

S18

symposium

The Ithaca College Honors Undergraduate Journal

V7

Work from Ithaca College
Honors Students

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Letter from the Director

Dear Readers,

This year, in Symposium Vol. 7, you'll find excellent, timely, interdisciplinary work by Ithaca College honors students. Here is what is in store for you in these pages:

Josie Sepel takes on the Trump administration's claims about immigrants with a compelling argument that the U.S. needs DACA.

In the face of this year's revelations about sexual abuse in the film industry (and beyond), Mira Mireau's Feminist Filmmaker's Manifesto refuses to settle for patriarchal relations in films and in film production and reclaims the film world for women and gender non-conforming people.

Isabella Julian's "Never Go To Bed Hungry" refashions Little Red Riding Hood into a haunting reflection on wolves, sleep, and loss of childhood.

Denise Ibarra's qualitative study contributes to understanding the Female Athlete Triad, a syndrome involving low energy, menstrual dysfunction, and decreased bone density, as a public health issue.

You might be surprised by Naomi Hanson's study of Cheng Shih, a female pirate leader at the turn of the 19th century whose control of thousands of men created a bureaucratic "floating empire," by offering more opportunities for women and lower-class men than the Neo-Confucian Qing dynasty. Shih thereby threatened the Qing dynasty, which failed in defeating her despite resorting to call on Portuguese and English Navy.

Emily Hutton and Katie Hutton find that government spending on education, healthcare, and social protection in European countries correlates with lower antibiotic resistance in *Klebsiella pneumoniae*, a bacteria that affects the urinary tract, respiratory tract, and bloodstream, while *Staphylococcus aureus* did not vary significantly.

Leighann Guardino applies Freudian theory to the ancient Greek tragedy of Medea, revealing through the characters of Medea, Jason and the chorus how three parts of the human psyche function in isolation and as a whole.

Miranda Ella and Emily Siniscalco examine the impact of an invasive species, the small Indian Mongoose and efforts to eradicate it on the Pacific islands of Hawaii, Fiji, and Japan.

The editors, fearlessly led by Emma Sheinbaum, bring these pieces to you in excellent form. I commend these scholars to you. May this knowledge stir in you what it needs to stir. May they inspire you to seek the truth you need to seek.

Yours,
Alicia Swords

Director, Ithaca College Honors Program

Letter from the Editor

Dear Readers,

I am proud and honored to present the seventh issue of the Ithaca College Honors Program's Undergraduate Scholarly Journal, *Symposium*. On behalf of myself, the associate editors, and the contributing writers I would like to thank our Honors Program director, Dr. Alicia Swords, for her unwavering support throughout the work-soliciting, editing, and publishing process!

Our wonderfully driven and intelligent associate editors—Arianna Ashby, Sarah Casey, Miranda Ella, Gabrielle Humphrey, Jacqueline Marusiak, Josephine Sepel, and Katrina Webster—also deserve recognition and a thank you for their hard work amidst their school and extracurricular responsibilities. Their dedication to collaboratively selecting submissions for publication, revising the selected submissions with the writers, and bringing their enthusiasm and expertise to *Symposium* is the reason why we are able to put out an issue every year. I am thrilled with how engaged the editors were to produce such a fantastic volume—thank you!

To all of the Honors Program students who submitted their inquisitive, creative, and scholarly work for publication in the 2017-2018 issue—we appreciate and are inspired by your curiosity and your intelligence. We encourage you to keep asking questions, keep exploring answers, keep writing, and keep sharing your work.

This year's issue is urgent in its content and its forms—the topics are relevant, are personal, are global, are innovative, are historical, and are inspiring by means of analyses, questions, manifestos, arguments, and primary and secondary research. I hope these works and the students behind them leave an impact on you as much as they did on us as an editorial team. Happy reading!

Best,

Emma Sheinbaum

Editor in Chief

Why the U.S.A. Needs DACA

By Josephine Sepel

The United States has a long and complicated relationship with immigrants. Despite self-identifying as a “melting pot” (or more recently a “salad bowl”) of foreign cultures, our nation has a long history that contradicts this idyllic image of peaceful coexistence. Over the past couple centuries, the U.S. has repeatedly exiled, scorned, and oppressed groups of people seeking a new life within our borders, particularly those who have entered the country illegally. In recent years, much of this anger and resentment has been focused towards one particularly controversial government program: DACA (Deferred Action for Childhood Arrivals). DACA was founded in 2012 by President Barack Obama and allots certain securities and rights to young immigrants, often referred to as “dreamers,” who were brought to the United States as children. The program protects these immigrants from deportation and allows them to legally attend school and seek employment (Gonzalez, 2017; Shoichet, Cullinane, & Kopan, 2017). Many DACA recipients have served in the armed forces, become organ donors, and have even obtained green cards (Gates, 2017; Glum, 2017; López & Krogstad, 2017). However, in the past few months, the Trump administration has begun to dismantle the program and plans for complete eradication by March 5, 2018. Unless Congress implements a replacement plan, over 700,000 undocumented immigrants will lose their “protected status” in the next two years (Bush, 2017; Shoichet, Cullinane, & Kopan, 2017). While the Trump administration’s choice to end DACA pleases critics who argue that DACA is an unconstitutional program that promotes unemployment, hurts the U.S. economy, and leaves our nation vulnerable to violence, there is much evidence suggesting that ending DACA will not only have disastrous results for its recipients, but for our nation as a whole.

On September 5th, 2017, Barack Obama posted on Facebook and voiced his support for the program. He argued that the choice to end DACA was “a political decision, and a moral question,” and not “required legally” (Obama, 2017). However, many debate this claim since the program was created as an executive order, a mandate with the force of law implemented by a president without Congressional approval. Attorney General Jeff Sessions has claimed that DACA is “an unconstitutional exercise

of authority by the executive branch" (Romo, Stewart, & Naylor, 2017). This view of DACA, as an example of executive overreach, is not uncommon. One group of state attorney generals, led by Texas Attorney General Ken Paxton, threatened to sue the Trump administration if it did not begin to phase out the program. They argued that DACA was immigration legislation formed by the Executive Branch and, using the principle of separation of powers as support, they claimed that the program was unconstitutional (Romo, Stewart, & Naylor, 2017). George Mason University law professor, Ilya Somin, disputes such criticisms in his article for the Washington Post by pointing out that DACA does not change current law but rather "suspends enforcement of a law against a particular category of migrants" (Somin, 2017). The American Civil Liberties Union has further emphasized the legality of DACA, explaining that "DACA is a lawful exercise of the enforcement discretion that Congress delegated to the executive branch in the Immigration and Nationality Act, which charges the executive with 'the administration and enforcement' of the country's immigration laws" (Bomboy, 2017). The claims that DACA is unconstitutional and lacking legal basis are not only unfounded, but they divert attention away from the true issue at hand.

Many immigrants that enter the U.S. illegally are children fleeing violence. According to a 2013 survey orchestrated by the U.N. High Commissioner for Refugees, in which 404 of the unaccompanied minors who had crossed illegally into the U.S. in the past year were questioned, 48% of the surveyed said they had "experienced serious harm or had been threatened by organized criminal groups or state actors, and more than 20 percent had been subject to domestic abuse" (Kiely, 2017). DACA protected them from such situations, but now they are once again at risk. Though Trump has left a six month delay for Congress to implement a permanent replacement for DACA, Congress has a history of moving slowly. By ending DACA before ensuring that another program will be there to take its place, the Trump administration has put thousands of individuals and families at risk of deportation. Deportation is a particularly risky scenario for these immigrants, not only because many will be sent to countries struggling with "Third World poverty and oppression," but because, as Republican Speaker of the House Paul Ryan explained, "these are kids who know no other country, who were brought here by their parents and don't know another home"

(Somin, 2017). The choice to end DACA is cruel, and the justifications given by the Trump administration for doing so are unsubstantiated and misleading.

Donald Trump and Jeff Sessions, along with many of their supporters, claim that illegal immigrants have “victimized” millions of U.S. citizens by taking American jobs and pushing wages down (Shear & Davis, 2017). However, there is much evidence proving that DACA has greatly contributed to economic growth in the past few years. Since DACA allows immigrants to work legally, it raises their average wage and therefore avoids the risk of immigrant workers pushing wages down for the general population. The program also allows immigrants to start businesses, thereby contributing to the U.S. economy (Bier, 2017). According to an economic analysis conducted by the Center for American Progress, “ending DACA would wipe away at least \$433.4 billion from the U.S. gross domestic product” over the next ten years (AV Press Releases, 2017). In 2016, University of California Professor Tom Wong worked with San Diego for United We Dream, the National Immigration Law Center, and the Center for American Progress to survey DACA recipients. Using the information they collected, in tandem with data collected by the U.S. Citizenship and Immigration Services, Wong calculated that by the time DACA has been completely dismantled, the U.S. will have lost 645,145 workers (Wolgin, 2016). The consequences of this extend beyond those who will lose their jobs; American employers will be forced to undergo the costly endeavour of rehiring and retraining new employees (Bier, 2017). DACA recipients have proven to be great assets to the U.S. By refusing to recognize their value, and instead viewing them as threats to national interests, the Trump administration has made a damaging and ignorant decision.

Jeff Sessions has voiced concern that failing to enforce strict immigration laws will “put our nation at risk of crime, violence and even terrorism” (Kiely, 2017). However, claiming that DACA does not adhere to strict regulation is both unfair and untrue. While DACA is certainly more compassionate than past immigration legislation, it still remains firm in its requirements. For a DACA application to be accepted, the applicant must pass a background check and have no criminal record (“Deferred Action”). DACA applications are denied to anyone with a connection to gang violence or who has committed “a felony offense, a significant misdemeanor offense, or three or more other misdemeanor offenses.” Sessions’ portrayal of immigrants as

dangerous criminals is further debunked by recent research proving that immigrants are no more likely to commit a crime than non-immigrants. In 2013, the American Sociological Review published a study showing that neighborhoods with more immigrants actually tend to experience less violence (Kiely, 2017). While there are definitely people who support the choice to phase out DACA, many others recognize the importance of the program.

The Trump administration's choice to end DACA has been met with backlash from politicians, businessmen, and the general public. The Mexican foreign ministry condemned the decision, Senator Bernie Sanders called it "one of the ugliest and cruelest decisions ever made by a president," and even conservative politicians such as Utah Senator Orrin Hatch and Speaker of the House Paul Ryan have voiced their concerns (Shear & Davis, 2017; Bush, 2017). Mr. Rowe, co-chairman of the Illinois Business Immigration Coalition, along with 132 other chief executives from around the nation, sent Donald Trump a letter arguing that ending DACA "is bad economics, bad politics and un-American" (Jordan, 2017). Numerous polls, including a 2012 Pew Research Center survey, a 2016 Global Strategy Group poll, and a 2017 survey orchestrated by NBC News have indicated that DACA is supported by a majority of the American public (AV Press Releases, 2017; Gonzalez, 2017). So while critics of DACA argue that the program is unconstitutional, by ignoring the will of the public they are undermining the democratic process, a key principle instituted within the Constitution.

Critics of DACA often focus on their own interests when condemning the program. While their concerns are arguably selfish, they are also unwarranted. There are no victims of DACA, but ending DACA victimizes thousands. DACA recipients can not be held responsible for entering the U.S. illegally because they were minors when they crossed the border. This program aims to give these children and young adults a chance to become educated and employed. Taking these opportunities away in such an abrupt and unforgiving manner strips these immigrants of their autonomy. If we wish to remain a country that can call itself the "greatest on earth," we can not allow the government to make inhumane decisions that discriminate against entire groups of people.

Citations

AV Press Releases. (January 18, 2017). *Why DACA and Policies Protecting Young Immigrants Benefit America and Should Stay in Place.*

Retrieved from

<https://americasvoice.org/avefc/daca-policies-protecting-young-immigrants-benefit-america-stay-place/>

Bier, D. (September 1, 2017). *Ending DACA Will Impose Billions in Employer Compliance Costs.*

Retrieved from

<https://www.cato.org/blog/ending-daca-will-impose-billions-employer-compliance-costs>

Bomboy, S. (September 1, 2017). *Explaining the legal arguments in the DACA controversy.*

Retrieved from

<https://constitutioncenter.org/blog/explaining-the-legal-arguments-in-the-daca-controversy>

Bush, D. (2017, September 5). Trump's Decision to End DACA, Explained. *PBS.*

Retrieved from

<https://www.pbs.org/newshour/nation/trumps-decision-end-daca-explained>

Gates, R. (2017, November 8). Robert Gates: Ending DACA Will Hurt Immigrant Troops. *The New York Times.*

Retrieved from

<https://www.nytimes.com/2017/11/08/opinion/robert-gates-daca-immigrant-troops.html>

Glum, J. (2017, August 30). Dac By The Numbers: 15 Facts About The Youth Immigration Program Trump Could Soon Shut Down. *Newsweek.*

Retrieved from

<http://www.newsweek.com/dreamers-daca-statistics-trump-deadline-657201>

Gonzalez, R. (2017, September 5). 5 Questions About DACA Answered. *NPR.*

Retrieved from

<https://www.npr.org/2017/09/05/548754723/5-things-you-should-know-about-daca>

Jordan, M. (2017, August 27). 'Dreamer' Plan That Aided 800,000 Immigrants Is Threatened. *The New York Times.*

Retrieved from

<https://www.nytimes.com/2017/08/27/us/politics/dreamers-trump-lawsuit.html>

Kiely, E. (September 6, 2017). *Spinning the Facts on DACA*.

Retrieved from

<http://www.factcheck.org/2017/09/spinning-facts-daca/>

López, G. & Krogstad, J. (September 25, 2017). Key facts about unauthorized immigrants enrolled in DACA. *Pew Research Center*.

Retrieved from

<http://www.pewresearch.org/fact-tank/2017/09/25/key-facts-about-unauthorized-immigrants-enrolled-in-daca/>

N.A. (n.d.). *Deferred Action (DACA)*.

Retrieved from

<https://unitedwedream.org/about/projects/deferred-action/>

Obama, B. [Barack Obama]. (2017, September 5). Immigration can be a controversial topic. We

all want safe, secure borders and a dynamic economy, and people of goodwill can have legitimate disagreements about how to fix our immigration system so that everybody plays by the rules. But that's [Facebook Post]. Retrieved from <https://www.facebook.com/barackobama/posts/10155227588436749>

Romo, V., Stewart, M., & Naylor, B. (2017, September 5). Trump Ends DACA, Calls On Congress To Act. *NPR*.

Retrieved from

<https://www.npr.org/2017/09/05/546423550/trump-signals-end-to-daca-calls-on-congress-to-act>

Shear, M., & Davis, J. (2017, September 5). Trump Moves to End DACA and Calls on Congress to Act. *The New York Times*.

Retrieved from

<https://www.nytimes.com/2017/09/05/us/politics/trump-daca-dreamers-immigration.html>

Shoichet, C., Cullinane, S., & Kopan, T. (2017, October 26). US immigration: DACA and Dreamers explained. *CNN*.

Retrieved from

<http://www.cnn.com/2017/09/04/politics/daca-dreamers-immigration-program/index.html>

Somin, I. (2017, September 4). The case for keeping DACA. *The Washington Post*.

Retrieved from

https://www.washingtonpost.com/news/volokh-conspiracy/wp/2017/09/04/the-case-for-daca/?utm_term=.567ecaf48a1e

Wolgin, P. (November 18, 2016). *The High Cost of Ending Deferred Action for Childhood Arrivals*.

Retrieved from

<https://www.americanprogress.org/issues/immigration/news/2016/11/18/292550/the-high-cost-of-ending-deferred-action-for-childhood-arrivals/>

The Feminist Filmmaker's Manifesto: A Ten-Point Agenda

By Mira Moreau

1. TO ACKNOWLEDGE that the film production business has historically been dominated by men and men's stories. TO RECOGNIZE that this inequality is caused by patriarchal tradition, not because women are sub-par storytellers.
2. TO STRESS that representation of women of color both in front of and behind the camera is still far less than white women. Successes for white women do not always equate to successes for women of color; therefore, education and activism surrounding racial inequality is absolutely a feminist filmmaker's issue.
3. TO STRESS that representation of gender nonconforming people is extremely sparse in film and that representation is the only way to normalize identities that stray from the gender binary. Deconstructing the gender binary is deconstructing a patriarchal system; therefore, education and activism surrounding gender identity is absolutely a feminist filmmaker's issue.
4. TO BRING ATTENTION to the entire history of women and gender nonconforming people's existence that has been swept under the carpet; telling the stories of these people breaks a persistent tradition of telling male-centric stories where women are love interests and gender nonconforming people are ignored.
5. TO NOTICE how cinematography, costuming, and character blocking are used create a "male gaze" that makes women's appearance "coded for strong visual and erotic impact" (Mulvey 837). TO REFUSE using these techniques so as to not submit to an objectifying filmmaking tradition.

