



University of Washington Bothell

# The CROW

Campus Research and Observational Writings

**VOLUME TEN**

Spring 2025

**EDITORIAL BOARD**

Cecilia Negash

Chuck Frickin-Bats

Kaya Schubiger-Lewis

Newton (Newt) Austria-Ball

Morgan Fu-Mueller

Rehema Hassani

Sabine Drake

**FACULTY AND STAFF ADVISERS**

Andrea Stone, Ph.D.

Erik Echols

Layla Youssef



© 2025 University of Washington Bothell *The CROW*

*The CROW (Campus Research and Observational Writings)* is an annually published journal of UW Bothell student research. We accept submissions throughout the year, with a priority deadline of January 1 and a final deadline of March 1 for each upcoming issue. You must be a student at the University of Washington Bothell, or a recent UWB graduate (up to one year post graduation), to submit. Submissions are accepted by email at [publish@uw.edu](mailto:publish@uw.edu).

*The CROW* is an equal opportunity student publication that does not discriminate or publish works that discriminate against any sex, gender expression, sexual orientation, race, color, ethnicity, creed, religion, political affiliation, or ability. We thoughtfully consider all potential publications within this guideline.

*The CROW*

c/o Writing and Communication Center, Box 358565

University of Washington Bothell, 18115 Campus Way NE, Bothell, WA 98011-8246

<https://www.uwbcrow.com/>

The contents of the University of Washington Bothell's *The CROW (Campus Research and Observational Writings)* are copyrighted. Under U.S. Law it is unlawful to reproduce or distribute the contents by any means without written permission.

This publication is courtesy of the University of Washington Bothell, the UWB Club Council, and is funded through Student Activity Fees.

The University of Washington Bothell is built on the unceded ancestral lands of the Coast Salish peoples, including the Duwamish and Snohomish tribes. We recognize the ongoing harm caused by colonization and affirm our responsibility as a student-led research publication to engage in decolonization efforts. The CROW seeks to create an inclusive and equitable publication that values Indigenous experience, knowledge, and culture, and fosters justice. We endeavor to encourage revisions unique to each paper, and not to unilaterally uphold Western standards of academic rigor.

Cover Design Credit: Morgan Fu-Mueller





## CONTENTS

Reflecting The <i>Poem That Never Ends</i> <i>phoenix kai</i> . . . . .	1
Racism in Healthcare: Researched and Analyzed from an Intersectional Angle <i>Sidra Yousaf</i> . . . . .	5
Similarities between Greater Roadrunner ( <i>Geococcyx californianus</i> ) birds and Mulgwa ( <i>Acacia aneura</i> ) Shrubs: A Review of Extreme Adaptations to Desert Environments <i>Faith Lambert, Niki Hakimi, Faith Manning, &amp; Geoffrey Tong</i> . . . . .	9
The Mexican American Experience: Healing Through Ethnic Studies and Bilingualism <i>Amado Chacon</i> . . . . .	19
Echoing Across a Nation: The New Wave of Gendered Terrorism in the United States <i>Brianna Fero</i> . . . . .	29
Judicial Compliance: The Supreme Constitutional Court and the Militarization of Egypt's Government <i>Hoda El Anany</i> . . . . .	43
Evolution of American Foreign Policy: The Creation of a Global Superpower <i>Hoda El Anany</i> . . . . .	55
Rebrand or Re-Bland? How Brand Image Reflects Appreciation for Consumers <i>Stephen Lovas</i> . . . . .	65
Family Perspectives of Alzheimer's Dementia Progression & Type of Care: A Qualitative Methods Approach <i>Robin Stone</i> . . . . .	71
The Impact of Social Media on Teen Mental Health: A Mixed-Method Intervention <i>Kelsey Sugita</i> . . . . .	83



