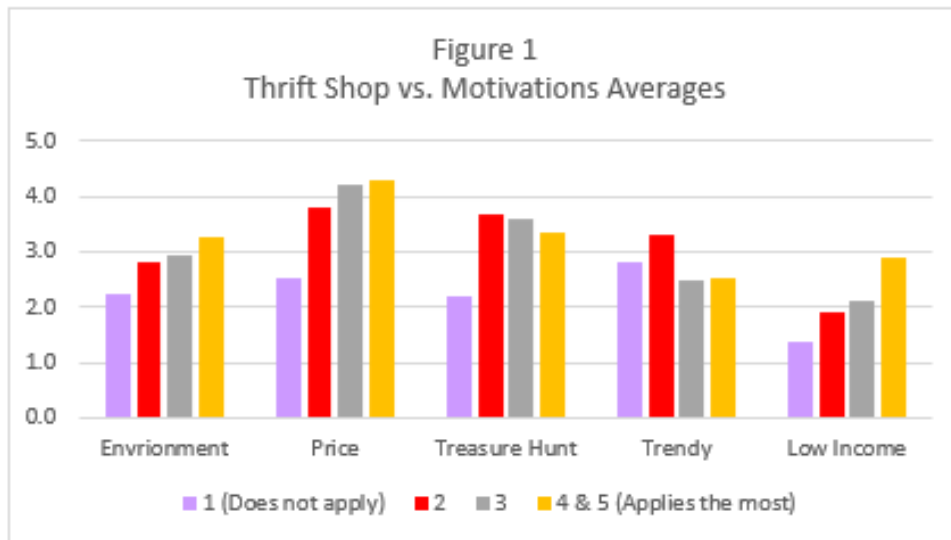
RESULTS

Thrift Shop

A chi-squared test for a contingency table was used to analyze if the different categories (environment, price, treasure hunt, trendy, and low income) are independent of Question 1 (I thrift shop for most of my clothing purchases). The results, presented in Table 2, show that all of the categories except for the trendy category are significant at the 0.05 level. This means that the proportion of responses to questions within these categories are not independent of how respondents answered the question regarding how often the participants shop at thrift shops. We can see that the price category is influenced the most significantly. Of the results with significance, the motivation category of environment displayed the weakest impact. Figure 1 shows the averages of the scores for the set of questions for each motivation. The numbers 4 and 5 are combined on the graph because of a low number of responses with that ranking. Table 2 illustrates that the significant categories generally have an upward trend suggesting that a person is more likely to be motivated by these categories when they thrift shop more often. The one category that was no significant, trendy, has a somewhat random trend.

TABLE 2		
Chi - Squared Test of Contingency Table:		
Thrift Shop vs. Questions Categories		
Category	Test Statistic	P-Value
Environment	30.327	0.0024*
Price	56.444	0.0000*
Treasure Hunt	40.300	0.000*
Trendy	12.185	0.4310
Low Income	33.139	0.0009*

*Significant at the 0.05 level



Environment

A chi-squared test for a contingency table was used to question if the category of environment was independent from shopping habits which includes thrift stores, consignment stores, and shopping brand-new. The results are presented in Table 3 and are significant at the 0.05 level. Thrift stores and brand-new are significant but the consignment category is not significant, so thrift stores and brand new are not independent of the motivation for environment. Figure 2 shows the averages of the scores for the environment questions compared to the scores of the questions regarding shopping habits. The rankings of 4 and 5 are combined on the graph

due to low responses. There is an upward trend for the thrift shop questions, meaning there is more awareness of the environmental impact of the fashion industry as the frequency of thrift shopping increases. The questions for shopping brand new shows a downward trend, meaning there is less concern for environmental impact the more a person shops for brand new clothing.