6. TO CREATE stories where women are shown inhabiting a multiplicity of jobs, personalities, and appearances, as a real woman need not solely inhabit the one-sided, beautiful, domestic, heterosexual, or submissive role.
7. TO TAKE AND DEMAND credit where credit is due, as patriarchy enforces the idea that women succeed because they receive help from men.
8. TO SUPPORT other women and gender nonconforming people, especially those new to the business. It is impossible to move forward in film without the support and mentorship of higher-ups, and in order to tell feminist stories, feminists need to support the visions of up-and-coming feminists.
9. TO RESIST being pushed toward certain jobs and away from others. Women are still found more often in writing, costuming, and set designing roles and less in directing, cinematography, and editing. If a woman wants to pursue the latter, she should be supported wholeheartedly.
10. TO RECLAIM the world of filmmaking from sexual predators. Zero-tolerance of sexual harassment, manipulation, or assault is a requirement. An atmosphere where a victim will not be blamed or shamed is a requirement. An expectation that allegations will never be ignored or hidden is a requirement.

Works Cited

Mulvey, Laura. "Visual Pleasure and Narrative Cinema." *Film Theory and Criticism: Introductory Readings*. Eds. Leo Braudy and Marshall Cohen. New York: Oxford UP, 1999: 833-44.

Never Go to Bed Hungry

By Isabella Julian

is the bad wolf's motto, you know,
the one with the big blue eyes
that follow you when you walk by.
No one is safe from the big bad wolf,
since his appetite is too strong to hide.

Never go to bed hungry, people say,
because he lustfully waits deep in the shadow
so he can grab you before
you even realize it is too late.

Never go to bed hungry, the wolf
says to me, or else you will always
crave the sweetness of desire that's
richer than wine and more delicious than cake.
It will never let you sleep, he says to me,
because hunger is the weakness of
every little sheep.

Never go to bed hungry, his eyes
whisper to me as they trace the
red outline of my body. I feel
their hands as they undress my skin, ripping
away my dress made of sheep's clothing.

Never go to bed hungry, he believes
is my desire and why I wear a chrisem dress
that shows my curves and chiseled frame.
Why else, he questions, would I wear something
that begs him to make me full.

Go to bed hungry, I scream as
he pounces at my body running
down the endless path that only leads
to despair. I wish my parents taught me
to never take the path, instead
of teaching me to never talk
to strangers, since strangers

don't care that this little red
is not hungry before bed.

I should have gone to bed hungry, I think
as I am forced into the dusty
ground of the path, where I lie,
ready for my slaughter. I hope it
will be quick and painless like the fairy
tales say, but I know deep down
this night will always haunt me;
this night where the wolf decided
to fill me.

Never go to bed hungry, the wolf
laughs in my face as he
gets down on all fours, ready to
take away the childhood that I first
brought with me when walking down
the now blood-stained path.

Never go to bed hungry, my parents say
to me as I push away
my untouched cake and wine
that night. They will never know
that my lack of appetite is
because the wolf's was
large enough for the both of us.

Go to bed hungry, I cry
as I lie down in bed.
I wish I had known, I wish
I could have realized
to never have worn that dress
down the unforgettable path.

The Female Athlete Triad: Prevalence and Effects

By Denise Ibarra

The Female Athlete Triad is a syndrome that consists of 3 factors: low energy availability (with or without disordered eating), amenorrhea or oligomenorrhea (menstrual dysfunction), and decreased bone density. Amenorrhea refers to the absence of a regular menstruation cycle in females and oligomenorrhea to a menstrual cycle occurring every 2-3 months. Both are most prevalent amongst participants of sports participants of sports which promote a 'perfect' body type, specifically those that idealize lean bodies. This culture can lead young women to participate in risky behaviors that can predispose them to the multiple constituents of the triad. Furthermore, the triad raises the likelihood of contracting a stress fracture by a large percentage in this population. In long-term cases, the syndrome can cause copious amounts of consequences that may hinder good health in these individuals; a branch of study which has been neglected in past years.

In a study conducted at Ithaca College, a qualitative survey was performed that targeted females between the ages of 18-23 to view the prevalence of particular aspects of the triad present within female college distance runners. The participants were asked to answer a set of questions that included BMI, dietary restrictions, amount of running mileage per week, incidences of stress fractures, and whether any menstrual dysfunction is present. The study included female distance runners of Division 1 and III.

The survey allowed researchers to review specific cases and study the correlation of dietary restrictions, menstrual status, BMI, and the incidence of stress fractures amongst individual female runners. Moreover, with a literary approach, this research also focused upon the hormonal and long-terms effects of the components of the triad. This is a topic that has often been deemed insignificant and unthreatening to female health within the world of pathology.

In order to prevent the female athlete triad from becoming a threat in the world of epidemiology, it is important that both the general public and practitioners become

aware of the potent and harmful effects of this syndrome. The female athlete triad can consume an individual hindering both the beneficial effects of endurance training and the social benefits of being on a competitive college team.

The purpose of this research was to further understand the qualities of the female athlete triad; a syndrome with high prevalence within the world of athletics. In addition, further research of the long-term effects of the components was performed, and resulted in some significant findings.

Background:

Female participation in sport has changed dramatically over the course of the last century. With the change of societal standards following the commencement of the 20th century, the role of women in the world of sports has grown to be more significant. The Summer Olympic games of 1928, which marked the highest level of female participation in track and field, was a landmark for women athletes. (Brian & Nattiv, 2016). However, it wasn't until 32 years later that women were allowed to compete in distances greater than 200 meters. With the passage of Title IX in 1972, came greater opportunities in the world of sports for women; women and men were required to be able to participate equally in sports. Despite this, there were great obstacles that were yet to be overcome regarding the participation of women in certain aspects of sport, particularly in distance running. The Amateur Athletic Union and the International Olympic Committee were slow in offering opportunities for participation to women despite the laws that were passed for equality

In the decades following the passage of Title IX in the U.S., female participation in endurance sports spiked exponentially. In the year 1980, only 10% of marathon finishers in the country were females. In 2013, this number expanded to over 40%. The increase in participation, however, does not only pertain to national standards. In the Summer Olympic games of 2012, women and men finally achieved a 50:50 ratio of participation in track and field. Furthermore, women outnumbered men in the Olympic marathon 118 to 105 (2016). At the youth levels, track and field has become one of the most popular organized sport for female participation following the turn of the century.

Despite the great changes that society has made in enabling the participation of women in sport, societal ideals continue to have a great effect on the status of female

athletes. These societal influences prevent men and women from reaching equality in the world of sports. The combination of societal influences and increase in competition has enabled the creation of a sports culture that promotes an ideal body image. This culture is prevalent in many endurance sports for which a specific image is deemed as most desirable for success in competition. The creation of this culture has led to the rise of a syndrome known as “The Female Athlete Triad.”

The Female Athlete Triad is not only prevalent in endurance sports, but in other sports that uphold a standard for female bodies (dancing, gymnastics, etc). The promotion of these ideals create an environment that often causes female athletes to acquire the female athlete triad syndrome.

The acquisition of the components of the female athlete triad can pose grave health risks for female individuals. Each of the 3 factors of the triad poses its own health risks, but the combination of all strengthens the potency of the consequences that it may inflict upon women. The first factor, disordered eating, differs from the criteria that other severe eating disorders, such as anorexia nervosa or bulimia nervosa, are composed of. An individual’s disordered eating patterns need not fulfill the specific criteria of anorexia or bulimia to be classified as such. However, the disordered eating of athletes may result in malignant consequences in the long-term. However, many elite athletes partake in dieting methods in order to enhance performance before competition. It has been estimated that up to 70% of elite athletes partake in some sort of dieting routine prior to competition (Ackerman & Nazem, 2012).

As a result of the extreme dieting methods used by many athletes, lower energy is available for natural bodily functions. As young women, appropriate nutrition intake is vital due to the energy requirements of menses. The lack of appropriate nutritional intake may cause a lack of enough energy necessary for normal physiologic function. The menstrual cycle of women requires a great amount of energy expenditure. When there is low energy availability, the body enters what is referred to as “starvation mode,” in which the body must decide what functions are most necessary for survival. Due to the lack of necessity of the reproductive system in survival, when the body needs to allocate low energy into various bodily systems, it is from this system that the body withdraws energy expenditure. This withdrawal leads to the presence of secondary amenorrhea (2012).

The acquisition of amenorrhea in young active individuals then leads to other health consequences. Through the body's physiological cycles, menses leads to the deposition of calcium in a female's bone, contributing to the maintenance of a healthy bone density. In the female long-distance runners who have suffered from secondary amenorrhea, or even oligomenorrhea, the bone density seems to decrease enough to pose a high risk of injury. For this reason, it is common for young women to attain stress fractures due to the combination of high intensity training and a lack of monthly menstruation.

The presence of the syndrome is not exclusive to elite athletes. The triad has been noted in female athletes from adolescent ages through the elite levels. Included in this subgroup of the population are distance runners of the collegiate level, where high competitive stakes are also found. College-aged women are subject to the influences of body image, and are also in a high competition level where the drive to perform well is heightened.

Methods:

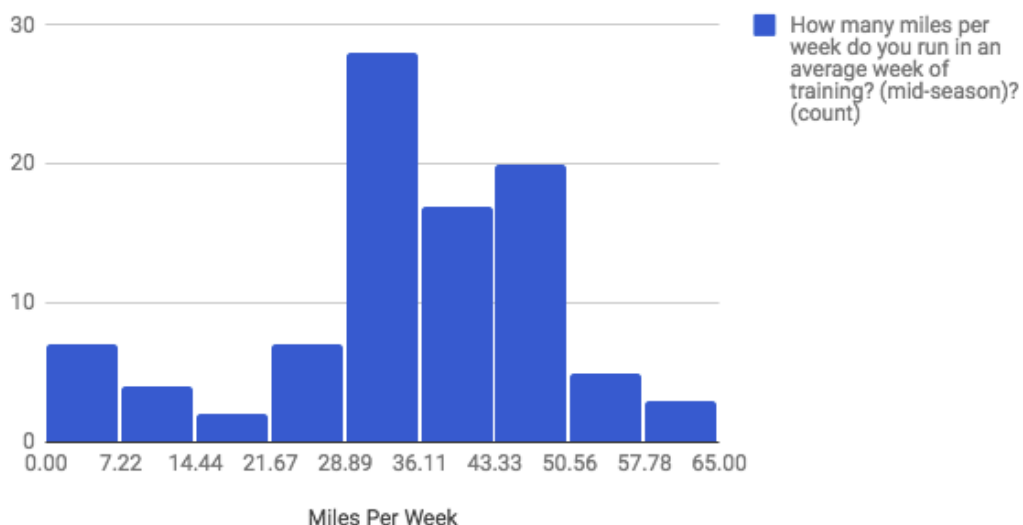
In order to understand the prevalence of the female athlete triad amongst long-distance runners in a collegiate level, a qualitative study was performed and sent out as a questionnaire filled with a variety of different questions. The study assessed the type of training, special eating restrictions, the type of menstruation present, BMI, and whether the individual has suffered from stress fractures. The study included a variety of different cross country teams, these included a variety of different Division I and Division III schools: Ithaca College, Cornell University, University of Sacred Heart, University of Hartford, SUNY Oswego, SUNY Geneseo and Rochester Institute of Technology.

Results:

The survey received a total of 108 responses from female athletes in the Northeastern Region of the country. The study of this particular group allows us to compare the data from studies of elite female athletes to this specific subgroup of the population and view the factors that may affect components of the triad.

Training Regimen:

How many miles per week do you run in an average week of training?

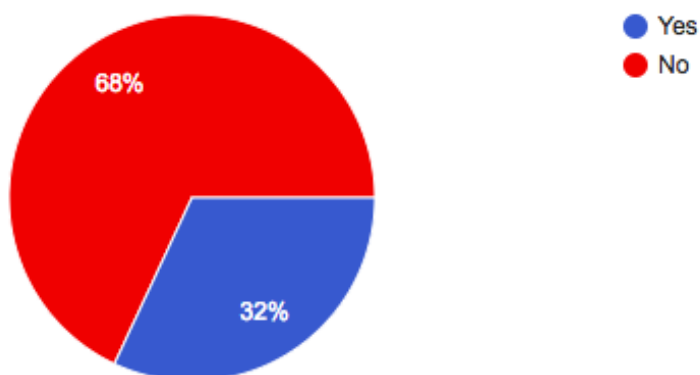


The findings show that most collegiate female endurance runners tend to average 35.2 miles per week, with some outliers lying below 20, and some training regimens above 50 miles per week. This is all likely due to the difference in training theories that arise from the different divisions of collegiate competitiveness that the survey responses contained. The specific amounts of training allow for an appropriate estimation of the energy expenditure which the female athletes are exposed to in a collegiate level.

Dietary Restrictions:

Coupled with the intensity of the training, an approximation of the prevalence of dietary restrictions (disregarding sensitivity or choice), was desired in order to obtain an idea of the factors that may predispose an individual to injury. The data obtained for prevalence of dietary restrictions is as follows:

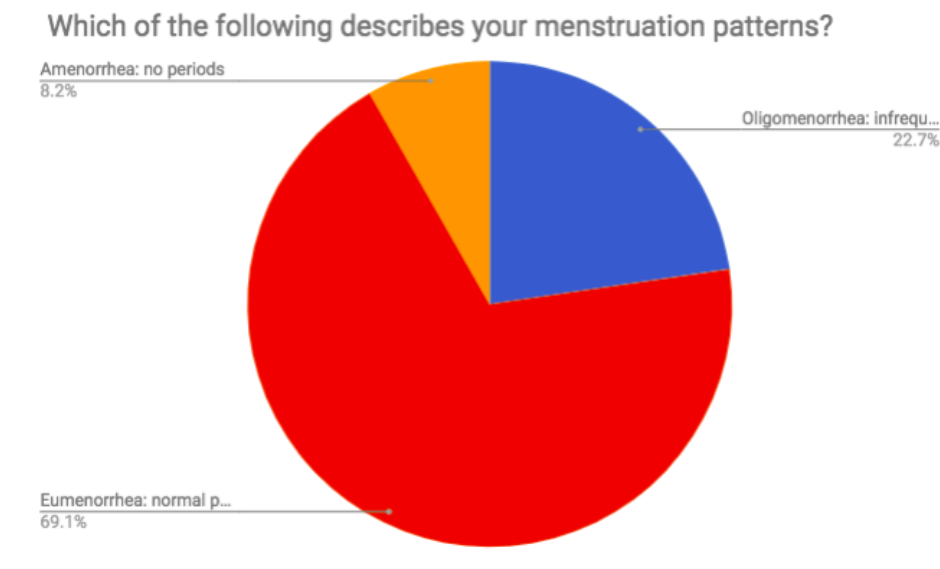
Count of Do you have any special dietary restrictions?



The subjects were asked to list the dietary restrictions if present, these included: vegetarian (most subjects reported vegetarianism as their dietary restriction), vegan, gluten free, lactose, and some had no sugar or refined products per choice.

Menstruation Patterns:

Without an appropriate balance of energy intake and training intensity, a female body may have difficulty maintaining homeostasis of the entirety of body systems. For this reason, a manifestation of low energy availability is presented as an absent or infrequent period. The next question of the questionnaire asked the individuals to respond with the status of their menstruation regularities. The respondents were asked to classify their menstruation patterns in one of three categories: eumenorrhea (regular periods), oligomenorrhea (infrequent periods; every 2-3 months), or amenorrhea (no presence of regular periods). The following chart shows the results of the collegiate study:

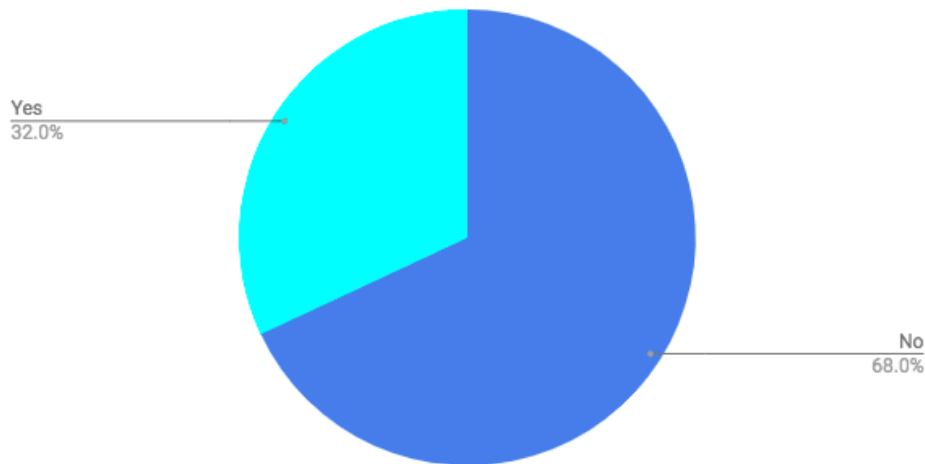


An amenorrheic population of 8.2% was found, but was exceeded by the oligomenorrheic population of 22.7%. Since an absence of regular menstruation can predispose an individual to decreased bone density, subjects were asked to declare whether they have suffered from a stress fracture in their training.

Stress Fractures:

The presence of a stress fracture in a runner may be the consequence of a sudden or drastic increase in training, or it may be caused by inadequate dietary ingestion. First, we asked the respondents to answer whether they have suffered from a stress fracture. As a follow up, we asked those who have suffered from a fracture to specify the placement of the fractures. The area of the bone fracture will dictate whether the area of weakness is a common stress fracture area, or whether the bone was severely weakened in order to have become fragile enough to suffer a stress fracture. The responses are as follows:

Have you ever had a stress fracture during your college or high school years?