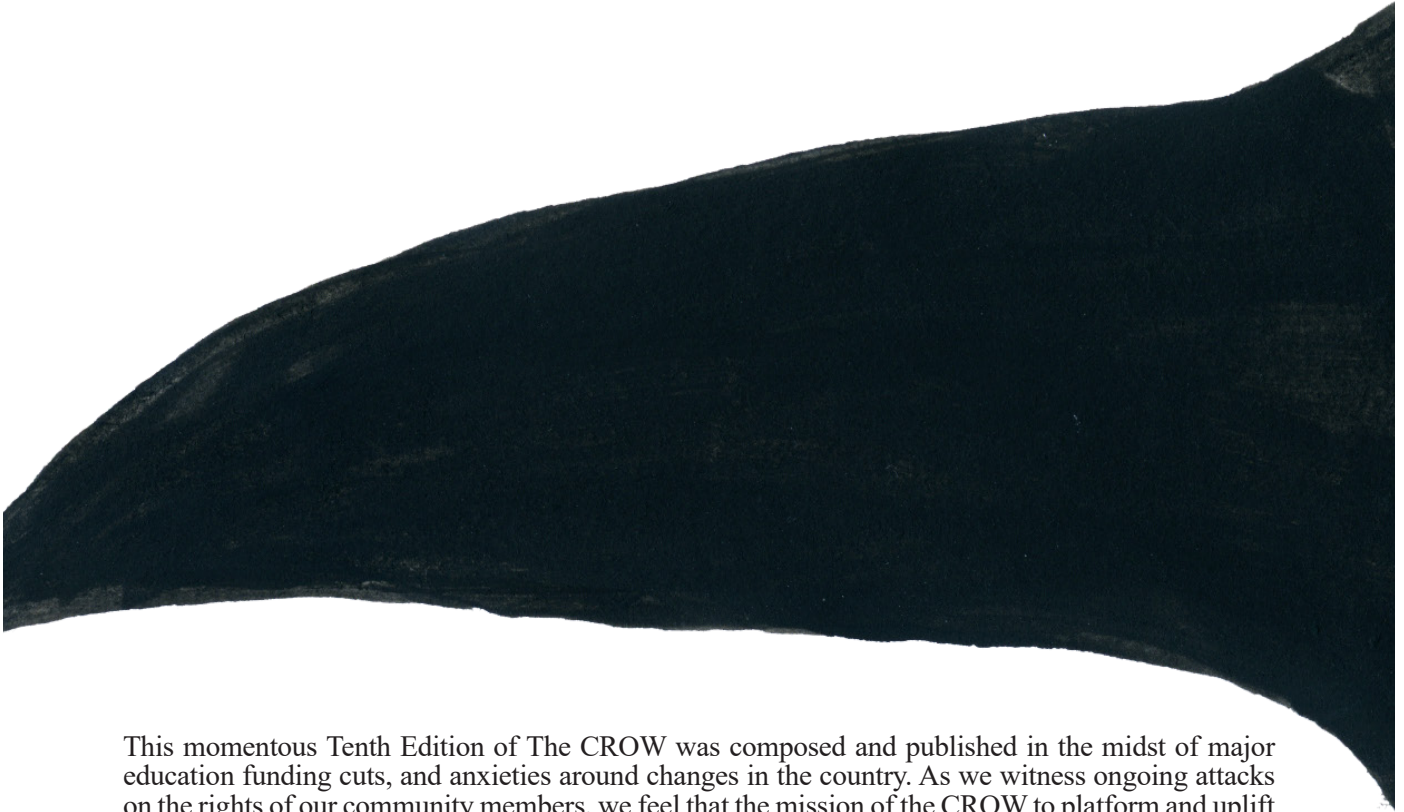
## CONTENTS

Breast Cancer: A Qualitative Study on Why Barriers Prevent North African Women with Stage III Breast Cancer from Seeking Mammography Screening and How to Overcome It <i>Muhy Hussein</i> . . . . .	91
A Comprehensive Analysis: The Relationship Between Temperature and Precipitation on Chokecherries <i>Gurkamal Kaur</i> . . . . .	101
Rodentia Species Did Not Follow the Latitudinal Diversity Gradient During the Miocene <i>Yordanos Berhane</i> . . . . .	111
Effects of the Paleocene-Eocene Thermal Maximum on Freshwater Plant Distribution and Its Relation to Modern Climate Change <i>Victoria Jeffords</i> . . . . .	117
Benthic Foraminifera Found to Have Survived Better During the Paleocene- Eocene Thermal Maximum with Implications to a Future Mass Extinction Event <i>Liz Macias</i> . . . . .	123
Students Eventually Value Active Learning <i>Parbeen Sekhon and Eric Onnen</i> . . . . .	131
ABOUT THE STUDENT AUTHORS	
ABOUT THE EDITORIAL BOARD	





## LETTER FROM THE EDITORS



This momentous Tenth Edition of The CROW was composed and published in the midst of major education funding cuts, and anxieties around changes in the country. As we witness ongoing attacks on the rights of our community members, we feel that the mission of the CROW to platform and uplift student voices is our way of advocating. We thank you for being part of this work and reaffirm our belief in the value and impact of student writing, student activism, and student investment in global futures.

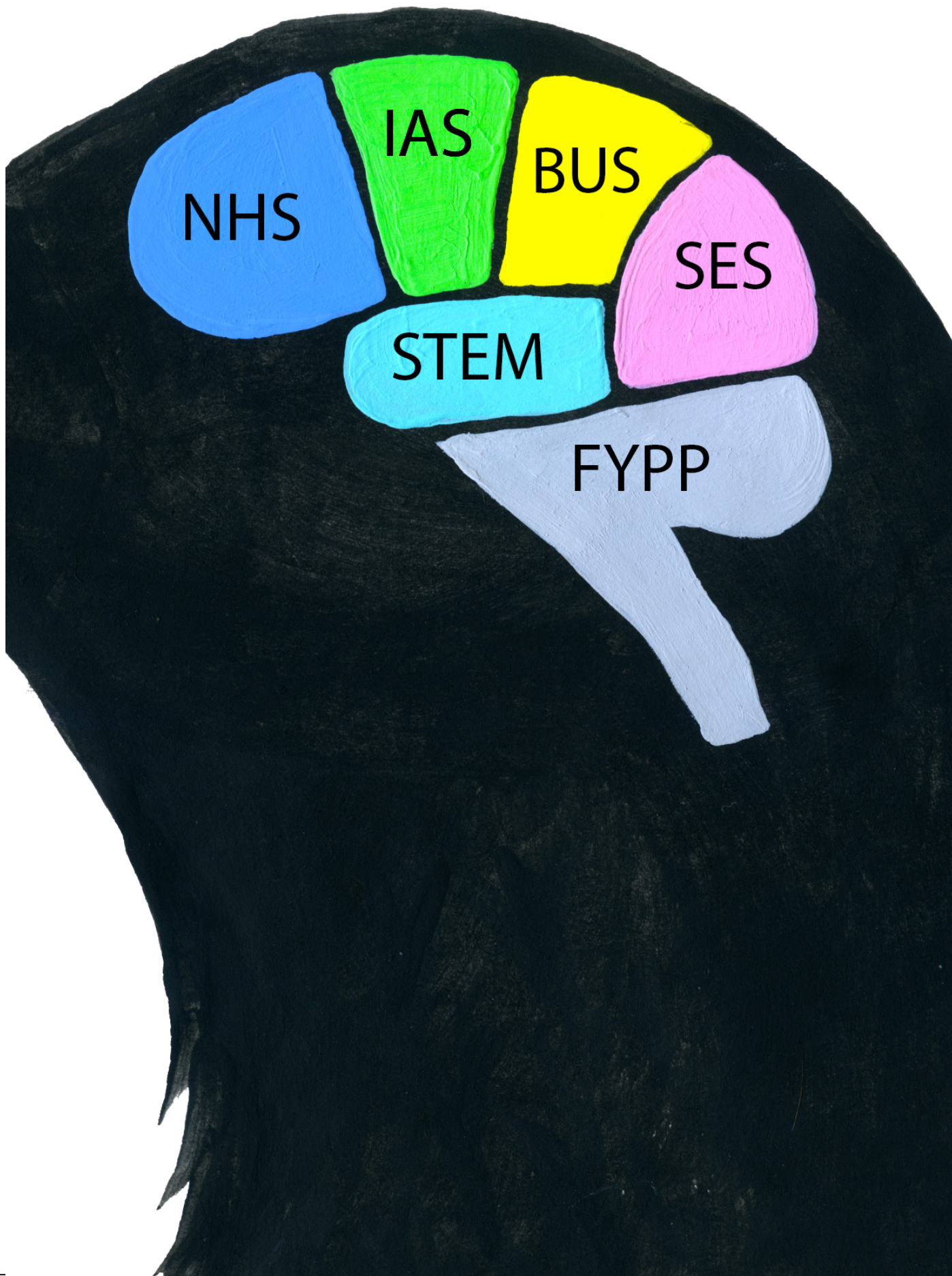
With this edition, The CROW continues to highlight the incredible dedication of students at UW Bothell as they synthesize their own investigations in topics ranging from science and technology, interdisciplinary arts, health studies, and everything in between. Research is a high-impact learning practice that engages students outside the classroom and allows them to think more critically about the topics they wish to discover. By taking the initiative to submit their work for review by a board of their peers, the authors in this journal have taken steps towards becoming active contributors to academic discourse that values inclusion, expansion, and critical thinking. As ways of writing and research advance, student publications like The CROW lie on the frontier. This year saw us throwing our belated 23-24 launch party, working through several power outages, and fielding papers from a wide variety of disciplines.