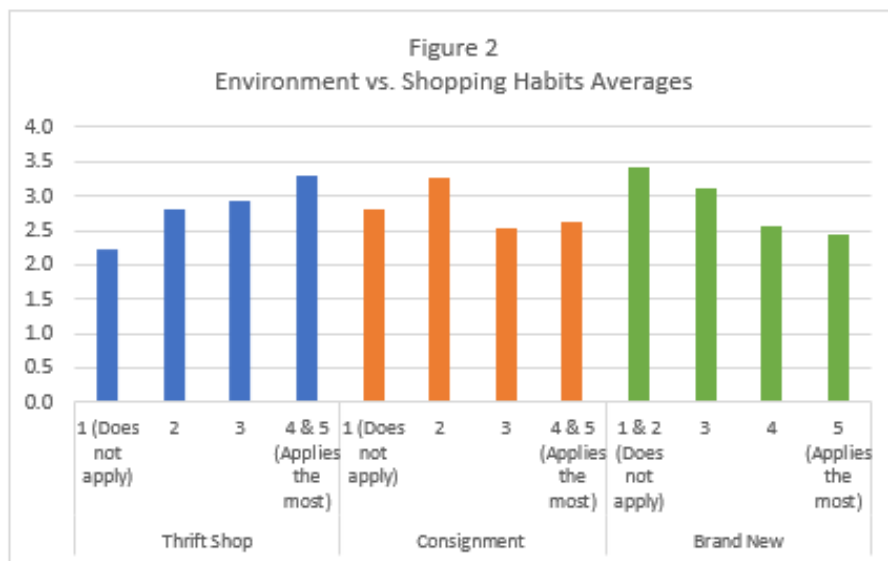
TABLE 3

Chi - Squared Test of Contingency Table:

Environment vs. Shopping Habits

Category	Test Statistic	P-Value
Thrift Shop	30.327	0.002*
Consignment	20.836	0.053
Brand New	42.674	0.000*

*Significant at the 0.05 level



Income Level

A chi-squared test of contingency table was used to determine if the income level is independent of the different question categories. The results shown in Table 4 show that the only category that is significant is the low income indicator questions. There is no evidence that a person's income level is related to the motivations of environment, price, treasure hunt, or trendy when thrift shopping.

Category	Test Statistic	P-Value
Environment	9.766	0.282
Price	14.243	0.076
Treasure Hunt	13.704	0.090
Trendy	14.280	0.075
Low Income	23.949	0.002*

*Significant at the 0.05 level

LIMITATIONS

This study has potential limitations. The number of responses to the survey were low, so in order to get a better statistic of this study a larger response rate would be required. The demographics of the participants is also a limitation. The survey was administered to the School of Business at Wingate University, so the responses lack diversity in age and geographic location. Also, eighty percent of participants were female so having a more even distribution of gender may impact the outcome of the study. Reaching a larger, more diverse group of participants would be beneficial for this study. One aspect of this study was to compare how the groups of different income levels respond to the questions. However, the groups of income levels had quite an uneven number of responses. In order to improve this, more in depth survey

questions should be implemented about income level specifically and how that affects shopping behaviors. Future research should study the different second-hand shopping behaviors of different income levels and the economic impact of the resale market. A large impact on the growth of the resale industry is due to online platforms to buy used clothes. Future research should look into attitudes of consumers towards second-hand online stores and apps and possibly compare this to the attitudes towards physical second-hand stores.

CONCLUSION

The study at hand sought to analyze the motivations behind the consumption of second-hand shopping. Respondents were asked various questions on different motivations for their shopping behaviors which included value, environmental concerns, shopping as a hobby or treasure hunting, current fashion trends, and indications of low income levels. Looking at the most significant motivation of price, respondents indicate that the idea of value and low prices is the most important aspect when shopping second-hand. However, price was not a significant factor when comparing different income levels which did not have evidence that there is any significance for any of the motivations. The motivation of environmental concerns shows that awareness of sustainability and the effects of the clothing industry on the environment increases the more a person shops at thrift stores and it decreases the more a person shops for brand new clothing. The idea of treasure hunting or shopping as a hobby showed significance with the thrift shop question category. This can mean shopping for unique finds or shopping without having a specific purpose in mind. Thrift stores rely on donations and do not buy multiples of the same inventory to sell like retail. So, thrift stores are a perfect environment for uncommon, quirky items that would satisfy the needs of those who seek that kind of experience. People in younger generations of Millennials and Gen Z have shown interest in the idea of shopping second hand

which may be for a variety of motivations, so this study included the idea that thrift shopping itself may be trendy. However, the results do not show evidence that the trendy motivation is independent of thrift shopping.

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APPENDIX

Survey Questions:

Please indicate on a scale of 1-5 (1 meaning it does not apply to you at all, 5 meaning it applies to you the most) how much each statement applies to you.