If the subjects responded as yes, then they were asked to additionally state in what bones they have gathered their injuries. These included:

Tibia	18
Femur	9
Ilium	3
Sacrum	2
Fibula	3
Pubis	3
Talus	1
Vertebrae	1
Metatarsal	8
Navicular	1

Cuneiform	1
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It is important to note that certain individuals have experienced stress fractures multiple times, thus marking them as prospects for further examination as potential individuals who have acquired aspects of the triad. In order to further investigate the qualities of these individuals, there were additional questions regarding the weight and height of the female runners. With this information, we were able to withdraw important information about the qualities of each female individual. Certain subjects portrayed the potential to have acquired one of the grave effects of the triad: decreased bone mineral density. This instigated further research regarding the cause-and effect relationship of menstrual dysfunction and osteopenia.

Subject X:

Of the subject population, the amenorrheic individuals are at highest risk of acquiring systemic secondary pathologic consequences. Amenorrhea in individuals causes decreased bone density and predisposes females to stress fractures. One individual who suffers from amenorrhea has showed to portray a progressive instance of decreased bone density, predisposing her to a stress fracture. One particular individual possessed the following data:

Miles per week: 15

Dietary Restrictions: None

Menstrual Status: Amenorrheic

Stress Fracture Incidence: Yes

Location: Tibia, Femur, Cuneiform, Pubic Ramus and Sacrum.

The high incidence of stress fractures in this individual portrays an additional condition that exists due to the lack of eumenorrhea. This amount of injuries is abnormally high with a relatively low amount of training mileage. This combination shows the possibility of the consequences of the triad manifesting themselves in this individual. Within the medical field, it is important to acknowledge the reoccurrence of injuries and examine an individual's background in order to pinpoint potential causes. In this individual, the manifestation that is present is decreased of bone mineral density. In order to study this further, we may look at other studies to test the theory of the triad affecting bone density in females.

Physiologic Manifestations:

In a study published in the *Clinical Journal of Sports Medicine*, a group of researchers in the Japan Institute of Sports Sciences set out to determine whether an incidence of secondary amenorrhea (a lack of menstruation for 3 or more months) caused a change in bone mineral density (BMD) of female athletes in their 20s. The research methods utilized included medical information regarding the individuals' past and current menstrual irregularities, training, history of stress fractures, and hormone results extracted from blood tests. Bone mineral density was studied through a dual-energy x-ray absorptiometry of the lumbar spine. The study results found that 18.6% of the female athletes that were recruited for the study had low BMD. Independent Correlation factors for low BMD were studied. Findings concluded that secondary amenorrhea and present body mass index were independent correlation factors for the presence of low BMD in females in their 20s (Nose-Ogura, Yoshino, Dohi et al, 2012).

In Seattle, Washington and surrounding communities, a study was designed by a group of scientists to analyze a generalized decrease of bone mass at particular skeletal sites in amenorrheic athletes in comparison to healthy eumenorrheic females. The study was case-controlled and included athletes between the ages of 17 and 39. The females recruited were labeled as amenorrheic if they experienced fewer than 2 menstrual cycles in the past 12 months or none in the last 6 months. They were considered eumenorrheic if they had had 10-13 menstrual cycles in the past year. This criteria was then confirmed by testing the subjects for estradiol and progesterone levels. The outcome measure utilized to identify the results was dual-energy x-ray absorptiometry (Chestnut & Rencken, 1996).

The study found that the athletes who suffered from a lack of menstruation had significantly lower BMD in the lumbar spine, femoral neck, trochanters, Ward triangle, intertrochanteric region, the femoral shaft, and tibia. These are areas in the body that tend to bear larger amounts of weight and might ultimately result in an injury. The decrease in bone mineral density of an individual female does not usually occur until she reaches menopause, predisposing the individual to further bone malignancies at a young age (i.e. osteoporosis, osteomalacia, etc.). The effects of amenorrhea in a female of her 20s may have severe consequences involving the quality of life and affecting

activities of daily living. Ultimately, this epidemic is a public health risk that should be acknowledged and acted upon by caregivers of the healthcare system (1996).

Public Health Significance:

The consequences of the female athlete triad are grave and is a field of study that is still rapidly growing. Despite the recent spike of female participation in sports over the past few decades, awareness of the syndrome is still not well-known. A study performed in the United States published in the *Journal of Performance Enhancement and Health* in the year 2012 conducted a study involving physician's knowledge of the triad. The study found that only 48% of practitioners in direct contact with female athletes could correctly identify the 3 components of the triad, and only 43% of physical therapists and 38% of athletic trainers were aware of the syndrome. In addition, the study found that only 11% of general practitioners, 11% of physical therapists, and 0% of medical students would feel comfortable and confident in treating an individual with the female athlete triad (Khana, Székely, Wheatley, 2012). This is most likely due to the fact that the syndrome has both physiological and psychological components.

It is vital to prevent the rapid spread of this syndrome in a society where female participation in sport is increasing steadily. In order for this to occur, it is necessary to include a larger public health effort into combating this complex syndrome that is evidently very present in specific female athlete populations. The long-term effects of this syndrome could also prevent large expenditures within the healthcare system on the national scale, due to the large impact that chronic diseases have upon programs like Medicare. Furthermore, overall health encompasses not only the physiological well-being, but the mental aspect as well. In a syndrome such as the Female Athlete Triad, the aspect of health must not only be approached as the physical, but especially the psychological components which need to be addressed in order for the individual to progress back to health. Collectively, the increase in awareness and knowledge of the Female Athlete Triad within the medical field will enable providers to have the capacity and confidence to treat individuals with the syndrome and ultimately acknowledge red flags in order to prevent the prevalence of the condition from proliferating.

Works Cited

- Kim, B Y, and A Nattiv. "Health Considerations in Female Runners." *Physical Medicine and Rehabilitation Clinics of North America*, U.S. National Library of Medicine, Feb. 2016.
- Nazem, Taraneh Gharib, and Kathryn E. Ackerman. "The Female Athlete Triad." *Sports Health*, SAGE Publications, July 2012.
- Nose-Ogura, S, et al. "Low Bone Mineral Density in Elite Female Athletes With a History of Secondary Amenorrhea in Their Teens." *Clinical Journal of Sport Medicine : Official Journal of the Canadian Academy of Sport Medicine*, U.S. National Library of Medicine, 27 Mar. 2018.
- Rencken, M L, et al. "Bone Density at Multiple Skeletal Sites in Amenorrheic Athletes." *JAMA*, U.S. National Library of Medicine, 17 July 1996.
- Wheatley, Sean, et al. "Expanding the Female Athlete Triad Concept to Address a Public Health Issue." *Performance Enhancement & Health*, Elsevier, 21 Apr. 2012.

A Question of Legitimacy: The Creation of Cheng Shih's Floating Empire

By Naomi Hanson

"Conquerors are deemed successful robbers, while robbers are unsuccessful conquerors."¹ The pirate queen Cheng Shih highlighted the thin line between legitimacy and illegality by becoming the head of such a large pirate operation that it rivaled the Qing dynasty. Shih was the leader of the largest pirate fleet in history, and was in control of thousands of men. She became so powerful that the Qing dynasty had to call on the assistance of the Portuguese and English navy, which was still not enough to defeat her. Cheng Shih created—politically and socially—a floating confederation, which threatened the existence of the Qing dynasty. While she ran an extralegal body, her legitimacy as ruler was drawn from a social contract between the thousands of crewmen and herself. Cheng Shih's success and legitimacy as a pirate came from her creation of an ad hoc government, including an extensive bureaucracy and strict discipline.

Our information on Cheng Shih is derived mainly from three sources. Two of which are captivity narratives; *A Brief Narrative of My Captivity amongst the Ladrones* by Richard Glasspoole, and *Further Statement of the Landrones on the Coast of China*, which includes a captive narrative by J. Turner. Both of these accounts provide information on the daily life of the pirate ship, as well as the larger political maneuvers, and both are European accounts of Chinese piracy, forcing the reader to be aware of any racial biases. The third is an eastern source by Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810*, which gives an account of the peak of piracy while Cheng Shih was chief. These three sources provide accounts that support each other and give an insight into the character and choices of Cheng Shih. Life in her fleet is best understood in two facets, political and social. The political structure of the ship helped to shape the social culture, and the two cannot be separated. They informed each other to create a unique and complex pirate culture. Through both facets, Cheng Shih's fleet acted as a governmental body.

¹ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810*, trans. Charles Neumann (London: The Oriental Translation Fund, 1831) 1

At the turn of the 19th century, Cheng Shih had created an extensive pirate fleet in which she was the chief who presided over a large bureaucratic organization. Her success as a pirate peaked between the years of 1801 and 1810. By 1805 she controlled 400 junks² and between 40,000 and 60,000 men. In the years to follow, her organization grew larger than ever before, thanks to her strong leadership.³ Piracy had long roots among the people living on the coast of the South China Sea, with cities like Macao and Canton as centers of frequent pirate activity. Chinese piracy at the turn of the nineteenth century was the product of the Tay Song⁴ rebellion in Vietnam. The rebellion utilized a large privateering force, and when it ended, a substantive unemployed mass of sailors turned to the most lucrative choice, piracy. Out of this mass came new pirate leaders, such as Cheng I, the husband of Cheng Shih.

Cheng I was the head of the pirate bureaucracy and developed a reputation as an honored and revered pirate leader. Cheng Shih was his favorite prostitute and in 1801 the couple was married and she was brought on his ship. After their marriage the couple worked as partners⁵. However, it was not until his death, around 1807, that she became the most powerful woman in the south of China. His death caused a power vacuum in which other leaders within the fleet vied for the position as ultimate Chief, but Cheng Shih quickly established herself as the new leader. After her succession of the pirate fleet she established herself the true “Commander of all the squadrons together” and saw immense growth in number of ships and men.⁶

Different captive narratives give evidence of the growth that the fleet experienced under the leadership of Cheng Shih. In 1803, a few years prior to her inheritance, the fleet had around 200 vessels. In 1806, J. Tuner, captive among the pirates, relates their numbers as far higher than 200 vessels: “as nearly as I can

² Junks were traditional Chinese ships which became extremely popular in the Song dynasty (960–1279).

³ Dian Murray, “Cheng I Sao in Fact and Fiction” in *Bandits at Sea: a pirate reader*, ed. C.R. Pennell (New York and London: New York University Press, 2001) 253-282

⁴ Rebellion from 1774 to 1802 over the nature of state in Vietnam. Rebellion threatened to erase Confucian establishment in Vietnam and leaders of the rebellion employed Chinese pirates to cause havoc.

⁵ Dian Murray “One Woman’s Rise to Power: Cheng I Wife and the Pirates” *Historical Reflections* Vol 8. n. 3 (1981)148-150

⁶ Yuan Yung Lun, *History of The Pirates who Infested the China Sea* 13

conjecture, between five and six hundred sail.”⁷ Turner also relates the amount of men stating that the crew varied depending on ship size, with the larger ships holding an upwards of a hundred men and the smaller ships with crews around thirty men. In the end, Tuner estimated around twenty-five thousand men in the entirety of the fleet.⁸

Mr. Glasspoole, another captive, recorded a vastly different amount of ships. In 1809 he estimated about 800 large vessels, about 1,000 small vessels and around 70,000 men in the entire fleet.⁹ Glasspoole comes much closer to accurately recording the vastness of the empire, as the Canton record also lists the amount of men in the fleet as 70,000 men.¹⁰ The difference in years between Turner and Glasspoole gives evidence of the immense growth experienced under Cheng Shih. This size is daunting, especially compared to the western Caribbean pirates, whose golden age was between the years of 1716-1726. Bartholomew Robert is considered by many historians to be the most successful Caribbean pirates, and he personally only controlled four ships.¹¹ Roberts could not even compare to the size of Cheng Shih’s fleet. Cheng Shih saw immense growth within her fleet and used a well-crafted bureaucracy and a strict discipline in order to control such a large amount of men.

Her unquestioned control over her vast empire was due in large part to the multi-layered bureaucracy that she maintained. Having such a extensive internal structure was unique to Chinese Piracy, and her fleet is a great example of its efficiency. This infrastructure modeled the structure of a government and due to its arrangement and its size, her fleet rivaled that of the existing Qing dynasty. This central structuring started with the main squadron, the Red Fleet. These are the ships that Cheng Shih sailed on and commanded the entire fleet from.¹² The other five squadrons — the yellow, the green, the blue, the black, and the white — all took commands from the Red Fleet. Within each colored squadron there were sub squadrons as well; for instance, Cheng

⁷ Dalrymple, *Further Statement of the Landrones on the Coast of China* (London: Land, Drling and Co. leadenhall-street, 1812) 63-65

⁸ *ibid* 63-65

⁹ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates : being the narrative of Mr. Richard Glasspoole of the ship Marquis of Ely: describing his captivity of eleven weeks and three days whilst held for ransom by the villainous Ladrone of the China Sea in the year 1809: together with extracts from the China records and the log of the Marquis of Ely: and some remarks on Chinese pirates ancient and modern* (London: Golden Cockerel Press, 1935) 55

¹⁰ “Canton consultations” referenced in Dian Murray *Cheng I Sao in Fact and Fiction* 259

¹¹ *Britannica Academic*, s.v. “Bartholomew Roberts,” accessed November 13, 2017

¹² Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 5-7

Shih's right hand man, Chang Pao, managed his own group of ships, although, ultimately, they were still under the control of the main chief. There was a hierarchy of leaders aboard each ship, as related in Turners account:

Each vessel has a captain [...] whose authority is sufficiently respected by the crew. The management of the sails, and steerage of the vessels, are instructed to two or more experienced hands, whose orders on those points are attended to and executed by the others. Under them are three or four men similar to our boatswain's mates, whose business it is to keep people on deck and at their duty.¹³

At the very top of this hierarchy was the commander in chief herself, Cheng Shih, whose legitimacy as a leader was derived from maintaining a strong network of men loyal to her.

By sustaining this chain of command, Cheng Shih built herself as the sole head of this large government-like structure. She drew her legitimacy from her own bureaucracy, and used different levels of command to ensure that there would be no dissent. In this structure, respect and reverence played an important part in its effectiveness. Influenced by the ideals of Neo-Confucianism, specifically respect for those above, the system of multiple leaders created a place of reverence for those at the top of the leadership train. Crewmen felt allegiance to their captain and their captain would owe loyalty to Cheng Shih, allowing her to pull legitimate power from her bureaucracy.

Loyalty kept her crew and her other captains in line. The captains' loyalty to her was the only thing that controlled inter-ship warfare, as related in the *History of Piracy*: "Ever since Pao was made Chieftain there had been altercations between him and O po tae. Had it not been out of respect for the wife of Cheng Yih they would have perhaps made war against each other."¹⁴ Sheer allegiance to Cheng Shih kept order among powerful men within her fleet. Loyalty of her captains was crucial to the structure of her ship, and her appointment of captains was strategic. For instance, she appointed her adopted son, Chang Pao, to be second in command. He owed her family allegiance and

¹³ Dalrymple, *Further Statement of the Landrones on the Coast of China* 67

¹⁴ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 65

Cheng Shih ensured a second in command she could completely trust. By choosing leaders, implementing layered rule, and demanding respect, Cheng Shih controlled every man in her fleet.

Having a pirate organization was inherently treason against the Qing dynasty, but it was profitable and many men came to join the ranks of the pirates. She appealed to different types of men, both men desperate for money and men who were against the Qing dynasty. She also had well entrenched methods for gaining and retaining members. Retention of crew members was vital to her success, as her legitimacy as a chief was derived from the consent and respect of her crew, and her ability to secure the services of so many men gives credit to her leadership and her methods.

She recruited her men in two main ways. First, men would volunteer to be crewmen, and they came in scores: "Their numbers are kept up... Chinese who come daily from different parts of the coast to join them."¹⁵ What drove so many men to join the ranks of these pirates? Evidence from captivity narratives suggests that the thousands of crewmen who joined the pirate's service were in reaction to the actions of the Chinese government. In Glasspoole's narrative he writes: "The Landrones [pirates] are a disaffected race of Chinese, that revolted against the oppressions of the Mandarines [The Qing Dynasty] [...] The oppressive state of the Chinese has the effect of rapidly increasing their [the pirates] numbers."¹⁶ Thousands of men, angry at the state of their government, became pirates and the disapproval of the current dynasty allowed Cheng Shih to keep her numbers high. Turner's narrative makes a distinction between the varieties of men from different socioeconomic statuses that join the pirate ranks:

Some of these were, doubtless, vagabonds, instigated by poverty and idleness to embrace this criminal mode of life; but many were men of decent appearance and some of them brought money with them. The only reason I ever hears them assign for their conduct, was, that the Mandarins of their district were unjust and that they came there to avoid their oppressions. These men are at liberty.¹⁷

¹⁵ Dalrymple, *Further Statement of the Landrones on the Coast of China* 65

¹⁶ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 54

¹⁷ Dalrymple, *Further Statement of the Landrones on the Coast of China* 66

Turner accounts that some pirates are merely criminals, but others that came from tiger stations in life were “men at liberty,” men who chose this way of life as a way to revolt against the Qing Dynasty. Not only were these men driven by political anger rather than poverty, but they also had some degrees of freedom. Having a ship full of crewmen dissatisfied with the current government, pushes the idea the Cheng Shih’s empire was a parallel institution that functioned as an oppositional ad hoc government. Cheng Shih’s empire also provided an outlet to rebel against some Neo-Confucian ideals, so those who did not benefit from those beliefs used piracy as a tool to voice their disapproval.