We would like to extend special recognition and gratitude to our student authors. Despite fears of rejection, judgement, or critique; our authors showed perseverance with the editing and publication process. We know submitting was difficult, and we appreciate your patience and effort as we tried to ensure your work would shine. We are so excited to share the 2025 Edition of The CROW!

With love,

Your friends on the Editorial Board: Layla, Chuck, Rehema, Kaya, Sabine, Newt, Cecilia & Morgan.









## REFLECTING THE *POEM THAT NEVER ENDS*

phoenix kai

*ABSTRACT: This paper critically examines the themes, details, language, and processes in Silvina López Medin's book Poem That Never Ends. Investigating personal lineages of motherhood, Poem That Never Ends navigates the complexities of writing about shared family history. Looking closely at the many thematic layers and the discussion of process into the book itself reveals insights into contemporary discourse around poetics, imagination, and form.*

Silvina López Medin's *Poem That Never Ends* is a haunting matryoshka<sup>i</sup> of motherhood. A nesting doll is a perfect visual representation of the book, a layering of experiences and stories through generations of mothers. *Poem That Never Ends* is an infrastructure of absence—paradoxical in a way—in that Medin writes around that which is missing. Specifically, she investigates the matrilineal gap passed down to her in her childhood, digging into the silence associated with “mother” and “mother’s mother.” Hoping to disrupt that cycle of silence, Medin critically reflects on her own position as a mother and searches for severed threads and fragments in her family’s past so that she might stitch together her intergenerational maternal void. This book serves as a contemporary excavation into processes of thinking and exploring one’s own poetics. Examining the content and themes in *Poem That Never Ends* reveals how a work of poetry can simultaneously act as a statement of poetics. It is important to distinguish poetics from poetry; in this context, poetics refers to an author or creator’s motivations and understanding of their own processes of creation. It reflects on the reasons why we write what we write, the intention of the work, and the context in which the work is situated. This paper seeks to unravel the many layers in Medin’s work by dissecting the thematic throughlines, the stylistic devices, and the multiple poetic mediums; doing so reveals Medin’s personal

poetics as well as the challenges of narrating a shared familial history.

Because *Poem That Never Ends* has so many interwoven literary principles, it is difficult to categorize; however, I would define it as experimental documentary poetics. It utilizes dated and timestamped locations alongside poems within poems within stories woven into her family’s source materials: photographs, messages, orations, and letters. In examining her own upbringing, her maternal lineages, and her experience as a mother, she confronts the reasons why she writes and to whom she writes. Or perhaps the inverse: to whom she writes and therefore, why she writes. As she follows the thread of her poetics, it leads to her mother and to her mother’s mother. By journeying back through her family’s long lineage of seamstresses, she explores the immense intergenerational trauma that informs her writing.

Silence haunts this book. Medin pulls the reader closer and closer to the void that is her childhood, describing in vivid detail her mother’s deteriorating ability to hear and her grandmother’s vacancy that somehow grows larger with every added piece of information. These seemingly oppositional forces work in tandem, creating a throughline of tension where paring layers reveals more emptiness, and more content only seems to create more absence. This aspect of holding space for seemingly dichotomous forces exists not only in the craft









writes, “Clothing is the most intimate inhabitable space... architecture is an expansion of that” (68) and goes on to describe how the artist Do Ho Suh recreates rooms and places he has lived out of fabric. It points to the importance of process and how it informs the emotional weight of creating—drawing a parallel to the process of stitching her own architecture in words, once again peeling back the fabric of her investigation into poetics. In a way it is a poetics of poetics; examining why she writes what she writes necessitates writing—as well as confronting the factors that push her to examine her poetics. There is a history of debate in poetics about whether the ideas being communicated dictate the form the writing takes or if the form/style it is written in takes precedent over the ideas themselves.<sup>iv</sup> In this case, neither form nor thinking precedes the other. It is a simultaneous process; form mirrors thought, where themes, poetry, and poetics are all nestled in overlapping layers like bundles of fabric.

This book is composed of layers upon layers of motherhood in many different mediums. She tells the story of a maternal haunting, of her mother, of her mother’s mother, of her father’s mother, but grounds it in her own experience. It lays bare the stitches that weave her story, transparently incorporating processes, barriers, and failures in gathering the information to write the book. The honesty, vulnerability, and sincerity convey the challenges of writing about family and about histories that are shared. *Poem That Never Ends* writes between genres by incorporating multimedia, documentary, and poetry elements interwoven with discussion of poetics and process. Poetics is largely a conversation by writers about writing, so the audience would generally be other writers; however, *Poem That Never Ends* takes a creative approach to documenting its own creation, offering a unique bridge between content, form, and analysis.