1. I thrift shop for most of my clothing purchases.
2. I shop at consignment stores for most of my clothing purchases. (Buy used clothing to sell instead of selling donations ex: Plato's Closet)
3. I buy most of my clothes brand new.
4. I think about environmental issues often.
5. I am aware of the environmental impact of the fashion and textile industries.
6. Environmental issues is my main motivation for shopping at thrift stores.
7. Price is the most important aspect when buying clothes.
8. I shop at thrift stores for the cheap prices.
9. I always find deals and ways to save when I buy clothes.
10. I go to thrift stores for unique finds you can't get anywhere else.
11. I thrift shop to find something surprising.
12. I do not always have something specific when I go shopping.
13. Social media/peers influence my shopping behavior.
14. I like to wear trendy clothes.
15. I pay attention to the latest fashion.
16. My family mainly buys clothes from thrift stores.
17. My family often cannot afford new clothing.
18. I wore a lot of hand me downs as a child.

19. Indicate your father's highest level of education.
20. Indicate your mother's highest level of education.
21. What is your gender?
22. What is your age?

It's the Culture for Me: An Analysis of the Impact of Membership in Black Greek Lettered Organizations and Other Culture-Based Organizations on African American Students at Predominantly White Institutions

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ABSTRACT

Bringing together multitudes of races, ethnicities, nationalities, and religious affiliations, higher education in the United States has worked diligently to develop progressive approaches to diversity on college campuses (McClain & Perry, 2017). While creating diverse learning and working environments for minoritized and historically excluded students, faculty, and staff, higher education administrators must be cognizant of the individualized needs of these demographics. Having community support is an essential component of the collegiate experience, especially for students of color. Many students seek support and a sense of community after leaving home to pursue higher education. Organizations that align with their culture, heritage, beliefs, and values are often effective means of community. Membership in Black Greek Lettered Organizations and other culture-based organizations can have significant impact on African American students at predominantly white institutions.

HISTORICAL BACKGROUND OF AFRICAN AMERICANS IN HIGHER EDUCATION

Early colonial higher education was designed and established to educate white men, with nonexistent notion given to Black students or women. The first documented attempts for expansion were experiments with grammar schools and schools for Native Americans to “increase the enrollments and resources of [their] institutions” (Thelin, 2011, p. 29). Inclusion of Native American students opened opportunities for conversions to Christianity and an increase in donor funds from England. Despite an attempt for expansion to be inclusive of Native Americans, there were several issues with this experiment. These included Native American students succumbing to disease and alcoholism and struggling with contradictory belief systems. Many tribal leaders opted to no longer send their sons to these colleges. Though this attempt was made with Native American students, there is no documented evidence of colonial commitment

to black students in any form, to include standard courses of study or specialty schools (Thelin, 2011, p. 30).

Early educational institutions were created for the purpose of training and preparing colonists to be active contributors to the church. This same notion holds true for the history of African Americans in higher education. Titcomb (2014), in his compiled timeline of landmark events in the progress of African Americans in higher education, documents John Chavis, a Presbyterian minister and teacher as “...the first black person on record to attend an American college or university,” which was in 1799. Chavis’ attendance served as the catalyst for Black people pursuing higher education. By 1833, Oberlin College was founded and has been dedicated to African American higher education throughout its history (Titcomb, 2014). Thelin (2011) notes that Oberlin Collegiate Institute gained notoriety for its commitment to “coeducation according both to gender and to race.” Since trailblazers like Chavis and institutions like Oberlin College initially promoted the notion of African Americans pursuing higher education, America has seen substantial change and growth in this area.

Legislation in 1890 made way for the expansion of Black land-grant colleges to provide access to higher education for students of color (Thelin, 2011, p. 76). These land-grants provided funding to build segregated institutions which mostly focused on agricultural and industrial trades. One of the most significant political and economic factors of Black progression in higher education was the contrasting philosophy of black education of W.E.B. Dubois to that of Booker T. Washington. Dubois believed that African Americans should seek equal traditional liberal education as whites and focused on the development of the “talented tenth,” while Washington promoted the idea of industrial education and developing skills in trades (Thelin, 2011, p. 102). Both philosophies focus on increasing the level of education for African American people. The

theories combined remove limits on what higher education “should be” for the Black community.

Increased enrollment of African American students at institutions of higher education not only created a more diverse student demographic but also opened the doors for advancement in programmatic offerings at many colleges and universities. In 1919, Carter G. Woodson reported that eight traditional Northern colleges offered courses in African American studies which include Harvard University, Stanford University, and Ohio State University. This was even before historically Black colleges and universities developed courses in relation to the Black experience. These colleges also began to adopt these programs.