Disciplined recruitment practices allowed Cheng Shih to control thousands of angry men, and grow her anti-Qing Empire. Once men joined Cheng Shih’s empire there were specific initiations they had to undergo. New crew members were required to take an oath, pledging their allegiance to Cheng Shih and the Fleet “would allow them to become Ladrones, if they agreed to take the usual oaths [...] three or four of them refused to comply, for which they were punished...till they died or complied with the oath.”¹⁸ The oaths were required of all those who would go on the ship, including captives. Captives joining the pirate fleet had specific procedures as well. Captured crews that did not resist during boarding were allowed to take the oath and join, but if a crew showed resistance and fought, they would be punished. If captives were not ransomed, and behaved well during their time as a captive, they were allowed to take the oath as well. Cheng Shih’s oath was one of her entrenched procedures that allowed her bureaucratic system to be controlled efficiently.

This centralized control and well regulated procedure created the outline for the growth of an incredibly powerful empire, and she used strict discipline to keep her domain. Her control extended past her ship as many costal villages paid tribute to the pirates. Fishermen would supply them with food so they never had to go hungry. “Unless villagers produced either a certain sum of money, or a quantity of rice the pirates inevitable burned their houses.... several villages, and even towns on the coast, paid the pirates annual tribute.”¹⁹ Villages would bargain with the pirates, food and

¹⁸ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 41

¹⁹ Dalrymple, *Further Statement of the Landrones on the Coast of China* 24

loyalty in exchange for protection and the guarantee that their villages would not be burned down.

The *History of the Pirates who infested the South China Sea* relates a particularly gruesome episode of villagers who refused to pay tribute. The pirates came to the small villages of Tsze ne and San Shen demanding thousands of pieces of money. Villagers were split on what to do; half knew about the violence of the pirates and wanted to pay, while the others believed that the pirates would always come back if they submitted. In the end the villages decided to resist, which led to a horrible episode of violence:

The pirates, seeing that the villagers would not pay tribute, became enraged, and made a severe attack during the night...the pirates took possession on the mountain in the rear they then threw the frightened villagers into disorder, pursed them, and killed about eighty...the villagers were from the beginning very much alarmed for their wives and daughters; they collected them in the temple and shut it up. But the pirates being victorious, opened the temple and carried the women by force all away on board ship...the villagers lost about two thousand persons. What a cruel misfortune! it is hard indeed only to relate it!²⁰

This story, even hard for the historian to relate it, is one out of many cases listed in the source of the extreme cruelty of the pirates. They showed no mercy for women or children. This case suggests the daunting size of the landing force as well, seeing as they were able to carry away two thousand people. This was a “cruel misfortune” indeed. Cheng Shih used violence to demand tribute all along the coast of the South China Sea. This harsh action helped to establish her network, solidify her reputation, and legitimize her as a terror. Having a network of tributaries parallels a government. This was one of the strategies dynasties used to control far away areas, such as the famous voyages of Zheng He, to establish an extensive overseas network of tributaries to the emperor. Cheng Shih and the pirates drew upon the same strategy of loyalty, even when she had to use violence to support it.

Loyalty was not always forced with violence, tributes who yielded with her wants were rewarded. “She was astute enough to gain the favor of the country people in certain coastal districts, and decreed that the friendly villages must be paid for all

²⁰ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 32-35

wine, rice and other goods they delivered. Any pirate who infringed this order was beheaded.”²¹ Villages could also count on the pirate’s protection, since they were practically the sole threat to coastal villages. Loyalty, both forced and persuaded was used by Cheng Shih to control her landed dominion.

Her use of force to ensure loyalty did not stop on land. Aboard her ship Cheng Shih used violence and procedure to institute control over the coast. Like pirates in the Caribbean, Cheng Shih had her own version of ‘articles.’²² There were three main rules; first, if a crew member transgressed the bars²³ his ears would be perforated and if he did it twice he would be put to death²⁴. Second, no one should take stolen goods for themselves. Finally, no one should force themselves upon captive women, to use violence against a female or wed a woman without her permission was punishable by death. These rules were enforced with severe punishment, usually torture or death. Having an objective and unwavering procedure to deal with insurgents on her ships, Cheng Shih maintained an obedient crew. Combining respect and fear allowed her unquestioned control.

Strict financial procedure helped to centralize internal control. “Whatever money is found in their prizes, is brought to the commander of the squadron as also the sums received for the ransom of the prisoners and goods. Of this a trifle is given to the immediate captors; part is reserved to purchase provisions and other supplies.”²⁵ The rules even create a general fund, “All [items] shall be registered, and the pirate receive for himself, out of ten parts, only two; eight parts belong to the store house, called the general fund; the penalty for taking anything out of this general fund shall be death.”²⁶ The collective good was enforced so strongly that “nobody dared to have private goods.”²⁷ Personal property was not a part of the pirate culture, crew members were allowed to have private possessions, but at their own risk. This system sent the majority

²¹ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 12

²² The articles of a ship were the rules created at the beginning of each voyage that pirates would swear their loyalty to

²³ A term meaning to go privately ashore

²⁴ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 11

²⁵ Dalrymple, *Further Statement of the Landrones on the Coast of China* 72

²⁶ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 11

²⁷ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 15

of wealth to the central powers and strengthened the internal structure, resulting in obedience among the crew and an efficient system.

Cheng Shih allowed no dissidence on her ships, and strict punishments were put in place for captives as well. Most captives were ransomed off, as the cases of Richard Glasspoole and J.M. Turner. However, not every captive made it too being ransomed off, if there was any resistance from captives they were punished brutally:

their hands were tied behind their back, a rope from the mast-head wove through their arms & hoisted three or four feet from the deck, & five or six men flogged them with three rattans twisted together 'till they were apparently dead; then hoisted them up to the mast-head and left them hanging nearly an hour, then lowered them down and repeated the punishment.²⁸

Good behavior was about the only thing that could protect a captive from any punishment, as any signs of resistance resulted in cruel retribution. Some other forms of punishment included nailing captives feet to the deck²⁹ and even a case of cannibalism.³⁰ Force was a method used by Cheng Shih to ensure that her rule was not questioned. She herself used force in battle and proved herself an active leader demanding respect.

Evidence from the primary sources suggests that her main role was to act as the administrative head. They constantly note other generals following her orders, however this does not reflect that Cheng Shih was merely a distant authority figure:

The wife of Ching Yih then order the pirates to go up the river; she herself remaining with the larger vessels in the sea to blockade the different harbors or entrances from the sea side; but the government officers made preparations to oppose her. There were about this time three foreign vessels returning to Portugal. Yih's wife attacked them, took one vessel, and killed about ten of the foreigners.³¹

²⁸ Richard Glasspoole, *Mr. Glasspoole and the Chinese pirates* 41

²⁹ Dalrymple, *Further Statement of the Landrones on the Coast of China* 52

³⁰ This is the only case of cannibalism directly mentioned in the captive narratives. This could very well be false, and based out of European views of the Chinese, heavily influenced by Orientalism. Dalrymple, *Further Statement of the Landrones on the Coast of China* 56

³¹ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 55-57

Her power is both pulled from a bureaucratic system and from proving her worth in battle. She led by example, an important characteristic of rulers in Confucianism. The captive narratives would paint Cheng Shih as a woman who ruled from the top, enforcing rules and systems but without being an active pirate, who did not participate in fighting. However, her time in battle proved her to be a well-rounded pirate queen.

Apart from the procedures and rules that Cheng Shih enforced, social life still existed on board her ships. Within a system that demanded obedience and efficiency still existed drunkenness, drugs, disease, and death. Pirates even had retreats where “they made a great noise during the night with crackers and their gongs, where heard at a great distance. At day break the flags were spread out, and the drums sounded; they were cheerful the whole day; they eat and drank and made a great noise.”³² Their social atmosphere was not separated from landed institutions. These ships were home for families and religion; accommodation for those institutions added a second layer to the ship’s broad society beyond just political structure. Adding a social responsibility provided another layer to the complexity of the pirate experience; not only does the pirate fleet politically resemble a government, but it provides the social aspect of an organized society as well.

Having families on ships changed the culture of piracy. Without families, namely wives and children, western piracy saw the growth of a fraternity that replaced the typical family structure. Crew members mattered more than abandoned wives³³. Chinese piracy, in comparison, did not have that degree of separation, and, therefore, the culture was similar to that on land. Having families on board also increased the amount of women on ships, which was vastly different from western maritime culture. “It was surprising the number of women who lived with these people; for all those who come to cohabit with females had generally a small cabin to themselves; of course the number of cabins were considerable.”³⁴ Chinese ships even enforced family obligation and responsibility. Unfaithful spouses were punished with death. “Adultery, I understood, if fully proved, the man was beheaded and the woman thrown overboard

³² Ibid 75-76

³³ Rediker, Marcus. *Villains of all nations: Atlantic Pirates in the Golden Age* (Boston: Beacon Press, 2004) 60-82

³⁴ Dalrymple, *Further Statement of the Landrones on the Coast of China* 26

with a weight attached to her legs.”³⁵ These rules about familial conduct were extended to captive women as well, pirates were allowed to take captives as wives but they were obligated, with threat of death, to remain faithful and provide for her. No captive women were allowed to be debauched. Women and familial conduct was an important and enforced aspect of the society.

Religion also played a large part in the social climate on board the ships. Contrarily, to western piracy, which rejected religion, Cheng Shih’s fleet worshipped certain gods. Pirates would make oaths and sacrifices to Joss, a religious deity statue. There is also mention of gods giving the pirates good favors. In Glasspoole’s captivity narrative, he noted some of the rituals that are associated with Joss. “Every person being ransomed, is obliged to present him [Joss] with a pig, or some fowls, which the priest offers him with prayers.”³⁶ Glasspoole also noted the existence of a priest on board, evidence of the importance of their religion in their personal lives. Pirates would choose whether or not to attack a town based on Joss’s decision. “The reason they gave for not attacking the town, or returning the fire, were, that Joss had not promised them success. They are very superstitious, and consult their idol on all occasions. If his omens are good they will undertake the most daring enterprises.”³⁷ Glasspoole trivializes the religious atmosphere on board as mere superstition, but the pervasiveness of the idols and rituals shows that it is far more complex than mere superstition. The crew members devotion to their beliefs lacked objectivity, while superstition relies on the objective idea that one occurrence causes another. The religious atmosphere aboard the ships is anything but objective, and crew members believed that their rituals and their gods were a crucial part of their success. The existence of a priest on board, the worshipping and rituals and the importance of the deity for making decisions, is all give evidence of a rich religious culture.

Cheng Shih used religion to her advantage. By aligning herself with Joss she established herself as a semi-religious revered figure. Even within the recruitment rituals, Joss plays a part in bolstering Cheng Shih’s legitimacy. When pirates took their oath, they promised their loyalty to Cheng Shih in front of Joss. In doing so, the

³⁵ Ibid 29

³⁶ Richard Glasspoole, *Mr. Glasspoole and the Chinese Pirates* 39

³⁷ Ibid 39

alliances new members had to Cheng Shih were sacred.³⁸ Similar to Emperors at the head of large dynasties and their divine mandates,³⁹ Cheng Shih had divine backing in her rule. The religious atmosphere on board both provided an important group cohesiveness and social aspect, but it also furthered the legitimacy of Cheng Shih's right to rule such a vast empire.

The social atmosphere within the fleet both reflected and rejected the ideals of Neo-Confucianism. The importance of filial piety remained a crucial aspect of Neo-Confucianism⁴⁰. Women were subject to the traditional power dynamics within a family—namely wives were subservient to their husbands. In the *Book of Filial Piety for Women* by Ban Zhao,⁴¹ she remarked on the importance of ritual, order, and devotion to upholding virtuous filial piety. “Filial piety expands heaven and earth, deepens human relationships, stimulates the ghosts and spirits, and moves the birds and beasts. It involves being respectful and conforming to ritual.”⁴² According to her instructions, filial piety had ritual and order, and this remains true on Cheng Shih's ship. Through threat of great punishment, Cheng Shih enforced the family obligation on ship.

However, though Neo-Confucianism clearly influenced the importance of family structures on board the ship, Cheng Shih did not hold true to the power dynamics within the family structure. Cheng Shih, in her own example, rejected the Neo-Confucian ideals of gender. Within the ideals of Neo-Confucianism, women were subservient to their husbands. They were, as Lady Ban describes, are “encompassed in purity, obedience, rectitude, straightforwardness, gentleness, absence of jealousy, orderliness in the inner quarters, absence of the contact with the outside.”⁴³ Even within these instructions, women were told to have as little contact with the outside as possible, excluding them to the domestic sphere. Ideal women, with their values of obedience, became servants to their husbands. Additionally, the role of the husband was glorified in Neo-Confucian ideals: “the husband is heaven...she transfers her

³⁸ Ibid 40

³⁹ Divine mandate is the Chinese philosophy that emperors gain their right to rule from the heavens

⁴⁰ Familial Piety is ones devotion to one family and the power dynamics that exist within the family

⁴¹ Ban Zhao is the first female Chinese historian, wrote a history of the Han dynasty (45-115)

⁴² Ban Zhao *The Book of Filial Piety for Women* in *Under Confucian Eyes* ed. Susan Mann and Yu-Yin Cheng (London: University of California Press: 2001) 50

⁴³ Ibid 50

heaven to serve her husband.”⁴⁴ Though the importance of family structure is upheld within the fleet, the husband-wife power dynamic is not. Within Cheng Shih’s pirate culture, women are not seen as subservient to men.

Cheng Shih, with her own example, defied the Neo-Confucian subservience of women. When her husband was alive they worked as equals. After his death, by the doctrine of Neo-Confuciansim, her adopted son, Chang Pao, would have been the correct choice for chief, but Cheng Shih put herself as the head of the fleet and Chang Pao as her first mate.⁴⁵ As pirate chief she commanded thousands of men, directly rejecting the idea that women serve men. She inverted the gender hierarchy and demanded respect. She did not remain in the domestic sphere, but concerned herself with all actions of her fleet. She even negotiated her own retirement at the end of her lifetime. The last few pages of the *History of the Pirates who Infested the South China Sea* convey the story of the negotiations between the pirates and the Qing dynasty. When the men proved incapable of doing a successful job, Cheng Shih took it upon herself:

The whole crew was of opinion that ‘the designs of government were unfathomable, and that it would not be prudent to go so hastily on.’ But the wife of Cheng Shih replied: ‘if his excellency, a man of the highest rank, could come quickly to us quite alone, why should I a mean woman not go to the officers of government? If there be any danger in it, I will take it on myself, no person among you will be required to trouble himself about it.’⁴⁶

Cheng Shih equates herself to a man of high rank, essentially saying that if he could go by himself, she could too. She shows courage and responsibility and denies the idea that women are lesser to their husbands and high-ranking male officials. In this anecdote alone Cheng Shih rejects the Neo-Confucian ideals of gender and values herself among the highest ranking of men.

Cheng Shih’s example allows for other instances of female leadership. It is noted by Yuan Yen Lu that she is not the only female pirate who actively fights on ship. “There was a pirate’s wife in one of the boats, holding so fast by the helm that she could scarcely be taken away. Having two cutlasses, she desperately defended herself, and

⁴⁴ Ibid 50

⁴⁵ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 13

⁴⁶ Ibid 86

wounded some soldiers.”⁴⁷ Cheng Shih’s fleet offered an outlet where women could find solace from the ideals of Neo-Confucianism and where women could turn the gender power dynamic on its head. Piracy was a tool for women to gain agency, through proving themselves of having courage and being physically capable.

Cheng Shih’s fleet did not reflect all ideals of Neo-Confucianism, but it did demonstrate the image of women that was previously idealized in popular culture. Chinese storytellers have long been in the spiritual awe of powerful women, and tales are filled with celebrated heroines, such as ballads like *Mulan*⁴⁸. Brave heroines who reject the gender roles of Confucianism were abundant in Chinese culture. Even within the captive narratives, strong women were celebrated, such as the story of a female captive who valiantly fought for her own honor:

Mei Ying, the wife of Ke Choo Yang, was very beautiful, and a pirate being about to seize her by the head, she abused him exceedingly. The pirate bound her to the yard arm; but on abusing her more, the pirate dragged her down and broke two of her teeth...The pirate sprang up to bind her. Ying allowed him to approach but as soon as he came near her, she laid hold of his garments with her bleeding mouth, and threw both him and herself into the river, where they were drowned.⁴⁹

Even in this small anecdote, the power of this female captive is clear. She chose death before dishonor and fought until her death. She is so celebrated that a song to mourn her fate is included in the narrative. Given this culture of powerful women that existed in Chinese popular culture it is not all together surprising that Cheng Shih would be the Chief of such a fleet. Nor is it entirely surprising that she would be respected, especially given the other celebrated heroines.