## References

- i. Medin, Silvina López. *Poem That Never Ends*. Essay Press, 2021.
- ii. Also known as Russian nesting dolls, stacking dolls, or tea dolls
- iii. A method of repairing a hole in fabric with needle and thread by interweaving stitches to create new material
- iv. See Muriel Rukeyser’s *The Life of Poetry*
- v. See works such as Ralph Waldo Emerson’s *Poetry and Imagination* [1872], Charles Olson’s *Projective Verse* [1950], and Denise Levertov’s *Some Notes on Organic Form* [1965]





# RACISM IN HEALTHCARE: RESEARCHED AND ANALYZED FROM AN INTERSECTIONAL ANGLE

Sidra Yousaf

*ABSTRACT: This literature review explores the interplay of racism and implicit bias in healthcare, particularly focusing on the reproductive health of women of color through an intersectional lens. The legacy of Jim Crow laws and forced sterilizations have contributed to a mistrust of the American healthcare system among women of color. These legacies motivated the Black Panther Party to form the People's Free Medical Clinics, so that their community members could feel safe seeking medical treatments. These historical contexts shape stereotypes and implicit biases that modern medical professionals still carry towards women of color. Ultimately, there is a significant need for healthcare reform in America by promoting equity in healthcare.*

## Introduction & Background

The famous Civil Rights Activist Martin Luther King, Jr. once said, "Of all the forms of inequality, injustice in healthcare is the most shocking and inhumane" (Galarneau 2). It is no secret that implicit bias exists in everything human related, and healthcare is no exception. The American Psychological Association defines implicit bias to be "...thought to be shaped by experience and based on learned associations between particular qualities and social categories, including race and/or gender. Individuals' perceptions and behaviors can be influenced by the implicit biases they hold, even if they are unaware they hold such biases" (APA). This particular type of bias is one that we are not consciously aware of and can stem from stereotypes about a particular marginalized population.

However, the cost of this bias is often life threatening for people of color. A critical research question that arises is: how does America's history of racism in healthcare influence current implicit bias towards the reproductive health of women of color?

Jim Crow Laws have left subtle, yet harmful legacies in America. Segregation affected

everything from residential neighborhoods to schools, and hospitals were no exception. Since hospitals and clinics were segregated, white staff were not allowed to interact with Black patients. The lack of Black staff in these hospitals meant that services for people of color were practically nonexistent. Because of these legacies, eugenics programs where Black women were coerced into sterilization without being told it was irreversible were allowed to exist, in order for white scientists to feel as though they were controlling the race. As a result of segregation and forced sterilizations, there is an implicit bias surrounding patients that are women of color, which leads to lack of equity in their reproductive healthcare. It is because of past sterilization abuse and segregation of hospitals that the reproductive healthcare of women of color is in jeopardy more so than that of white women.

## Literature Review

### Implicit Bias

A reader compiled and edited by Lydia Isaac and Thomas LaVeist called *Race, Ethnicity, and Health: A Public Health Reader* is a collection of articles that discusses the health disparities in America and how there is a dire need for



Yousaf

health equity. Some topics covered in this reader consist of hospital treatment of minorities, health disparities in integrated communities, etc. Implicit bias is recognized by Lydia Isaac and Thomas LaVeist, “When we focus on race in reproductive health, syphilis control, cancer treatment, and other interventions, it seems clear that racism may affect the way decisions are made by medical and public health professionals” (38). From this, we are able to deduce that implicit bias that is likely a result of healthcare segregation in hospitals and lack of access for people of color as a whole.

The overall evidence of this kind of bias having long lasting and harmful impacts on the black community is also seen in chapter 16, where Isaac and Laveist identify evidence that black-white disparities in healthcare have not changed significantly over time. For example, “age-adjusted all-cause mortality for African Americans was one and a half times as high as that of whites in 1998, identical to what it was in 1950” (Isaac 331). This shows that even though there was almost a forty-year difference in the time of when the statistics were taken, well before and well after the Civil Rights Movement and Acts, there was no difference between the mortality rates between Black patients and white patients (Isaac 331). Furthermore, this displays that healthcare segregation has left a lasting legacy in the form of implicit bias.

### Healthcare Segregation

Alondra Nelson’s “Body and Soul: The Black Panther Party and the Fight Against Medical Discrimination” goes over one of the main reasons that the Black Panther Party formed: to combat healthcare racism. Known to be militant according white media, the book talks about how the Party was more focused on helping their own communities be self-sufficient. According to Nelson, in social settings where social abandon (i.e. insufficient social welfare programs) and social control (i.e. police harassment) were a common form of racial oppression, health was

a “site where the stakes of injustice could be exposed and a prism through which struggles for equality could be refracted” (Nelson, 5). As a result of this, as well as stories about black people in their communities who died from lack of healthcare access, the Party formed the People’s Free Medical Clinics. These clinics were formed to provide services that were respectful, free, and sufficient, in contrast to the options (or lack thereof) in underprivileged, minority communities. The work of the women’s health centers comprised of rape counseling, birth control services, midwifery, cervical self-examinations, obstetric procedures and, sometimes abortions (Nelson 89). Moreover, these clinics were formed because of the lack of adequate healthcare for Black communities in segregated hospitals. The work of the women’s health centers comprised of rape counseling, birth control services, midwifery, cervical self-examinations, obstetric procedures and, sometimes abortions (Nelson 89). This is significant because the Black Panther Party recognized that Black women of their community were at a huge disadvantage when it came to their own reproductive healthcare. The Party recognized how deep segregation ran in this country, and included that in their health activism.

### Sterilization Abuse

After looking at the history of health segregation and how that affects people of color to this day, it’s crucial that we narrow in on the history of sterilization abuse, as well as the activism that fought for reproductive justice. In Jennifer Nelson’s book, *Women of Color and the Movement for Reproductive Justice*, she goes into depth about the history of women of color who fought, not just for reproductive rights, but for reproductive justice. In this particular book, she writes about how women of color, particularly black women, were often coerced by medical professionals to have parts of their uterus removed by telling them they would still be able to conceive. Jennifer Nelson



writes that because of these heinous acts, many that were often federally funded, activist organizations were formed by women of color for women of color. It is important to note who these groups were formed by because “Women of color activists...believed that mainstream white feminist organizations did not make health care issues defined by women of color, and associated with their experiences of both racism and classism, priority political issues in the 1980’s” (Nelson 199). These groups focused on issues more specific than just abortion, which is what many white feminist organizations were primarily focused on. In fact, “...SisterSong and the women of color organizations that made up their coalition also focused on advocating for health care services that were culturally appropriate for different groups of women” (Nelson 196). This indicates the difference between the two types of feminism that were prevalent in that time period and one of them was much more inclusive and intersectional than the other. From this, it is deduced that white feminism did not take into account the reproductive struggles that women of color were more prone to face. White women did not have to face the same struggles that were based on both gender and racial stereotypes that women of color did.