Historically Black colleges and universities (HBCU) began to rise as more African American students sought out means of engaging in higher education. According to Thelin (2011), early HBCUs often placed an overt emphasis on more industrial programs along with a variety of other fields. By 1971, there were over 500 colleges and universities with complete programs in African American studies and at least 1300 institutions that offered at least one course in African American studies. “Black Studies has been evolving as a result of the social movement that opposed institutional racism in higher education... Many African Americans began to consider Black Studies and Black education as having a “special assignment” to challenge and call out White mainstream knowledge for its deficiencies and racial corruption” (Hayes, 2019, para. 9). The presence of historically Black colleges and universities has had considerable impact on the history of African American students in higher education.

BLACK STUDENT COMMUNITY AT PREDOMINANTLY WHITE INSTITUTIONS

The racial climate of a college campus can serve as an essential component of African American students’ matriculation, retention, persistence, and graduation from predominantly

white institutions (Hurtado et al., 1999). Factors connected to the racial climate of a campus include, but are not limited to: inclusion of students, faculty, and staff of color, inclusive curriculum that presents past and present experiences of people of color, initiatives that support students of color, and cultural spaces/organizations (McClain & Perry, 2017). According to *The Journal of Blacks in Higher Education*, “A nurturing environment for black students is almost certain to have a positive impact on black student retention and graduation rates” (JBHE Contributors, 2006, para. 15). This nurturing environment not only includes positive racial climate, but also orientation and retention programs that help Black students adapt to the culture of predominantly white campuses, mentoring programs, and strong culture-based student organizations that generate a sense of belong among the African American student population (para 16). Being intentional about the improvement of campus racial climate and developing strategic planning around support for students of color can support the recruitment and retention of Black students at predominantly white institutions.

Bryan K. Hotchkins, Assistant Professor of Educational Psychology & Leadership at Texas Tech University, along with University of Oklahoma Professor and Associate Dean for Community Engagement and Academic Inclusion, T. Elon Dancy, completed an in-depth study on the role of campus racial climate in residential housing at predominantly white institutions. They focused on the Black student experience, utilizing photovoice in order for students to analyze the strengths and limitations of Black student community, develop a level of discourse and conversation about community concerns, and provide a forum in which to present this experiential knowledge (Hotchkins & Dancy, 2017, p. 41). Some significant findings from the study include Black student desire to find their own “spaces” on campuses to connect with other Black students in environments where they are not tokenized or exposed to macro- and

microaggressions. They also discovered a lack of Black cultural expression in campus spaces such as names of residence halls or art on campus. A final finding was the concern of perpetual homelessness and a constant space exclusion or race authenticity. Ultimately, Hotchkins and Dancy found that Black resilience is often a survival method for Black students and, while it helps Black students function and often thrive on predominantly white campuses, it should not replace holding white staff and administration accountable for ensuring a safe and inclusive environment for students where they feel included and free to exercise self-expression. In order for racial climate at predominantly white institutions to be improved, allyship and support for the growth and development of these culture-based organizations and campus spaces from white faculty, staff, and administration is essential.

Black Greek-Lettered Organizations

Perhaps one of the largest historical social impacts in higher education in relation to African American students was the founding of National Pan-Hellenic Council (NPHC) organizations/Black Greek Lettered Organizations (BGLO), or historically black fraternities and sororities as collegiate community service organizations. Institutions of higher education in the 19th century focused more on intellectual advancement versus social development. Fraternities were established to create a community for men away from their families, as well as break the "...monotony, dreariness, and unpleasantness of the collegiate regimen," (Rudolph, 1990, p. 146). However, many of these organizations had clauses preventing African Americans from gaining membership. Desiring that same sense of family and community, fraternities and sororities for black collegians were established. These historically black organizations were not developed simply to imitate white sororities and fraternities. Instead, they created a network of safety and support for black collegians that challenged the stereotypes that African Americans

could not form community and express interest in academic excellence (Thelin, 2011, p. 233). To this day, NPHC organizations dominate campuses and communities, giving students of all races, genders, religions, etc. an opportunity to acquire a sense of belonging and a drive for success in the academic and social realms of higher education.