Something that Cheng Shih’s rule does demonstrate is the disjunction between the government mandated Confucianism and the rich popular culture that existed in the lower classes. Though Neo-Confucianism was pushed as the dynasties official philosophy, it restricted the lower classes in career opportunities and restricted the

⁴⁷ Ibid 24

⁴⁸ Legendary female warrior from the Northern and Southern Period, described in the Ballad of *Mulan*

⁴⁹ Yuan Yung Lun, *History of The Pirates who Infested the China Sea from 1803 to 1810* 48

agency of women. Those who rejected the overarching doctrine could find a place on board Cheng Shih's ships. As a leader, Cheng Shih benefited from this counter culture; her legitimacy was supported by images of powerful women. But resembling the heroic women celebrated in popular culture was not enough to control such a large powerful fleet. Her strategic organization and her strict enforcement of rules commanded respect. Why was she different from her male counterparts? Why was she more successful than western male pirates? In part, it was the culture she created, one where powerful women were celebrated, and it was also her unrelenting demand for loyalty.

Both Political and Social aspects of Cheng Shih's fleet was a threat to the Qing dynasty. It was more than a disorganized band of pirate ships; it was a floating empire. It provided familial and religious structure, a social atmosphere that offered more opportunities for women and lower-class men than the Neo-Confucian ideals pushed by the Qing. Cheng Shih had unrelenting loyalty, on her ships and on the coasts. Her reputation caused fear, allowing her easy control of the South China Sea. She offered a different way of life, both politically and socially, for those who opposed the Qing dynasty. Above all she led by example. She was an active fighting pirate who managed the diplomatic and strategic choices of her fleet. Cheng Shih created an ad hoc government that rivaled the Qing dynasty and became one of the most powerful women in history; one that built her own legitimacy.

European government public expenditure affects the rise of antibiotic resistance

By Emily Hutton and Katie Hutton

Abstract

Bacteria becoming resistant to antibiotics is a rapidly growing problem worldwide, and there are many possible factors that could be contributing to this increase. Data shows that some European countries have an especially large incidence of bacteria developing antibiotic resistance, and even geographically close countries have drastically different amounts of resistance. We sought to figure out how different government expenditures on public services (education, healthcare, and social protection) in European countries affect the amount of antibiotic resistance in each country. We compared the percentage of a European government's GDP that was allocated to these services and the amount of reported antibiotic resistance of both *Klebsiella pneumoniae* to fluoroquinolones and *Staphylococcus aureus* to methicillin in 2011 using data from European Union databases. Increased government expenditure in each of the public services studied resulted in decreased antibiotic resistance. There was a statistically significant difference between amounts of antibiotic resistance in *K. pneumoniae* in countries spending high and low percentages of GDP, but no significant difference in *S. aureus*. It is important to study the relationship between government spending and antibiotic resistance so that countries can lower the incidence of resistance and eventually reduce overall spending on infection treatments.

Introduction

Bacteria are able to survive in most ecosystems on Earth, including within the human body. In cases where the body has trouble fighting off infection, antibiotics are used to target specific of the bacterial structures to eliminate the organism. Bacteria naturally evolve mechanisms to combat the drug, and some inevitably develop resistance to antibiotic treatments (Levy and Marshall, 2004). The growing problem of antibiotic resistance stems from increased development of resistance and the spread of resistant strains. The development of resistance is accelerated when antibiotics are used incorrectly, such as incomplete dosage, incorrect antibiotic prescription, and

unnecessary use (Levy and Marshall, 2004). Resistant strains of bacteria spread through the globe by human contact, ingestion of livestock, water supply, infected patient contact in hospitals, and lack of hygiene in healthcare personnel (Levy and Marshall, 2004).

Prevention of antibiotic resistance development and spread is key in reducing infections in the future. An example of a commonly resistant strain is *Klebsiella pneumoniae*, which infects the urinary tract, respiratory tract, and bloodstream (Nordmann *et al.* 2009). Additionally, *Staphylococcus aureus* primarily infects the skin, but can spread to blood, bone, and soft tissue (Williams *et al.* 2017). If these two bacteria became completely multidrug resistant (MDR), they would become virtually untreatable.

Previous studies have researched the occurrence of methicillin-resistant *S. aureus* (MRSA) (Voss *et al.* 1994) and fluoroquinolone-resistant *K. pneumoniae* (Acar and Goldstein, 1997) across Europe. These studies describe amounts of resistance with no correlation to other factors. There is limited research on the correlation between the gross domestic product (GDP) of a country and amount of resistant bacteria, especially in recent years' data. It is important to study the relationship between government expenditure and antibiotic resistance because increased antibiotic resistance can result in increased resource allocation and higher healthcare costs (Schoemaker *et al.* 2015).

This study examines the relationship between antibiotic resistance and percent of GDP per capita spent on health, education, and social protection. Data from 2011 on expenditure and antibiotic resistance of *K. pneumoniae* and *S. aureus* is used because of accessibility from EARS-Net, Eurostat, and OECD databases. Sixteen European countries were selected based on data availability and divided into high and low GDP categories.

It was hypothesized that increased expenditure would result in decreased antibiotic resistance, and that there would be a statistically significant difference between high and low GDP countries for health, education, and social protection expenditure data in relation to antibiotic resistance data. Key results show that antibiotic resistance is lower for countries with higher expenditure, however this difference is only significant for *K. pneumoniae*, and not *S. aureus*. Further studies are

needed to show the correlation between government expenditure and antibiotic resistance over time and with other strains of bacteria.

Methods:

Gross Domestic Product

Data was collected annually for consumer spending, government spending, exports, imports, and investments. GDP was calculated by adding consumer spending, investments, government expenditures, and adding the difference between exports and imports (Amadeo, 2017). GDP was measured in US dollars at current prices and divided by the population for each year to normalize data for each country in GDP (USD/capita) (OECD, 2016). Data for 2011 GDP/capita was used in this report.

Antibiotic Resistance Surveillance

Klebsiella pneumoniae

This pathogen infects the urinary tract, respiratory tract, and bloodstream (EARS-Net, 2016). The European Centre for Disease Control and Prevention (ECDC) monitors antimicrobial resistance using the European Antimicrobial Resistance Surveillance System (EARS-Net), which collects data specifically on blood and cerebrospinal fluid using antimicrobial susceptibility tests (AST) (EARS-Net, 2016). For further information on clinical facilities see the EARS-Net annual report (EARS-Net, 2016). Data from the EARS-Net for fluoroquinolone resistance was used in this report.

Staphylococcus aureus

This pathogen infects the blood, bone, skin, and soft tissue (EARS-Net, 2016). The ECDC uses the EARS-Net to survey data again from blood and cerebrospinal fluid using confirmation tests (polymerase chain reactions) and AST (EARS-Net, 2016). Results from confirmation tests are prioritized over AST, and data is mixed for each country and year (EARS-Net, 2016). Data for methicillin resistant *S. aureus* (MRSA) was used for this report.

Government Expenditures

Education

Government expenditure on education according to the Eurostat database includes directly funding capital expenses of educational institutions, supporting students with scholarships and loans, and transferring subsidies to private firms or non-profits for educational activities (Eurostat, 2017). These expenditures for each country were combined into a total public education expenditure and divided by the country's GDP to normalize the data in terms of percent GDP (Eurostat, 2017). We used data from 2011 because it was the most recent year with all available expenditure and antibiotic resistance data.

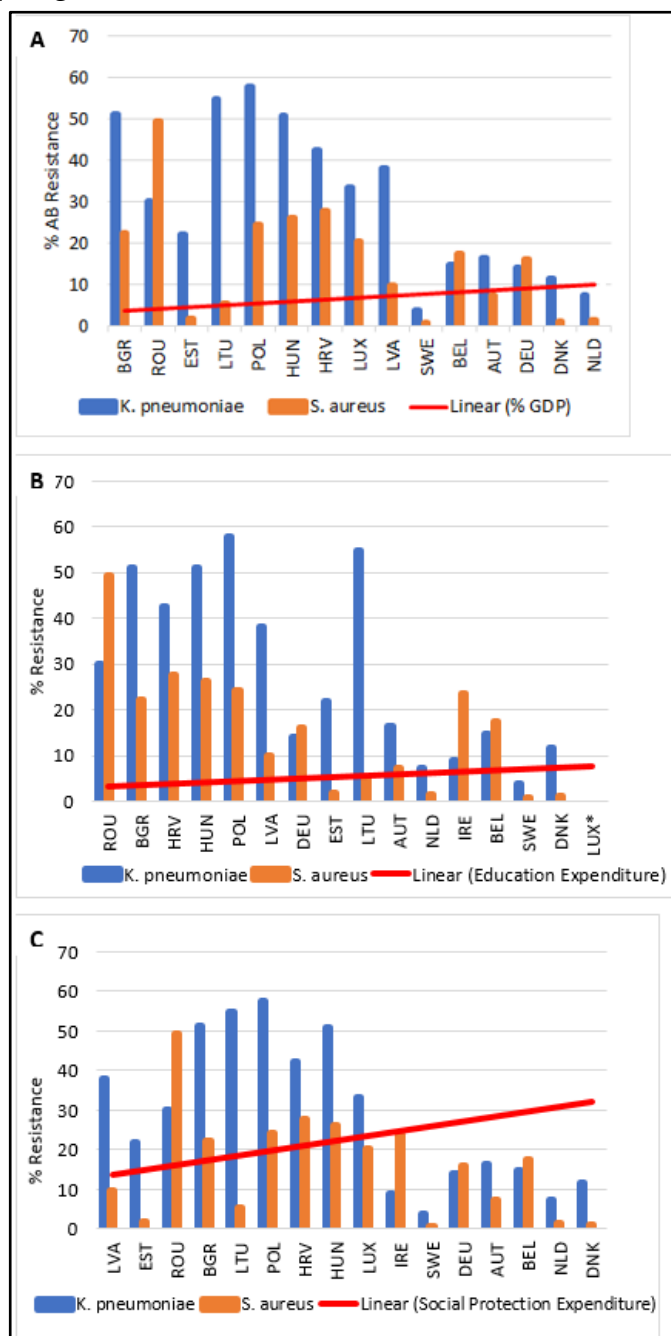
Healthcare

Healthcare expenditure includes money the government allocates to preventive or curative care as well as healthcare providers, like hospitals or clinics (Eurostat, 2017). These data were expressed as percentage of each country's GDP spent on public healthcare (Eurostat, 2017). Expenditures from 2011 were used for this study to be consistent with other variables.

Social Protection

Social protection expenditure includes social benefits, such as transfers to households and individuals to relieve them of the burden of a defined set of needs. It also encompasses government administration costs and other miscellaneous expenditures by social protection programs, like payment of property income (Eurostat, 2017).

Figure 1 (A-C). The effects of government expenditure on the presence of antibiotic resistant bacteria. *Klebsiella pneumoniae* resistance to fluoroquinolones is graphed in blue. *Staphylococcus aureus* resistance to methicillin is graphed in orange. The percentage of GDP per person allocated to health care, education, and social protection for each country in 2011 is shown by a red trendline. Resistance data are from the Surveillance Atlas of Infectious Disease presented by the European Center for Disease Prevention and Control. Expenditure data on healthcare, education, and social protection are from the EuroSTAT database. In Figure 1A, health expenditures and antibiotic resistance were reported on European countries where data was available in the year 2011. The average of the data for percent GDP spent on health available for Latvia (2004-2010) and Netherlands (2003-2011) was used. Data for health expenditure of Ireland was unavailable. In Figure 1B, education expenditures and antibiotic resistance were reported on European countries where data was available in the year 2011. Data was not available in education expenditure for Luxembourg. In Figure 1C, social protection expenditures and antibiotic resistance were reported on European countries where data was available in the year 2011.



Results:

In the years since the antibiotic Golden Age, antibiotic resistance in bacteria has increased substantially. According to the European Centre for Disease Control and Prevention (ECDC), the incidence of antibiotic resistance varies greatly between countries of the European Union. We hypothesize that resistance variation is influenced by government expenditure on the population, specifically healthcare, education, and social protection. Data on antibiotic resistance (EARS-Net, 2016), government expenditure (Eurostat, 2017), and GDP (OECD, 2017) of European countries in 2011 showed that increased expenditure on public services was correlated with a decreased incidence of resistance for *Klebsiella pneumoniae* and *Staphylococcus aureus*. Additionally, an interesting finding was that 81% of the countries considered had a higher percentage of resistance in *K. pneumoniae* than *S. aureus*.

As seen in Figure 1A, the presence of antibiotic resistance decreased as government spending on health care increased. Countries that spent a higher percentage of their annual GDP on health care had lower percent resistance. This was true for both *K. pneumoniae* and *S. aureus* for the sixteen countries selected. There was also a difference in the overall percent resistance of these microbes, with *K. pneumoniae* having a higher percent resistance in all countries, except Ireland, Belgium, and Germany which had higher percent resistance for *S. aureus*.

Antibiotic resistance decreased on average in European countries that spent a higher percentage of their GDP on educating the public (Fig. 1B). This was true for both fluoroquinolone resistance in *K. pneumoniae*, a gram-negative bacteria, and methicillin resistance in *S. aureus*, a gram-positive bacteria. Although the differences in amounts spent on education between countries did not vary widely, there was a large variation in the resistances of the microbes in question between countries. There were outliers, including high resistance in *K. pneumoniae* in Lithuania and slightly higher *S. aureus* resistance in Ireland and Belgium than countries with comparable education expenditures.

There was a clear association between countries with lower spending on social protection expenditures and higher antibiotic resistance percentages in *K. pneumoniae*

(Fig. 1C). This trend was less evident in *S. aureus* antibiotic resistance but was still present, except for in outliers Latvia, Lithuania, and Estonia. In *K. pneumoniae*, however, the countries with higher spending on social protection had much lower average antibiotic resistance than countries with lower spending on these expenditures.

For health care, education, and social protection, increased government spending led to decreased antibiotic resistance for both *K. pneumoniae* and *S. aureus*. Additionally, *K. pneumoniae* had a higher resistance incidence overall as seen by the majority of countries having a higher percent resistance for *K. pneumoniae* than *S. aureus*.

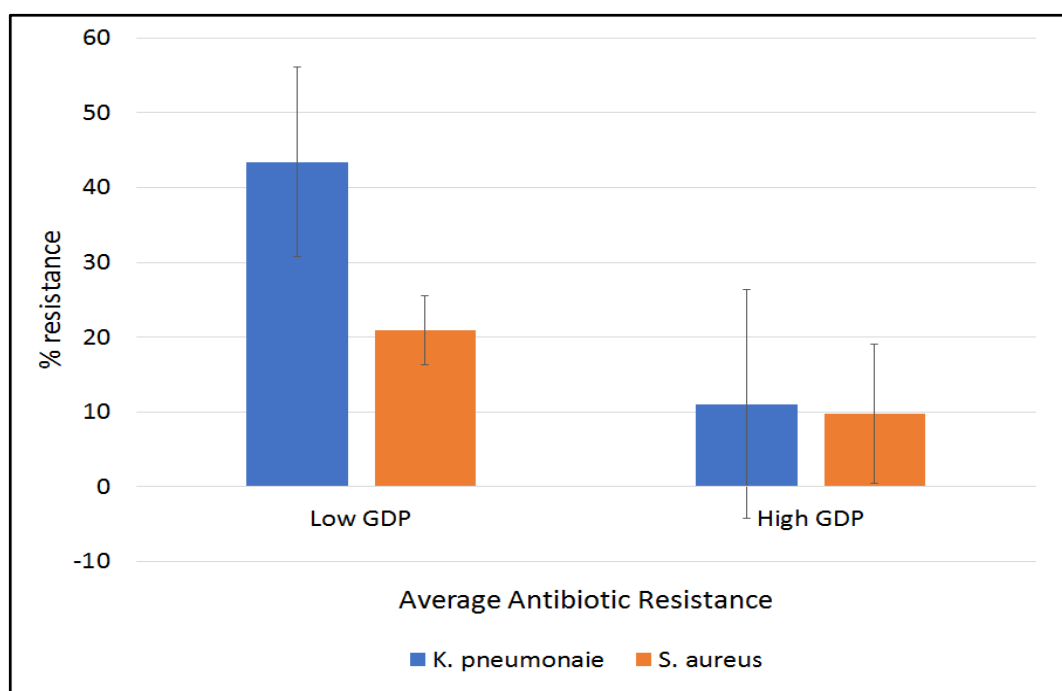


Figure 2. Statistical analysis of percent antibiotic resistance. The resistance data was divided into high and low GDP/capita with eight countries in each category. Data was then averaged and standard deviation was calculated. A statistical T-test was performed to analyze significance of the data. Analysis was performed on antibiotic resistance of *Klebsiella pneumoniae* and *Staphylococcus aureus*.

It was found that the difference in incidence of antibiotic resistance between high and low countries varied. For *K. pneumoniae*, the T-test resulted in a p-value of 2.38×10^{-5} . Since p was less than 0.05, the difference between antibiotic resistance in high and low GDP/capita countries was significant. For *S. aureus*, the T-test resulted in a p-value of 0.118. Since p was greater than 0.05, antibiotic resistance differences were not statistically significant between high and low GDP/capita countries.

Table 1. Three letter country abbreviations. The sixteen countries evaluated in this report were referred to in figures using three letter abbreviations from Nations Online Project (Kästle, 1998).