### **Modern Impacts of Sterilization Abuse**

After researching the history of coerced sterilization abuse, it is necessary to take a look at how this is still ingrained in American society. In a study conducted by Lisa Rosenthal and Marci Lobel, “Gendered Racism and the Sexual Reproductive Health of Black and Latina women”, they take a look at current healthcare from an intersectional perspective, both race and gender and how stereotypes can contribute to racial disparities. This study provides recent data about birth control distrust among Black and Latina women from an intersectional perspective (race and gender). The authors talk about how many women of color’s mistrust of birth control is directly linked to the gendered

racism found in the American healthcare system. They explain that due to its relation to pregnancy and motherhood, “it can create distress for Black and Latina women throughout their lives and specifically during pregnancy, with potential adverse consequences for birth outcomes” (371).

### **Reproductive Healthcare Inequity**

Birth control mistrust from women of color stems from the history of nonconsensual sterilizations performed on these women. Because of this history, this deep-rooted mistrust can lead to them being more at risk sexually. This is important to note because it provides insight to how the stereotype of women of color being more fertile and/or promiscuous relates to this inherent mistrust of government/medical officials.

Due to America’s own history with sterilization abuse towards women of color, they are more at risk sexually. Harmful stereotypes also play into the adverse experiences of pregnancy that women of color face. From an intersectional angle, Rosenthal and Lobel identified stereotype-related gendered racism, a type of gendered racism that is based on the historically rooted-stereotypes of Black and Latina women. This would include stereotypes specifically about their sexuality and motherhood), as well as worry or concern over those experiences (i.e. stereotype threat) (369). The article references an experiment from 2016 where undergraduates shared their perceptions of a young adult Black woman, including having more sexual partners and being less likely to use birth control regularly. A pregnant Black woman perceived by the same participants as less likely to have the baby’s father involved in raising the child, as well as more likely to utilize government assistance to help raise her child than a white woman (370). The potential of being viewed this way by medical professionals causes additional distress during pregnancy, putting the mother and fetus at risk. This demonstrates that women



Yousaf

of color during pregnancy are more at risk than white women are during pregnancy due to the fact that as well as the typical worries that come with pregnancy, the experiences of gendered racism that they face adds on to their distress.

### Conclusion

All in all, it's crucial to trace the prevalence of racial disparities throughout healthcare as a whole before focusing specifically on a field. By individually tracing the past through to the present in two different ways – the healthcare of people of color through a broad lens and the reproductive healthcare of women through a focused lens – it is evident that the legacy of segregated hospitals and sterilization abuse still affects women of color today. It is because of past sterilization abuse and segregation of hospitals that the reproductive healthcare of women of color is in jeopardy more so than that of white women.

When thinking about these race disparities, whether it be in healthcare, education, or academia, it is crucial to acknowledge that these are all a part of a larger system that everyone is a participant in. It is only a matter of how individuals choose to participate.

Healthcare workers can choose to be silent and complicit to these struggles that many individuals face, or we can choose to work to change things for everyone. In order for there to be true changes to underprivileged communities and healthcare, a dismantling of the system that is designed to be oppressive towards certain groups of people is needed to heal and move forward.

### Works Cited

- Galarneau, Charlene. "Getting Martin Luther King's Words Right." Physicians for a National Health Program, *Physicians for a National Health Program*, 2018.
- "Implicit Bias." American Psychological Association, *American Psychological Association*, Nov. 2022, [www.apa.org/topics/implicit-bias](http://www.apa.org/topics/implicit-bias).
- Isaac, Lydia A., and Thomas A. LaVeist. Race, Ethnicity, and Health: A Public Health Reader. John Wiley & Sons, Incorporated, 2012.
- Nelson, Alondra. Body and Soul: The Black Panther Party and the Fight Against Medical Discrimination. *University of Minnesota Press*, 2011.
- Nelson, Jennifer. "Women of Color and the Movement for Reproductive Justice." *More Than Medicine: A History of the Feminist Women's Health Movement*, NYU Press, 2015, pp. 193–220.
- Newkirk II, Vann R. "America's Health Segregation Problem." *The Atlantic*, Atlantic Media Company, 18 May 2016.
- Rosenthal, Lisa, and Marci Lobel. "Gendered Racism and the Sexual and Reproductive Health of Black and Latina Women." *Ethnicity & Health*, vol. 25, no. 3, pp. 367–392.





# SIMILARITIES BETWEEN GREATER ROADRUNNER (*GEOCOCCYX CALIFORNIANUS*) BIRDS AND MULGUA (*ACACIA ANEURA*) SHRUBS: A REVIEW OF EXTREME ADAPTATIONS TO DESERT ENVIRONMENTS

Faith Lambert, Niki Hakimi, Faith Manning, & Geoffrey Tong

**ABSTRACT:** This literature review paper will focus on the Greater Roadrunner (*Geococcyx californianus*) of the Southwestern U.S. and the Mulga shrub (*Acacia aneura*) of Australia. The former is one of the fastest running, flightless birds on the planet, and the latter is an evergreen shrub capable of growing to incredible heights. Greater Roadrunners and Mulga shrubs demonstrate remarkable adaptations that enable survival in the so-called harsh environments of North American deserts and arid regions of central Australia. In this paper, we will examine the Greater Roadrunner's salt-secreting nasal glands and the Mulga's phyllodes as extraordinary adaptations to the desert biome. Additionally, we will explain the ecological roles of *G. californianus* and *A. aneura* in their respective habitats, including how their adaptations to the desert biome influence such roles and ecological interactions. Finally, we will examine how human actions have affected each species, taking into account direct and indirect threats and any actions taken to correct them.

## Introduction

The species of choice in this review paper are the Greater Roadrunner (*Geococcyx californianus*) and the Mulga shrub (*Acacia aneura*). The former is one of the fastest running (and flightless) birds on the planet, capable of reaching up to 25 miles per hour (40 km/h); the latter is an evergreen shrub capable of growing upwards of 15 to 25 feet (4.5 to 7.5 meters) in height. Both species have very large habitat ranges (Figures 1, 2, and 3).

We selected *G. californianus* and *A. aneura* for this review paper because a considerable amount of research on them is available, yet is not exhaustive and can be explored further. The availability of published research of these species is decent, but could improve; particularly, the literature is skewed to be primarily from the 1970s and 2010s. We want to encourage further research on these species,

especially since there could be more to their story regarding human influence and impacts. Both species are not considered endangered or vulnerable as of yet, but with what little research there is, we cannot assume that will not change in the near future. The Greater Roadrunner and Mulga bush are both desert-dwelling species that provide necessary ecological roles in their respective geographies. However, they are not discussed or recognized for their importance as much as say, the saguaro cactus or camel. We chose these species to further emphasize the need for diversity in research and conservation efforts.