Membership in Black Greek Lettered Organizations has increased the performance of Black students at predominantly white institutions in several ways. These organizations do not accept members without a standing institutional grade point average, allowing for first-year and transfer students to become acclimated to the institution and expectations set forth about academic performance and progression. If prospective members have an eligible grade point average, in addition to all other requirements set forth by each respective organization, they are expected to maintain at or above that minimum grade point average in order to be an active member. These members are also required to plan, implement, and evaluate community service projects and initiatives throughout the year, which allows opportunities to support the advancement of the local and campus communities. Members of BGLOs obtain leadership experience, public speaking skills, and networking/mentorship that are transferrable to individual collegiate experiences and career focus after graduation.

Other Culture-Based Organizations and Opportunities

There are several other culture-based organizations and campus spaces that provide support for Black students on predominantly white campuses. Some of these include the National Association for the Advancement of Colored People (NAACP), 100 Black Women, 100 Black Men, the National Council of Negro Women (NCNW), and Black Student Union/Black Student Alliance/Black Student Association (BSU/BSA). These organizations provide community within campus communities to support and address the needs of African American students. Lamont A.

Flowers (2004) reviewed survey results of roughly 100,000 students surveyed about their student experiences and reported over 90% of students reporting “good” or “excellent” student experiences when engaged in student involvement activities (p. 633). These also resulted in more positive educational outcomes for students. In fact, student involvement in cocurricular activities such as BGLOs and culture-based organizations “significantly predicted several aspects of psychological well-being including: students’ personal growth, positive relationships with others, and purpose in life” (Kilgo et al., p. 1043).

Impacts of Involvement of Black Students on Predominantly White Institutions

Today’s contemporary Black student experience stems from several strides made from the role that HBCUs played in the 1960s in developing many risk takers and leaders (Thelin, 2011, p. 305). Several historical concepts within American higher education have contributed to the rich history of African American diversity within American higher education. Today, Black progression in higher education theories supported by both Dubois and Washington are cause for increasing enrollments of Black people in institutions of higher learning and benefits communities socially and economically. Since the 1800s, the African American community has continued to make significant historical impacts on contemporary higher education. Political, economic, and social impacts have been instrumental in driving Black progression in contemporary higher education.

Contemporary higher education has also significantly benefitted from the presence of Black Greek Lettered organizations, culture-based organizations, and increased programs of study and course offerings in African American studies. In addition to both increasing enrollment of African American students at colleges and universities and creating increasingly diverse student demographics, they also help to create strong minority leaders for today’s society. If such

social movements continue in contemporary higher education, the growth and development of diversity and inclusion at colleges and universities will persist in being an ongoing core of the community. As higher education continues to evolve, it is evident that African Americans will continue to be a driving force in the processes and operations of higher education.

The support and inclusion of African American students also impacts the teaching and learning paradigm within higher education and individual integrative complexity. If Black students are provided spaces and opportunities for advancement, they can become essential contributors to learning communities serving as authentic spaces for intellectual diversity. Integrative complexity, or IC, is “the degree to which students’ cognitive styles involve differentiation and consideration of multiple perspective” (Anderson, 2008). Low IC is a more simplistic approach to evaluation and reasoning, while high IC is more reflective and considerate of various perspectives. Anderson found that the more ethnically and racially diverse a group of students were, the greater the level of cognitive complexity was. Students engage and learn from each other about personal and social attributes and develop other skills and competencies as well. Ultimately, high levels of diversity, inclusion, and student involvement not only has positive impacts on African American students, but also on the campus community as a whole.

CONCLUSION

Involvement in Black Greek Lettered Organizations and other culture-based organizations plays a major role in the personal and professional growth of African American students. In addition, this level of involvement increases students’ connections to the institution, thus increasing recruitment, retention, and matriculation rates among African American students at predominantly white institutions. Through the implementation of strategic planning change initiatives, such as increasing the availability and supporting the sustainability of BGLOs and

other culture-based organizations at predominantly white institutions, several stakeholders, including students, staff, and faculty, are able to evolve the current campus climate and generate equity for students of color. This should potentially impact overall enrollment and institutional reputation and revenue. If initiatives such as these are successfully employed, support for other projects can be created for several other underrepresented groups on campuses to improve overall recruitment, retention, matriculation, and experiential satisfaction of minoritized and historically excluded populations at predominantly white institutions.

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