Country:	Three Letter Code:		
Austria	AUT	Ireland	IRL
Belgium	BEL	Latvia	LVA
Bulgaria	BGR	Lithuania	LTU
Croatia	HRV	Luxembourg	LUX
Denmark	DNK	Netherlands	NLD
Estonia	EST	Poland	POL
Germany	DEU	Romania	ROU
Hungary	HUN	Sweden	SWE

Discussion:

Certain societal factors have been previously shown to affect amount of certain bacteria that develop resistance to antibiotics, such as the amount of out-of-pocket health expenses spent on average (Schoemaker et. al. 2015) and medicare status (Arizpe et. al. 2016); however, government expenditures on social programs has not yet been considered as a factor in development of antimicrobial resistance. We hypothesized that countries with higher government expenditure on different public services, including education, healthcare, and social protection, would have a lower prevalence of antibiotic resistance. Our results show a significant correlation between all three of these factors and antibiotic resistance in *Klebsiella pneumoniae*. The antibiotic resistance of *Staphylococcus aureus* did not vary significantly between countries. These findings were based on data from European countries in 2011 reported to the ECDC and EuroSTAT databases. Establishing correlations between antibiotic resistance and different social factors can lead to governmental adjustments that could reduce the rate at which antibiotic resistance is increasing.

Countries with higher expenditures on social programs like education presumably have more knowledge about how antibiotics work and why proper usage is so important. Schoemaker and colleagues (2015) have shown that when a country does not spend enough money on healthcare, its citizens are forced to get private insurance, which usually have less regulations or restrictions on excessive antibiotic prescribing. Social protection can allow poorer citizens to be better able to pay for proper health care that will not overprescribe antibiotics. Data was also analysed comparing these social expenditures with *S. aureus* antibiotic resistance in the European countries during the same year, but a T-test revealed that the variation in resistance of *S. aureus* between high and low GDP countries was not a statistically significant difference (Fig. 2). These results indicate no change in the bacterial resistance of a strain to antibiotics based on the social factors tested, which could be due to the lesser prevalence of this type of resistance compared to *K. pneumoniae* in most of the countries tested.

Data was limited to the year 2011 because this was the latest year that had sufficient data from most countries being analyzed, with the exception of Luxembourg's resistance data, which was unavailable. We compared only the countries with the highest and lowest GDP in the European Union to see the most difference in expenditure data when looking for correlations with resistance. Also, only three of several possible government expenditures were used in this study. Further testing could be done in this area, searching for more factors of expenditure, different types of antibacterial resistance, and other countries around the world. As more data becomes available, more recent years can be compared as well.

Antibiotic resistance is a rapidly growing global problem, and there are factors besides overuse and misuse that speed up this process substantially. In Europe, different countries' expenditures on education, health care, and social protection were all correlated with the percentage of *K. pneumoniae* resistant to fluoroquinolone antibiotics. Understanding the relationship between these along with other social factors can help us understand how resistant strains are spreading so rapidly and steps governments can take to slow this process significantly.

References:

- Voss A, Milatovic D, Wallrauch-Schwarz C, Rosdahl V, Braveny I. 1994. Methicillin-Resistant *Staphylococcus aureus* in Europe. *European Journal of Clinical Microbiology and Infectious Diseases*. 13(1):50-55.
- Acar J, Goldstein F. 1997. Trends in Bacterial Resistance to Fluoroquinolones. *Clinical Infectious Diseases*. 24(1):S67-S73.
- Kästle K. 1998. List of Country Codes. Nations Online Project. [cited 2017, November 14]. Available from http://www.nationsonline.org/oneworld/country_code_list.htm
- Levy SB, Marshall B. 2004. Antibacterial resistance worldwide: causes, challenges and responses. *Nature Medicine*. 10:S122-S129.
- Nordmann P, Cuzon G, Naas T. 2009. The real threat of *Klebsiella pneumoniae* carbapenemase-producing bacteria. *The Lancet - Infectious Diseases*. 9(4):228-236.
- Alsan M, Schoemaker L, Eggleston K, Kammili N, Kolli P, Bhattacharya J. 2015. Out-of-pocket health expenditures and antimicrobial resistance in low-income and middle-income countries: an economic analysis. *The Lancet Infectious Diseases* 15(10):1203–1210. doi:10.1016/S1473-3099(15)00149-8.
- Arizpe A, Reveles KR, Aitken SL. 2016. Regional variation in antibiotic prescribing among medicare part D enrollees, 2013. *BMC Infectious Diseases* 16(1): 744-750. doi:10.1186/s12879-016-2091-0. [accessed 2017 Nov 15]. Available from <http://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-016-2091-0>.
- European Center for Disease Prevention and Control. 2016. Summary of the latest data on antibiotic resistance in the European Union: EARS-Net surveillance data. Stockholm: ECDC; [cited 2017, November 13]. Available from <http://ecdc.europa.eu/en/eaad/antibiotics-get-informed/antibiotics-resistance-consumption/Documents/antibiotics-EARS-Net-summary-2016.pdf>.
- Friedman ND, Temkin E, Carmeli Y. 2016. The negative impact of antibiotic resistance. *Clinical Microbiology and Infection* 22:416–422. doi:10.1016/j.cmi.2015.12.002.
- Organization for Economic Co-operation and Development. 2016. Gross Domestic Product. OECD; [cited 2017, November 14]. Available from <https://data.oecd.org/gdp/gross-domestic-product-gdp.htm>
- Amadeo K. 2017. What is GDP? Definition of Gross Domestic Product. The Balance. [accessed 2017 Nov 01]. <https://www.thebalance.com/what-is-gdp-definition-of-gross-domestic-product-3306038>.

European Commission. 2017. Eurostat. [cited 2017, November 14]. Available from <http://ec.europa.eu/eurostat/data/database>.

Williams MR, Nakatsuji T, Gallo RL. 2017. *Staphylococcus aureus*: Master Manipulator of the Skin. *Cell Host & Microbe*. 22(5):579-581.

A Psychoanalysis of Medea: A Freudian Interpretation

By Leighann Guardino

Sigmund Freud, a psychologist from the early twentieth century, introduced a revolutionary theory arguing that human action is entirely controlled by the unconscious mind. Essentially, Freud claimed that the human psyche was structured into three parts: the id, ego, and superego. Each aspect contributes to an individual's behavior, and ultimately, the three combine to form one's personality. In the tragic story of a mother's quest for revenge against her unfaithful husband, Medea, Jason, and the Chorus all act upon their ethical and subconscious thoughts, whereby each reflects a part of the human psyche. Euripides' tragic play *Medea* reflects Sigmund Freud's theory concerning the division of the human psyche by demonstrating the id, ego, and superego through the character's behaviors.

The id is the most primitive part of the human mind. According to Freud, it is the impulsive part of our psyche which responds directly and immediately to the bodily needs, wants, desires, and impulses; it operates on the pleasure principle, the idea that every wishful impulse should be satisfied immediately, regardless of the consequences (CommonLit). Medea undoubtedly represents this concept, as exhibited through her rage-driven and murderous actions. Medea herself recognizes her lack of rationality; she says, "I understand what evil I am about to do but my wrath is stronger even than my thoughts..." (Medea, 1078-1079). The id is also referred to as the selfish part of our mind, in that it "knows no judgements of value: no good and evil, no morality." It is entirely motivated by the immediate need for one's desires to be fulfilled (CommonLit).

After Medea hears of Jason's decision to abandon their marriage, the heroine spirals into a state of immense grief. She says,

"Hurl your fiery bolt of lightning straight through
my skull. What use is life to me?
feu, feu! [Aah, aah.] Let me die and leave
this life I hate" (Medea, 142-146)

In her melancholic state, Medea has only one driving force that burns within her – revenge. Revenge is one of the impulsive and rage-driven needs that the id desires to be fulfilled. Medea has no morality or concept of good and evil. She knows only that she desires to see "him [Jason] and his bride ground down to nothing, house and all" (Medea, 162-164). The love that was once directed towards Jason has essentially transformed into outrage. As Weigel phrased it, "As a woman of passion, Medea is wholly committed to Jason as the object of her emotional life, whether in love or hate" (Weigel).

Initially, Medea's actions were motivated by grief and a sense of resentment. The nurse witnesses her heartache, and says,

"She won't eat; she just gives in to her grief,
washing away all her hours in tears,
ever since she realized her husband had abandoned her" (Medea, 23-25)

Her reflection of the id isn't emulated until her rage begins to emerge, accompanied by her need for revenge. Medea's rage can be compared to a fire, and her murderous actions are the water. It's often thought that when pouring water on fire, it will go out – however, it only grows more intense. This concept parallels with her rage; she wrongly believes that once she commits a small act of revenge, her rage will be satisfied. Instead, Medea's rage goes to unthinkably immoral lengths, in which we see the id growing increasingly evident. She states, "...I will turn three of my enemies into corpses, the father, the daughter, and my husband" (Medea, 373-374). It's apparent that Medea is allowing her rage to influence her actions. There is no rationale or practicality or realism of any sort because only the id is present. Her rage towards Jason is so intense that it's almost impossible to relate to her anger because she's lacking part of her human psyche.

Even so, her character is designed to engender a sense of sympathy from the audience. The sympathy derives either from relatability to her experiences with betrayal or her sense of impulsiveness that is within everyone's psyche. Weigel says, "Medea is a practitioner of black magic, a cold-blooded murderer, and a total monster; but under Euripides' spell the audience understands her" (Weigel).

Medea's heartache becomes so intense that it even extends to her sons, whom she thinks of as a representation of their untrustworthy and disloyal father. She initially tells them she hates them and then, like her rage toward Jason, her murderous feelings grows towards her sons as well. She states,

"I have determined to do the deed at once,
to kill my children and leave this land
...

They must die..." (Medea, 1235-1239)

Admittedly, Medea does display some forms of hesitation and guilt over killing her own innocent children, but her rational isn't apparent enough to give her the moral sense to not go through with it. Because the id has no rational or moral sense, only Medea's rage-filled impulsiveness is evident within her murderous actions. Nothing else matters to her except her need to satiate her hunger for revenge. She tells the chorus that "all other words are in vain" if they won't somehow lead her to revenge (Medea, 818). Ultimately, Medea's embodiment of the id causes her to be seen as a force to be reckoned with, and elucidates the consequences of this particular part of the psyche in isolation.

However, any part of the psyche in isolation could be potentially detrimental – including the ego. Freud explains this component of the human psyche as a part of the id which has been modified by the direct influence of the external world. The ego develops in order to mediate between the unrealistic id and the real world. Essentially, it is the decision making component of personality. The ego works by reason whereas the id is chaotic and totally unreasonable (McLeod). Jason illustrates this concept almost perfectly: his actions reflect the id in some ways, but his behaviors are injected with a level of rationale. Jason left his wife Medea because he grew bored of their marriage and

he desired someone younger to fulfill his desires. By itself, this selfish and cruel action could paint a picture of the id. However, throughout the play, Jason contributes to that portrait and the ego ultimately emerges. Jason justifies his abandonment of Medea for Glauke when he says,

“...I will prove first that I did the smart thing
and showed good sense and finally that I am a great benefactor
to you and my children...

...

[I want] to give you
security and to father royal brothers
for my children, a support for my house” (Medea, 547-596)

Essentially, Jason argues that he wants to father more children and join his families so that they all can live well together; he believes that it’s his job to help his children live their best life. Jason’s sexist comments and perceived superiority over Medea demonstrates how he is a product of an intensely patriarchal greek society. In ancient Greek times, “men’s role in society was to keep the family stable, both financially and in general” (Joo). Ultimately, Jason was merely fulfilling his role as a man and husband in this civilization. Medea, unfortunately, does not see it that way. According to CommonLit, “indulging in our selfish impulses can sometimes be problematic” (CommonLit). Jason experiences this first-hand, when Medea indulges in her selfish impulses and murders everyone dear to him. In some ways, her actions were unfair to him since Jason repeatedly attempted to help her. When she’s threatened to be sent out of the country, he offered,

“But if you want to take me up on my offer
of money for the children or your own exile
say so. I am ready to be generous to you
and to send letters to friends abroad who will take care of you” (Medea, 609-612)

Jason is persistent in his claim that he never stopped caring for Medea. This relates back to the idea of the ego and its relation to our interactions with the external world. Jason's relationship with Medea was too meaningful to him to be able to dismiss it as if it were frivolous. He says to her,

"Still, in spite of this I have not come to renounce
my loved ones, but because I care for your well-being, woman,
so that you will not go into exile with the children in need
or wanting for anything. Exile brings many problems
in its wake. Even if you hate me
I could never think badly of you" (Medea, 458-463).

Jason's action of leaving his wife and children is evidently wrong, and in some ways, catalyzed by his id. However, because his behaviors were justified and reasonable, he represents the ideal ego. By marrying Glauke, Jason rescues both he and his family from a life a tribulation and ultimately assures his sons a place in society. The relationship between Medea and Jason allows the audience to see how the id and ego function together, and how an individual can exhibit either one or both parts of the psyche. As Weigel phrases it,

"Jason is a Greek, subject to law, rationality, and practical calculation. As a result, he seems cold and indifferent beside Medea, who is a creature of passion. However, this is merely a surface appearance. Euripides exposes the inner layers of their psyches with unflinching honesty in the course of the play" (Weigel)

Jason's characteristics of reasoning are easier to pick out when they are displayed side by side with Medea's sheer impulsiveness. Although his actions might be cruel and selfish, these behaviors give a solid view of Euripides' depiction of the ego.

The final part of the human psyche, the superego, is represented by the Chorus. In *Medea*, the chorus does not advance or complicate the plot in any way, but merely delineates the central concepts and motifs that Euripides incorporates into the story. In other words, the Chorus guides the characters along, in both their rage and their grief. The superego is the moral part of the human psyche, reflecting the internalization of

cultural rules, mainly taught by parents applying their guidance and influence (CommonLit). Whereas the id has almost no morals and the ego has only some, the superego incorporates morals into every decision; all behaviors are motivated by ethics. The chorus highlights the moral and immoral acts that are committed by both Medea and Jason. For example, the chorus says to Medea,

“The god has inflicted many troubles
on Jason today and he deserves them.
Unhappy daughter of Creon, done to death,
how we pity you for your tragedy,
all because of your marriage to Jason” (Medea, 1230-1234)

Here the Chorus emphasizes the wrongfulness of Jason leaving his family and therefore, his immorality warrants punishment. In a way, the Chorus also influences the audience’s reactions. The group guides the audience by directing them towards who deserves sympathy and who does not. According to CommonLit, “The superego strives to act in a socially appropriate manner, whereas the id just wants instant self-gratification. It controls our sense of right and wrong, and helps us fit into society by getting us to act in socially acceptable ways” (CommonLit). Consequently, the chorus’ opinions majorly juxtapose those of Medea’s, who disregards any sense of right and wrong. After Medea admits her plan to kill her own children, the Chorus responds by saying,

“Since you have shared this story with us,
in our desire to help you and in keeping
with human values, we beg you not to do this.

...

How then will the city of holy rivers,
the land that gives safe-passage
to friends,
welcome you, child-killer,

not holy with the others?
Picture the blow to the children;
picture the murder you are committing.
Do not, at your knees
in every way we beseech you,
do not kill your children" (Medea, 810-855)

Saul McLeod explains how it's possible for the superego to instill a feeling of guilt within the id and ego when the two are acting unethically (McLeod). This concept is illustrated here, when the Chorus attempts to illuminate the evilness of killing one's own flesh and blood. Ultimately, the Chorus' persistence in enforcing morality within Medea and Jason reflects Freud's idea of the superego being the ideal self. The ideal self, or ego-ideal, is an imaginary picture of how you ought to be, and represents how to behave as a member of society (McLeod). The Chorus' commendable values and principles are what make the group ideal; together, they accurately reflect Freud's theory on the human psyche.

Ultimately, the behaviors exhibited by Medea, Jason, and the Chorus demonstrate how Sigmund Freud's theory can be applied to this ancient Greek tragedy. Medea's murderous and rage-driven impulsiveness, Jason's rationale, and the Chorus' ethical guidance are the paramount factors towards comparing these characters to the theory proposed by Freud regarding the human psyche. By psychoanalyzing this play, the readers are able to better comprehend the Freudian Theory. In addition, because of the characters and their relationships, we're able to see how the three parts of the human psyche function in isolation, as well as how they function as a whole.

Works Cited

- CommonLit Staff. "Freud's Theory of the Id, Ego, and Superego." *CommonLit*. N.p., 2015. Web.
- Joo, Jae-Hwan, Mariana Lara, Alyssa Carranza, and Joe Gallagher. "Ancient Greece: Religion

and Gender Roles." (n.d.): n. pag. *John Jay*. John Jay. Web.

McLeod, Saul. "Saul McLeod." *Id Ego Superego* | *Simply Psychology*. N.p., 01 Jan. 1970. Web.

Weigel, James, Jr. "Medea." *Literary Reference Center*. Salem Press, Nov. 2010. Web.