The Greater Roadrunner is found in North American deserts, most commonly in the southern central to southwestern United States (Kelley et al. 2011). The deserts encompassed by the range of *G. californianus* are the Sonoran and Chihuahuan (Rylander 2002; Smith 2017). The Sonoran Desert is known for being the



hottest of all four North American deserts. During winter- and springtime, the northwestern region of the desert experiences variable precipitation gradients, while the southeastern region experiences monsoonal rainfall in the warmer seasons. The inland Sonoran Desert regularly reaches freezing temperatures, but those events last less than 24 hours and are typically most extreme in the northeastern section. Heterogeneous landscapes dominate this desert as a result of strong cold-air drainages (i.e. temperature inversions) across the biome. Recent trends indicate that the Sonoran Desert is warming more in the winter and spring, and the freeze-events are shortening (both in length of time and temperature severity) (Weiss and Overpeck 2005). As for the Chihuahuan Desert, it is the second largest desert in North America, occupying over 54,000 mi<sup>2</sup> (140,000 km<sup>2</sup>) of land including parts of Mexico and Texas. Having hot summers and dry cold winters, the Chihuahuan Desert is also known for having higher amounts of rainfall than many other deserts, with an average annual precipitation as high as 20 in (500 mm). Due to climate

change, the average temperatures are projected to rise by a few degrees and potentially decrease precipitation across the region (Briggs et al. 2020).

The Mulga plant is found in central (arid) Australia, particularly in the Great and Little Sandy, Gibson, Great Victoria, Tanami, and Simpson Deserts (Morton et al. 2011). These deserts contain rudisol and tenosol soils (sandy ground with low fertility), and spinifex grassland and acacia shrubland dominate their vegetation landscape. Like any desert, the *A. aneura* habitat is characterized by severe rainfall variability, extended droughts, occasional flooding, and widespread nutrient poverty (specifically, low phosphorus levels). This region is especially fire-prone because of these abiotic stresses and the biotic response to the stresses (i.e. excess carbohydrate plant products, such as saps or oils, and detritivore abundance) (Morton et al. 2011).

In general, deserts are perceived as “hostile” or “extreme” environments. For species adapted to other conditions, this is true; however, desert

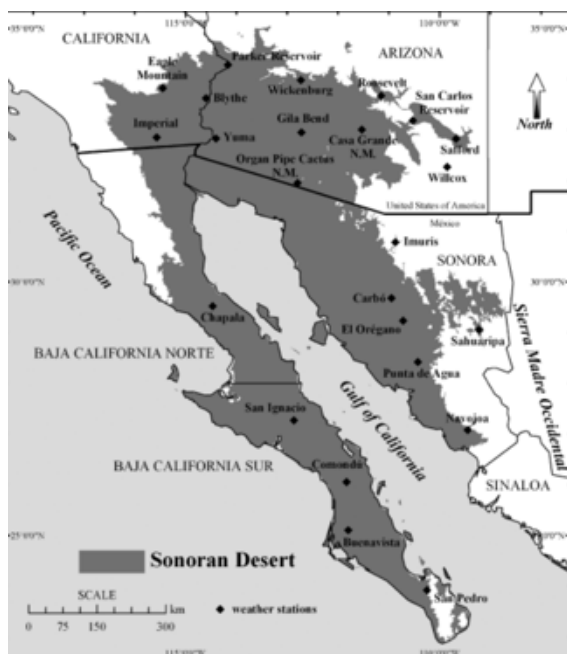


Figure 1: The Sonoran Desert boundary (Weiss and Overpeck 2005).



Figure 2: The Chihuahuan Desert boundary (Schmidt 1979).





flora and fauna have adapted to these particular conditions in a way that allows them to survive and reproduce. For instance, because of the extremely hot and arid climates in the Sonoran and Chihuahuan Desert, the Greater Roadrunner is more likely to survive because of salt-secreting glands near their eyes that remove excess salt in their bodies and conserve water (Ohmart 1972). Similarly, to counteract and survive in the hot and arid climates of the Australian deserts, the Mulga shrub has phyllodes with fewer stomata and thicker cuticles that reduce water loss (Winkworth 1973).

In this paper, we will document the importance of—and additions to—the Greater Roadrunner bird's salt-secreting nasal glands and the Mulga shrub's phyllodes. Additionally, we will explain

the ecological roles of *G. californianus* and *A. aneura* in their respective habitats, including how their adaptations to the desert biome influence such roles and ecological interactions. Finally, we will examine how human actions have affected each species, taking into account direct and indirect threats and any actions taken to correct them.

### Extreme Adaptations

In arid regions, animals and other living organisms have adapted to maintaining the amount of water needed to survive. One such example of this desert specific extreme adaptation are the salt-secreting nasal glands located below the eyes of Greater Roadrunners. These glands act as an electrolyte balancer, excreting