The Effects of the Small Indian Mongoose (*Herpestes auropunctatus*) on Fiji, Hawaii, and Japan

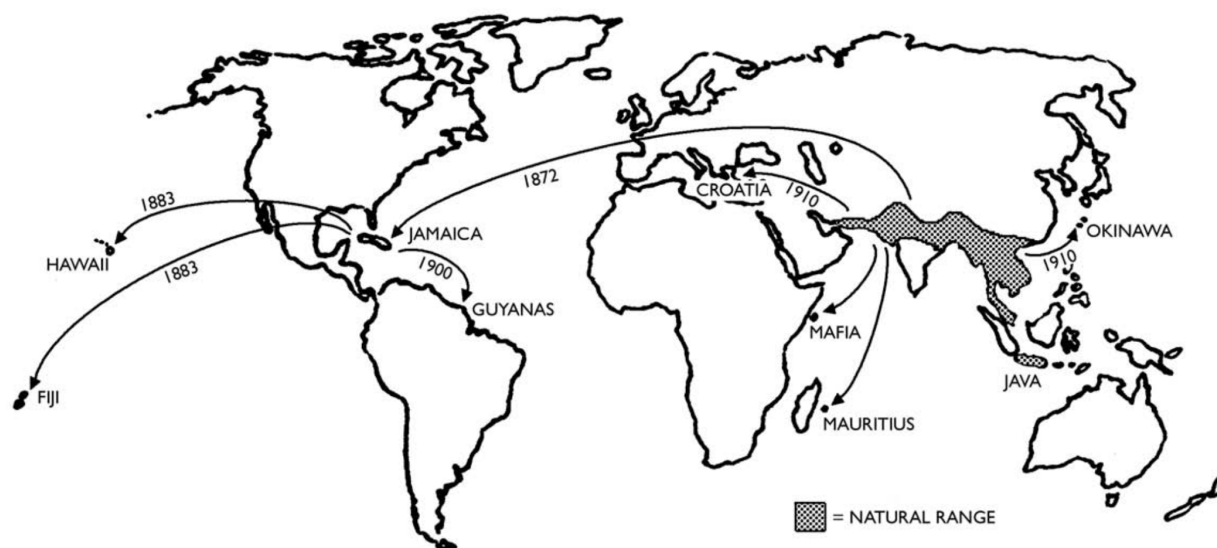
By Miranda Ella and Emily Siniscalco

Introduction

Island environments exist in a delicate balance that can easily be thrown off by disaster. Sometimes, hurricanes or earthquakes decimate islands physically with massive force, but in other cases, island ecosystems can be disrupted more subtly. One such form of disruption is the introduction of an invasive species, a foreign organism that takes over an environment after being introduced (Minnich 2009). Because of invasive species' tendencies to spread rapidly across ecosystems and compete for resources with native biota, invasive organisms can cause a lot of damage to flora and fauna naturally present on islands (Minnich 2009). The small Indian mongoose (*Herpestes auropunctatus*) is one such organism. It has been introduced to over 70 islands across the world and has since been categorized as one of the world's worst invasive species (Owen 2017; GISD 2011). Our paper focuses on the damage caused by the mongoose on islands in the Pacific Ocean, specifically those of Hawaii, Fiji, and Japan. We aim to examine the history of mongoose introductions on these island groups, the evolution of the mongoose between the native and introduced ranges, the impact of the mongoose on native biota, and the efforts island communities have made to eradicate the mongoose in order to obtain a comprehensive understanding of the effects of the small Indian mongoose on Pacific islands.

History of Mongoose Introductions

The native range of the small Indian mongoose is in southeast Asia, but since the nineteenth century, these animals have been intentionally introduced to islands around the world as shown in Figure 1. These include islands like Jamaica, Puerto Rico, and Trinidad and Tobago in the Caribbean, Mauritius and Indonesia in the Indian Ocean, and some Croatian islands in the Adriatic Sea (Hays and Conant 2007).



and some Croatian islands in the Adriatic Sea (Hays and Conant 2007).

Figure 1: This map shows the spread of the small Indian mongoose from their natural range (shaded region) to island groups across the world (Hays and Conant 2007).

Introduction to Hawaii

Mongoose introduction to the Hawaiian islands occurred in 1883 when they were brought to the Pacific from Jamaica. Planters of sugarcane wanted the introduced mongooses to prey on rats, detrimental pests in Hawaii that affected the farming of this crop (Duffy *et al.* 2015). Due to this, planters brought 72 mongooses to Hilo on Hawaii's big island, where their population grew (Simberloff *et al.* 2000). Eventually, the offspring of this original population were introduced and established on three more Hawaiian islands (O'ahu, Maui, and Moloka'i). Mongooses were also introduced to Kaua'i, but before they could be released, the crate carrying the animals was pushed off

the dock. In spite of this, mongoose sightings frequently occur on Kaua'i, but there is little evidence of an established population on the island (Hays and Conant 2007; Duffy *et al.* 2015).

Introduction to Fiji

Similar to mongoose introduction in Hawaii, mongooses were introduced in Fiji to control rat populations. The presence of mongooses was specifically intended to protect sugarcane crops from the damaging force of rats (Brown and Daigneault 2015). The two Fijian islands with established mongoose populations are Viti Levu and Vanua Levu. Viti Levu was colonized first, with planters from Jamaica introducing the species in 1883, and Vanua Levu was colonized some time afterwards (Hays and Conant 2007). Currently, mongooses on Fiji are threatening native species, so eradication efforts are underway. To date, these programs have been met with a moderate degree of success, as mongooses have been eradicated on some small Fijian islands. However, they still remain presence on the two main Fijian islands of Viti Levu and Vanua Levu (Brown and Daigneault 2015).

Introduction to Japan

Of the three island groups, the most recent mongoose colonization has occurred in Japan on two islands: Okinawa and Amami-Oshima (Hays and Conant 2007). Both introductions occurred during the twentieth century with the introduction of mongooses to Okinawa occurring in 1910 and the introduction of mongooses to Amami-Oshima occurring in 1979 (Watari *et al.* 2008; Saito *et al.* 2009). In both cases, mongoose populations were intentionally introduced to control certain undesirable animal populations on the islands through predation (Watari *et al.* 2008; Saito *et al.* 2009). On Amami-Oshima, the main target of mongoose introduction was the native habu (*Trimeresurus flavoviridis*), a venomous pit viper, which posed a threat to the island's human inhabitants. To control this snake, a group of thirty mongooses were released onto the island, but instead of preying on the intended habu, the mongooses inhabited the island's forests and preyed mostly upon the native and endemic species present there (Watari *et al.* 2008). Similarly, the mongooses introduced to Okinawa were intended to control rat and snake populations but had no effect on these animals (Saito

et al. 2009). Though small numbers of mongooses were introduced to the islands originally, both islands experienced a boom in mongoose population since their introduction. The mongoose population of Okinawa, which was originally about fifteen individuals, is now around thirty thousand individuals. Likewise, the population of mongooses on Amami-Oshima grew from thirty mongooses to ten thousand mongooses. Both of these spikes occurred in short periods of time as the Okinawa population has only been established for one hundred years, and the Amami-Oshima population for less than thirty (Watari *et al.* 2008; Saito *et al.* 2009).

Insular Evolution of the Mongoose

Changes in Anal Pads and Testis

From an evolutionary standpoint, an important morphology of the small Indian mongoose are the anal glands, rich in sebaceous and apocrine glands, and the anal pads, which deposit the anal gland secretion onto a substrate (Owen 2017). The glands hold a variety of lipids, proteins, bacteria, and carboxylic acids that are used by the mongoose for marking and long-distance communication in their native range (Hays and Conant 2007). While both male and female mongooses have these glands and pads, the pads are larger in males than females indicating sexual selection (Figure 2; Owen 2015; Owen and Lahti 2015). The anal pad size, as well as testis size, are sexual characteristics that are significant indicators of mongoose evolution because it is expected that, comparatively to their native range, these structures would change in the mongoose when introduced in new environments (Owen 2017).

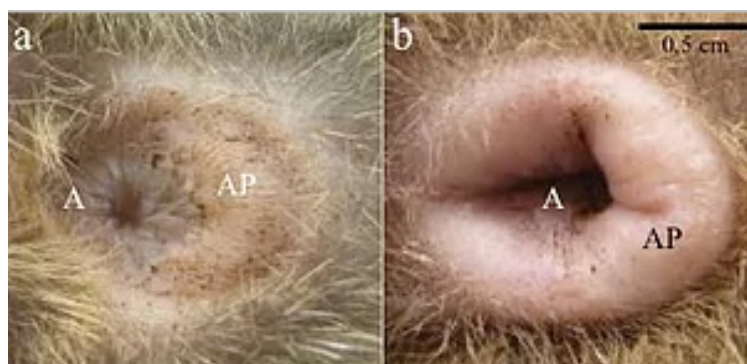
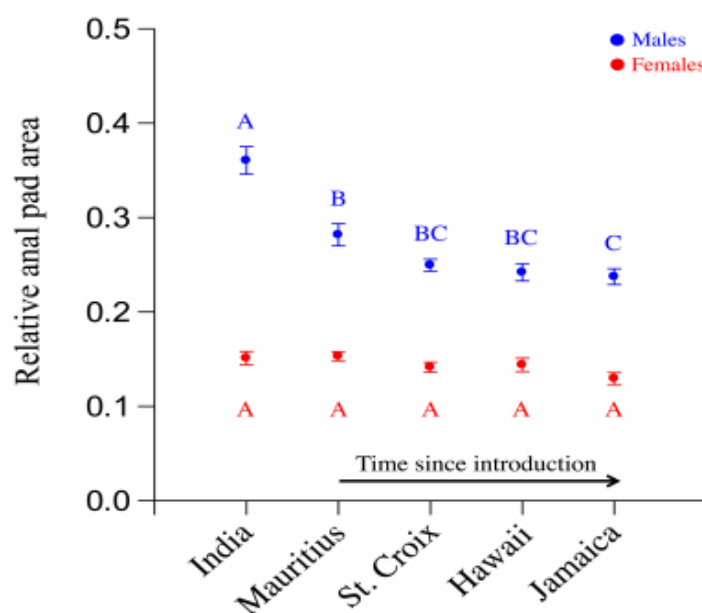


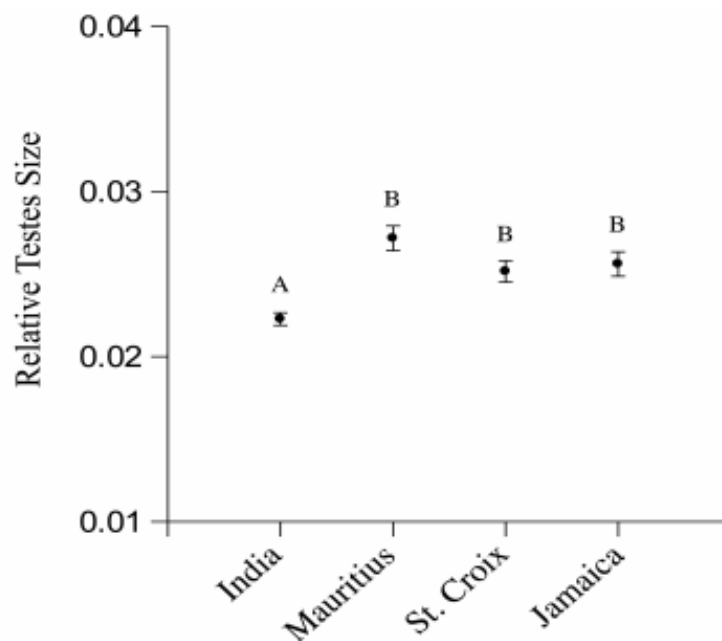
Figure 2: Anal pads difference between the female (a) and male (b) small Indian mongoose. A indicates the anus and AP indicates the anal pad (Owen 2015).

Owen (2017) tested his predictions of evolutionary change in anal pad and testis size by comparing mongooses from India, their native range, to those on the islands of Hawaii, Jamaica, Mauritius, and St. Croix. He found that the average male anal pad size was smaller in the introduced range, with no difference in females, and was correlated with time since initial introduction, becoming smaller with time (Figure 3; Owen 2017). Further, Owen found that relative testis size was larger in mongooses in the introduced range than in the native range. Owen proposed that when mongooses are introduced to islands, they no longer face predation and interspecific competition,



resulting in an increased population density and a decreased need for long-distance chemical signaling. This decrease in the need for the anal pad lead to a reduction in its size, however the large population also correlated to an increased sperm competition, favoring an increase in testis size (Figure 4; Owen 2017). Overall, male mongooses tend to have larger anal pads and smaller testis in their native ranges due to the lower population density, but in introduced ranges, anal pads decrease in size and testis increase as a result of higher population density and competition for mates (Owen 2017).

Figure 3: Change in male anal pad size of the small Indian mongoose between its native range (India) and subsequent introduced ranges (Mauritius in 1902, St. Croix in 1884, Hawaii in 1883, and Jamaica in 1872). Anal pad area is corrected for total body length, and each circle represents the average for each location. Letter differences indicate $P <$



0.05 (Owen 2017).

Figure 4: Increase in testis size of the small Indian mongoose between its native range (India) and subsequent introduced ranges (Mauritius in 1902, St. Croix in 1884, Hawaii in 1883, and Jamaica in 1872). Testis size is corrected for total body length, and each circle represents the area for each location. Letter differences indicate $P < 0.05$ (Owen 2017).

Important Phylogenetic Distinctions

Molecular differences among species of mongooses have been useful in reconstructing the phylogenetic tree of the organism and analyzing how the small Indian mongoose relates to other mongoose species. A molecular phylogeny was created using mitochondrial and nuclear DNA sequences from almost every recognized mongoose species (Figure 5; Patou *et al.* 2009). These analyses were performed using Maximum Likelihood and Bayesian Inference and divergence ages were estimated by

using a relaxed molecular clock approach. The outgroup of the phylogeny consists of two Madagascan species *Fossa fossana* and *Cryptoprocta ferox*. The phylogeny as a whole can be divided into two groups, the eusocial and the solitary species (Patou *et al.* 2009). In Figure 5, the clade highlighted in orange with *Suricata*, *Mungos*, *Liberiictis*, *Helogale*, and *Crossarchus* represents the eusocial mongooses that inhabit Africa and some Mediterranean regions, and the remaining clades are the solitary species. The purple clade, with *Ichneumia*, *Cynictis*, *Paracynictis*, *Rhynchogale*, *Bdeogale*, *H. ichneumon* and *Galerella*, and the green clade with *Atilax* and *H. naso* include solitary African mongooses. *Atilax* and *H. naso* are sister to the Asian mongooses, all of which are solitary species and indicated by the blue clade. Our species of interest is *H. auropunctatus*. It is in a clade with *H. javanicus* and *H. edwardsii*, and they all have a common ancestor with *H. fuscus* which inhabit Sri Lanka, an island south of India. *H. fuscus* descended from *H. vitticollis*, a species that lives in southern India and Sri Lanka.

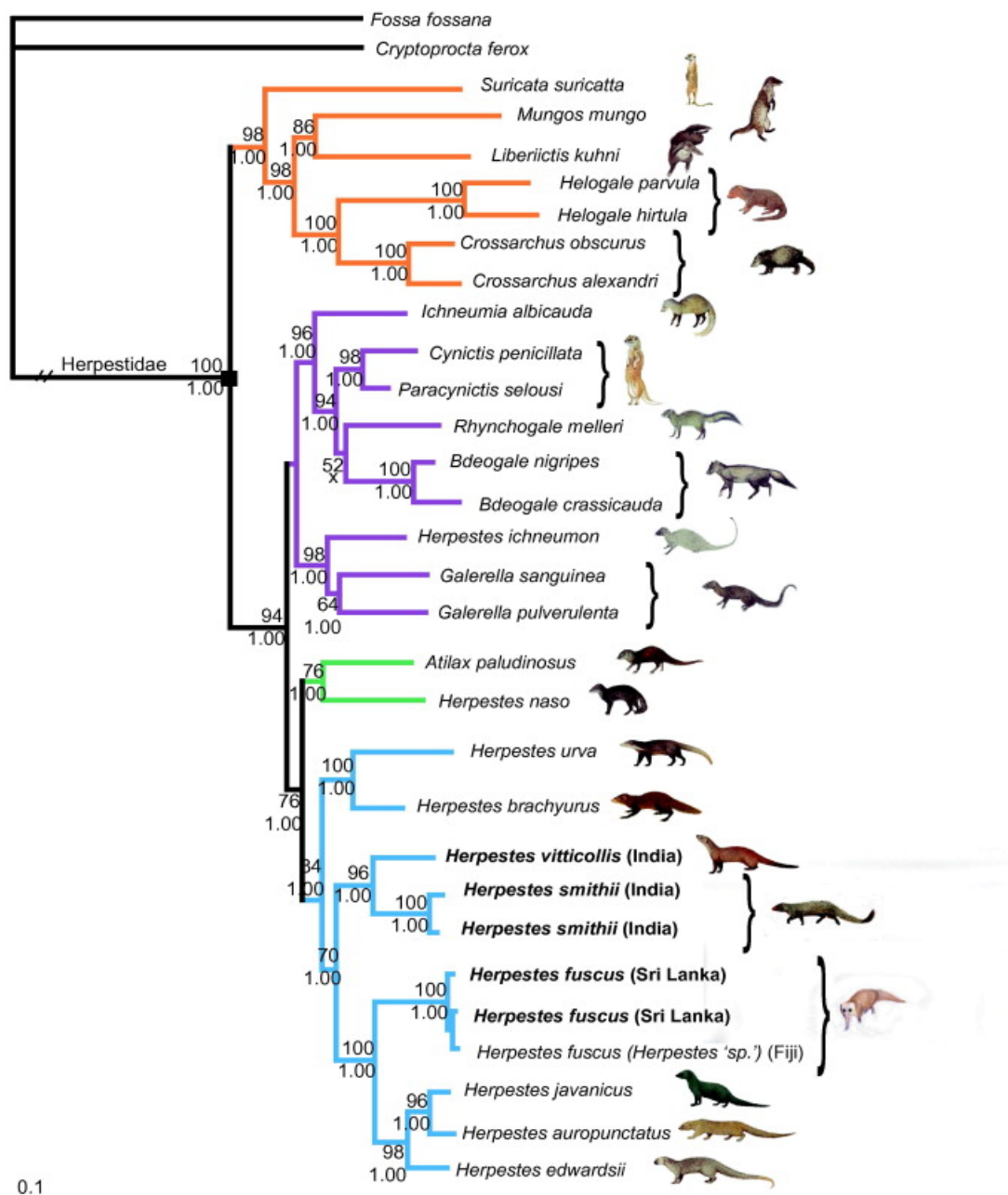


Figure 5: A molecular phylogenetic tree produced from the Bayesian analysis of both mitochondrial and nuclear DNA (Cytb, ND2, FGBi7, and TTRi1 (3350bp)) created by Patou *et al.*. Bootstrap and Bayesian values are reported above and below each node, respectively. (x) indicated Bayesian values less than 0.70. Sequences in bold were collected from the location in parentheses (Patou *et al.* 2009).