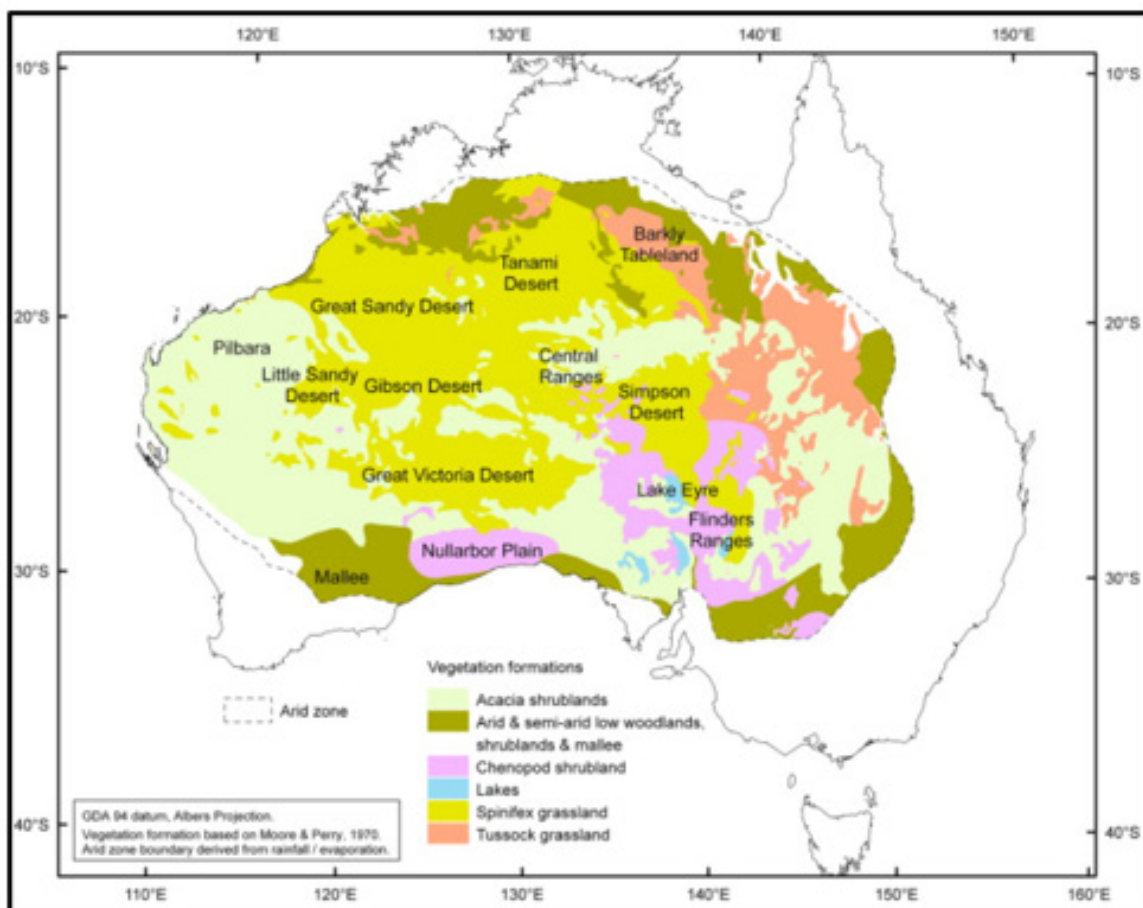


Figure 3: Vegetation formations in central arid Australia, including the Mulga shrub habitat boundaries (Morton et al. 2011).



excess salt from their bodies, allowing for the conservation of water as excessive salt can lead to dehydration. Compared to their urinary tract and kidneys—the systems that most birds use to get rid of excess salt—these salt-secreting glands are better at reducing the amount of water lost in the process. A comparative study written by Ohmart (1972), found that the salt-secreting nasal gland in *G. californianus* had the greatest survival value for the young during the nestling period (Table 1). The platform nests are primarily found in round stemmed cactuses which allows for direct sunlight and occasional shade. At around 4-5 days old, the young black-skinned roadrunners will absorb solar radiation to passively increase their body temperature after the freezing desert nights. They also use gular fluttering and cutaneous evaporation to control their body temperature once the environmental temperature begins to climb. One trade-off with these adaptations is that the roadrunner could lose excess amounts of water; the excretion of salts by their salt-secreting nasal glands are used to counterbalance the water lost in gular fluttering and cutaneous evaporation (Ohmart 1972).

Another water conserving adaptation is found in the modified leaves (phyllodes) of Mulga shrubs. Phyllodes reduce the water lost through transpiration as they have fewer stomata and thicker cuticles compared to regular leaves (Winkworth 1973). Research by Wujeska-Klaue et al. (2014) observed that this anisohydric species has a large capacity to tolerate or adjust to strongly negative water potentials in the phyllodes. Moreover, their study of Mulga phyllodes found that the stomata remain open for a long time during medium-intensity droughts to ensure carbon balance, but run the risk of drought stress if the Mulga plant becomes too water-deficient. To prevent this, the stomata remain fully open and then sharply close, once soils become relatively too dry. Additionally, these phyllodes have granular hairs that produce sticky, shiny resin that protects them from heat and water loss (Groom et al. 2015). Although these modified leaves have adapted to conserving water, they have also adapted defensively, as phyllodes have been found to secrete extrafloral nectaries (EFNs), which attract ants. These ants then act as protectors against insectoid herbivores (Marazzi et al. 2013).

TABLE 1—RATIOS BETWEEN NASAL GLANDS AND BODY WEIGHTS IN ROADRUNNERS OF VARIOUS AGES					
Age (days)	Gland weight (mg)			Body weight (kg)	Ratio (mg/kg)
	Right	Left	Total		
2·5	2·0	2·0	4·0	0·0287	139
3·0	2·8	2·6	5·4	0·0317	170
3·5	2·7	2·8	5·5	0·0418	131
3·5	2·8	2·6	5·4	0·0420	128
5·5	4·1	3·9	8·0	0·0445	179
7·0	4·1	4·3	8·4	0·0640	131
9·0	6·5	6·0	12·5	0·1000	125
9·0	4·0	3·9	7·9	0·1002	79
14·0	5·0	4·9	9·9	0·1150	86
Adult	6·0	5·7	11·7	0·2491	46
Adult	6·6	8·0	14·6	0·2930	49
Adult	8·5	8·0	16·5	0·3137	52

Table 1: The ratio between nasal glands weight (mg) and body weight (kg) in *G. Californianus* by age (Ohmart 1972).



A paper written by Page et al. (2011) found that within the Mulga complex, the phyllode shape varied between landscape positions. Phyllodes that had a terete form were found to be dominant on hill slopes, whereas phyllodes that had a broad form were most commonly found in valley woodlands. Although less distinct, single stemmed forms were found more commonly on hills, and those with multi-stemmed form were found in the valleys (Table 2 and Figure 4). They determined that landscape position strongly influences phyllode shape in *A. aneura*, but not in other *Acacia* complexes.

They also determined that water availability may be responsible for the differences in phyllode shape, as they may be reflected by differences in water use and drought tolerance among varieties of *A. aneura* (Page et al. 2011).