The small Indian mongoose is often interchangeably referred to as *H. auropunctatus* and *H. javanicus*, although this phylogeny indicates that these are two separate species. The native range of *H. auropunctatus* is Central Asia while *H. javanicus* is found in Southeast Asia (Patou *et al.* 2009). While this phylogeny did not identify which of these species has invasively inhabited Pacific islands, another group found that *H. auropunctatus* did so in the Caribbean and Hawaiian Islands (Bennett, Wilson and Desalle 2011). Further, Patou *et al.* identified a second mongoose species in Fiji called the Indian brown mongoose, *Herpestes fuscus*, indicating a second mongoose introduction since the 1883 *H. auropunctatus* introduction (Patou *et al.* 2009).

Impacts of Mongooses on Islands

The small Indian mongoose has such a significant impact on world ecosystems that it is listed as one of the world's 100 Worst Invasive Alien Species by the Global Invasive Species Database (GISD 2011). This high level of invasiveness is due to the mongoose's generalist feeding habits. It preys on a variety of animals including birds, small mammals, and reptiles; and is responsible for numerous extinctions throughout the world. The mongoose is also highly adaptable, agile, and lacks predators in its new island environments. Additionally, mongooses mature at the young age of 10 months and have a high rate of reproduction, breeding up to three times a year with litter sizes between 3 and 10 pups (GISD 2011). This set of characteristics makes the mongoose an ideal invasive predator on islands and allows them to prey on native populations unchecked.

The mongoose's original introduction on many islands was intentional, to control rats and other pests in cane fields (Lee 2011; Duffy *et al.* 2015; Brown and Daigneault 2015). Some sources argue that this introduction was a failure due to the diurnal nature of the mongoose and the nocturnal nature of the rats; however, other sources indicate that it was indeed successful by preying on pests of the sugarcane (Hays and Conant 2007). Nonetheless, this serves as an example of a positive impact of the mongoose, a significant consideration before describing the many negative impacts of the small Indian mongoose.

Impact on Bird Populations

Birds, especially ground birds and ground nesters, are vulnerable to mongooses. Bird populations on Fiji and Hawaii have shifted since its introduction, with some extinctions like the Barred-wing Rail (*Nesoclopeus poecilopterus*) on Fiji in the 1880's. Further, many surviving species have adjusted their nesting habits in response to mongoose predation, nesting in trees instead of on the ground (Hays and Conant 2007). Two researchers studied how the mongoose affects endemic birds in Fiji, looking at islands with and without mongooses. They found that three bird species, *Gallirallus philippensis*, *Anas superciliosa*, and *Porphyrio porphyrio*, are negatively influenced by the mongoose since it eats their eggs and chicks from ground nests (Morley and Winder 2013). Mongooses also prey on both the eggs and adults of Hawaiian petrels (*Pterodroma sandwichensis*) and Newell's shearwaters (*Herpestes javanicus*), both of which are endemic to Hawaii. This unchecked predation has led to the birds' conservation status as vulnerable and endangered, respectively (Duffy *et al.* 2015; IUCN 2016a; IUCN 2016b). In Japan, four bird species have been negatively affected. *Hypotaenidia okinawae* has been listed as endangered, *Scolopax mira* and *Garrulus lidthi* are vulnerable, and *Larvivora komadori* is near threatened, all due to the introduction of the mongoose (Owen 2017).

Impact on Reptile Populations

Mongooses also prey on small reptiles. Hays and Conant describe many instances where the mongoose has been falsely accused of driving a variety of Caribbean reptiles to extinction, however it remains true that mongooses severely inhibit reptile populations on many islands they inhabit (Hays and Conant 2007). In fact, while Caribbean lizards may not be entirely threatened by mongooses, skinks in Fiji are extremely vulnerable to predation by mongooses (Morley and Winder 2015). On two of the largest Fijian islands, two species of large skinks, *Emoia nigra* and *Emoia trossula*, were extirpated largely by the mongoose (Morley and Winder 2015). In Japan, three species of frogs, *Odorrana amamiensis*, *Odorrana ishikawae*, and *Babina subaspera*, are endangered by the presence of the mongoose, not to mention the near threatened skink, *Ateuchosaurus pellopleurus* (Owen 2017). Mongooses, wherever they are present, greatly reduce the number of reptiles living in an area thereby making these species more

susceptible to other threats. Such other threats can include natural phenomena like hurricanes, other invasive species, and depletion of habitat due to human urbanization (Gasc *et al.* 2010).

Mongoose Control and Eradication

Due to mongooses' destructive impacts on many of the islands they inhabit, many island governments view the mongoose as a pest and push for its eradication. For over a century, governments and researchers have tried a multitude of tactics to destroy the small Indian mongoose, but their efforts have rarely been met with success (Yamada 2002; Ulrich 1913). Nevertheless, the quest to minimize the impact of mongooses on islands continues, and many different methods are currently being developed.

There are three main ways to eliminate mongooses on islands: trapping, poisoning, and hunting (Ulrich 1913; Brown and Daigneault 2015). In the early 1900's, efforts to remove mongooses involved government-sponsored programs which offered incentives for citizens who presented dead mongooses. Methods used to kill mongooses included iron traps (Figure 6) and bait poisoned with sulfate of strychnine (Ulrich 1913). Today, some islands still offer incentives for dead mongooses, and trapping and poisoning continue to be used for eradication purposes, but the technology allowing the use of these methods has improved (Yamada 2002). Current traps are built with species specificity, limiting the number of other animals being accidentally trapped, and many traps contain mechanisms to quickly and humanely kill the captured mongooses (Figure 6; Brown and Daigneault 2015). Additionally, today's poisons are more advanced than those used to kill mongooses in the early 1900's. One promising poison that is being developed is diphacinone, which is an anticoagulant known to cause fatal internal bleeding in mongooses. In particular, mongooses display an increased susceptibility to diphacinone compared to other animals, which allows lower doses to be used and limits the poison's impact on other species (Stone 1994).

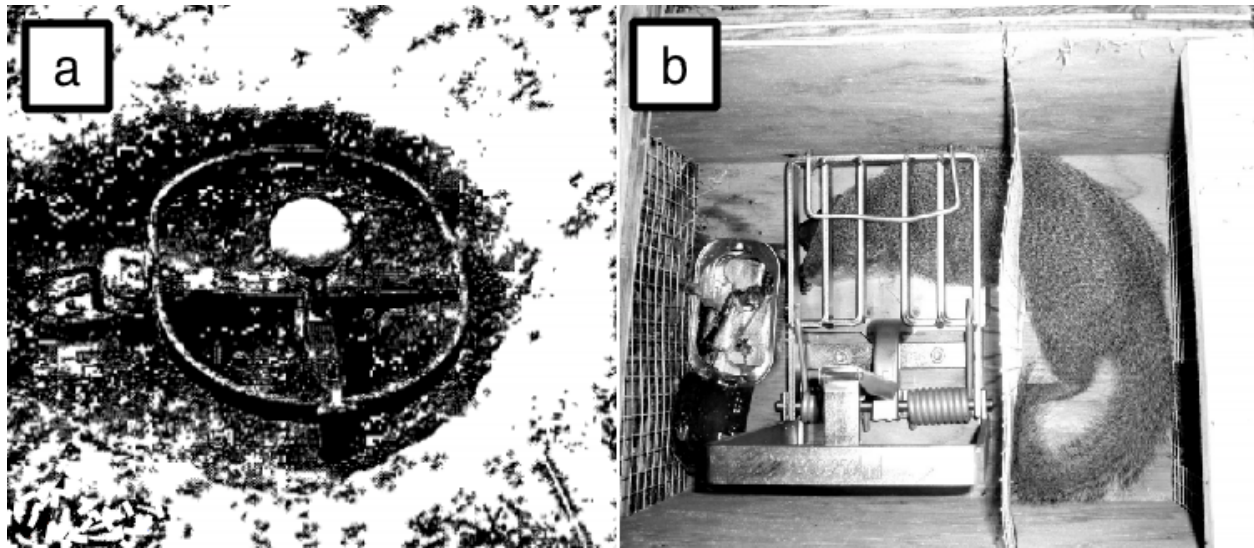


Figure 6: Iron traps used in the early 1900s (a) and the DOC 250 kill traps currently in use (b) are both methods employed to target mongoose populations on islands (Urich 1913; Peters *et al.* 2011). Though both trap and kill the mongoose, newer technology has allowed the DOC 250 trap to specifically target and humanely kill the small Indian mongoose (Brown and Daigneault 2015).

The methods of poisoning, trapping, and hunting are all currently in use on Pacific islands including those of Fiji, Japan, and Hawaii. All three of these island groups have suffered great ecological damage from the small Indian mongoose and have attempted to eradicate it to preserve their native biota and ecosystems (Yamada 2002; Stone 1994; Brown and Daigneault 2015). Eradication efforts in these island groups used a combination of some or all of the three main methods of mongoose destruction. In Japan, trapping and hunting were the main tactics used to lower mongoose populations. Trappers used cage and box traps baited with meat to catch mongooses, and they were paid \$18 per mongoose caught (Yamada 2002). Hawaiian research efforts have focused on using diphacinone as a poison for the mongoose (Stone 1994). Of the three island groups examined, Fiji is the only one that has not yet implemented a mongoose extermination program; however, researchers have investigated eradication options for Fiji and recommended the use of species-specific kill traps designed to quickly and humanely kill captured mongooses (Brown and Daigneault 2015).

Unfortunately, mongoose eradication programs on islands have not been extremely successful (Yamada 2002). Trapping efforts have a limited effectiveness as mongoose populations drop and the animals become harder to catch (Yamada 2002). Moreover, poison is difficult to administer to an entire population (Stone 1994). These obstacles make it extremely challenging to completely eradicate mongooses from islands. However, mongoose eradication is not an island's only hope. Even if mongoose populations cannot be completely decimated, keeping their numbers below carrying capacity and eliminating mongooses near the habitats of endangered species could vastly decrease the negative impact of the mongoose on an island's native biota (Hays and Conant 2007). This can be accomplished with the traditional trap and poison methods, which are able to efficiently decrease mongoose populations to an ecologically tolerable level.

Conclusion

Islands house vulnerable environments that can easily fall victim to natural disasters and external disruptions. One such disruption is the small Indian mongoose, a medium-sized mammal that has caused trouble for islands in the Pacific. The mongoose was introduced to numerous islands worldwide to control pests, perhaps most notably on the island groups of Hawaii, Fiji, and Japan (Duffy *et al.* 2015; Brown and Daigneault 2015; Watari *et al.* 2008; Saito *et al.* 2009). However, due to the mongoose's adaptability, as well as its reproductive and generalist qualities, it has become an invasive terror that has caused immense ecological damage including the extinction of unique species (GISD 2011; Hays and Conant 2007). Due to the menace it has caused, eradication programs have been established, such as trapping and poisoning, to rid Pacific islands of the mongoose. Nonetheless, mongooses persist, continuing to cause lasting damage in their introduced ranges.

Literature Cited

- Bennett CE, Wilson BS, Desalle R. 2011. DNA barcoding of an invasive mammal species, the small Indian mongoose (*Herpestes javanicus*; E. Geoffroy Saint-Hillaire 1818) in the Caribbean and Hawaiian Islands. *M. DNA*. 22(1-2):12-18.
- Brown P, Daigneault A. 2015. Managing the Invasive Small Indian Mongoose in Fiji. *Agricultural and Resource Economics Review*; Durham 44:275–290.
- Duffy D, Elliott D, Hart G, Gundersen K, Aguon-Kona J, Bartlett R, Fujikawa J, Gmelin P, Javier C, Kaneholani L. 2015. Has the Small Indian Mongoose Become Established on Kaua'i Island, Hawai'i? *Pacific Science* 69:559–565.
- Gasc A, Duryea MC, Cox RM, Kern A, Calsbeek R. 2010. Invasive Predators Deplete Genetic Diversity of Island Lizards. *PLoS ONE* 5(8):e12061.
- GISD (Global Invasive Species Database). 2011. Species profile: *Herpestes javanicus* [internet].
- Hays W, Conant S. 2007. Biology and Impacts of Pacific Island Invasive Species. 1. A Worldwide Review of Effects of the Small Indian Mongoose, *Herpestes javanicus* (Carnivora: Herpestidae). *Pacific Science* 61:3–16.
- IUCN. 2016a. *Puffinus newelli*: BirdLife International: The IUCN Red List of Threatened Species 2016.
- IUCN. 2016b. *Pterodroma sandwichensis*: BirdLife International: The IUCN Red List of Threatened Species 2016.
- Lee W. 2011. Islands. In: *Encyclopedia of Biological Invasions*. 391-395.
- Minnich A. 2009 Dec 1. Insidious Island Invasion: An exploration of *Falcataria moluccana* stand ecology - eScholarship. University of California - Berkeley.
- Morley CG, Winder L. 2013. The Effect of the Small Indian Mongoose (*Urva auropunctatus*), Island Quality and Habitat on the Distribution of Native and Endemic Birds on Small Islands within Fiji. *PLOS ONE*. 8(1):e53842.
- Morley CG and Winder L. 2015. Vulnerability of skinks to predation by introduced Mongoose in the Fiji islands. *Pacific Science*. 69(3):313-317.

- Owen MA. 2015. Research [Internet]. The Graduate Center and Queens College (CUNY); [cited 2017 Dec 3]. Available from: <http://maaronowen.wixsite.com/m-aaron-owen/research>.
- Owen MA, Lahti DC. 2015. Sexual dimorphism and condition dependence in the anal pad of the small Indian mongoose (*Herpestes auropunctatus*). *Can. J. Zool.* 93:397-402.
- Owen MA. 2017. Ecology, evolution, and sexual selection in the invasive, globally distributed small Indian mongoose (*Urva auropunctata*) [Ph.D.]. [United States -- New York]: City University of New York.
- Peters, D., L. Wilson, S. Mosher, J. Rohrer, J. Hanley, A. Nadig, M. Silbernagle, and M. Nishimoto. 2011. "Small Indian Mongoose: Management and Eradication Using Doc 250 Kill Traps, First Lessons from Hawaii." In C.R. Veitch, M.N. Clout, and D.R. Towns, eds., *Island Invasives: Eradication and Management*. Gland, Switzerland: IUCN.
- Patou ML, Mclenachan PA, Morley CG, Couloux A, Jennings AP, and Veron G. 2009. Molecular phylogeny of the Herpestidae (Mammalia, Carnivora) with a special emphasis on the Asian *Herpestes*. *MPE*. 53(1):69-80.
- Saito M, Nakata K, Nishijima T, Yamashita K, Saito A, and Ogura G. 2009. Proposal for Japanese encephalitis surveillance using captured invasive mongooses under an eradication project on Okinawa Island, Japan. *Vector-Borne and Zoonotic Diseases* 9:259.
- Simberloff D, Dayan T, Jones C, Ogura G. 2000. Character Displacement and Release in the Small Indian Mongoose, *Herpestes javanicus*. *Ecology* 81:2086–2099.
- Stone C. 1994. Use of an Anticoagulant to Control Mongooses in Nene Breeding Habitat. *'Elepaio* 54:73–78.
- Urich F. 1913. *The Mongoose in Trinidad and Methods of Destroying It*.
- Watari Y, Takatsuki S, Miyashita T. 2008. Effects of Exotic Mongoose (*Herpestes javanicus*) on the Native Fauna of Amami-Oshima Island, Southern Japan,

Estimated by Distribution Patterns Along the Historical Gradient of Mongoose Invasion. *Biol Invasions* 10:7.

Yamada F. 2002. Impacts and control of introduced small Indian mongoose on Amami Island, Japan. *Turning the tide: the eradication of invasive species*:389–392.