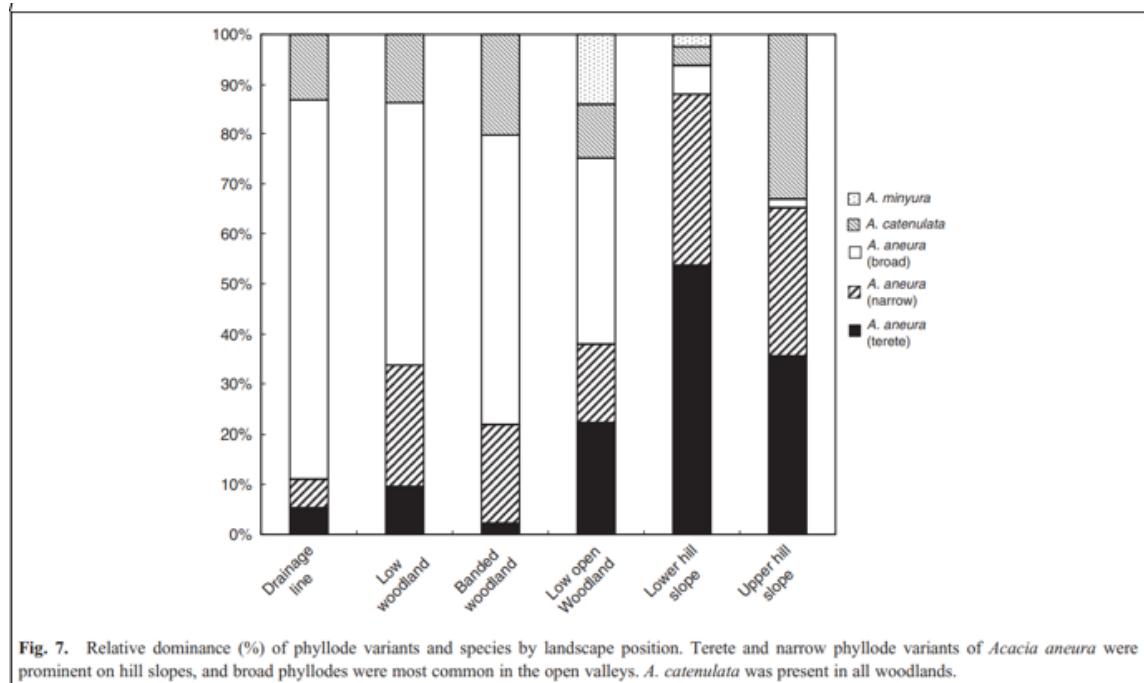
### Ecological roles

In the study by Kelley et al. (2011), the researchers noted a preference for woody shrub cover across both sexes of *G. californianus*. Specifically, male and female Greater Roadrunners prefer woody shrub cover for

**Table 1. Phyllode size and shape of four *Acacia* species, and three phyllode variants of *A. aneura***  
Mean values bolded, and standard errors given in parentheses. Data is untransformed. Lowercase letters denote significant groupings from Tukey's Honestly Significant Difference post-hoc tests when one-way ANOVA  $P < 0.05$

	<i>n</i>	Length (mm)			Width (mm)			Thickness (mm)		
		Min.	Mean	Max.	Min.	mean	Max.	Min.	Mean	Max.
<i>A. ayersiana</i>	140	45.5	<b>65.4ab</b> (0.66)	90.5	7.60	<b>12.3a</b> (0.16)	17.8	0.31	<b>0.48a</b> (0.006)	0.72
<i>A. catenulata</i>	840	29.7	<b>80.2c</b> (0.55)	133.2	0.97	<b>6.30b</b> (0.07)	14	0.15	<b>0.41b</b> (0.003)	0.87
<i>A. minyura</i>	220	8.39	<b>26.7d</b> (1.08)	45.3	2.59	<b>5.86c</b> (0.13)	10.8	0.31	<b>0.46ab</b> (0.006)	0.72
<i>A. aneura</i> (terete)	1617	7.40	<b>62.6a</b> (0.34)	115.4	0.46	<b>1.01d</b> (0.01)	2.23	0.25	<b>0.64c</b> (0.004)	1.50
<i>A. aneura</i> (narrow)	1560	23.9	<b>66.3b</b> (0.44)	148.9	0.48	<b>1.62e</b> (0.02)	4.99	0.20	<b>0.56d</b> (0.004)	1.18
<i>A. aneura</i> (broad)	1440	19.2	<b>63.5a</b> (0.36)	114.6	0.65	<b>3.18f</b> (0.03)	10.3	0.17	<b>0.47a</b> (0.003)	0.99

**Table 2:** The lengths, widths, and thicknesses of phyllodes for four *Acacia* species, and three phyllode variants of *A. aneura* (Page et al. 2011).



**Figure 4:** Relative dominance of phyllode variants by landscape position (Page et al. 2011).



nesting, roosting at night, and thermal refuge. Both sexes were also observed to strongly prefer mesquite woodland and mesquite savanna, but males have a weaker preference for riparian woodland. At a moderate preference, female roadrunners were observed to use the riparian woodland for post-breeding and nesting grounds. In times of resource scarcity, individuals within a *G. californianus* population will increase their home ranges (i.e. daily travel for food and water, and locations of nesting or roosting grounds).

Additionally, roadrunners are territorial; there is very little overlap for male-male or female-female territories, yet there are relatively larger overlaps of male-female territories (Kelley et al. 2011). This can be attributed to the fact that Greater Roadrunners mate for life: they live in the same territory for years at a time with their mate and co-defend it from competitors and potential nest predators (Folse 1978). During non-breeding seasons, mating pairs will forage together. In contrast, during breeding and nesting season, they hunt synchronously and separately to maximize food catch for their chicks (Folse 1978).

While adult roadrunners eat mostly insects and small vertebrates (like mice), they feed their chicks much larger prey, such as the whip-tailed lizards. Their diet provides them with enough water to live in the desert, and by providing their chicks with large amounts of food, they maximize the chances of their offsprings' survival (Ohmart 1973). In general, Greater Roadrunners are preyed on by raptors (i.e. Red-tailed Hawks (*Buteo jamaicensis*), Cooper's Hawks (*Accipiter cooperii*)) and ground predators (i.e. bobcats (*Lynx rufus*)). Males are typically more vulnerable to predation during mating season. Specifically, their behavior—such as displays and calls from perches, courting females, and chasing competitors—makes them easier to spot and less focused on predator awareness (Kelley et al. 2011).

The Mulga shrub habitat is limited by competition with grassland, specifically the

*Triodia* and *Spinifex* grasses of Australia. It is not as common for *Spinifex* to be in competition with *A. aneura* because of its coastal habitat preference, so the Mulga shrub is often in nutrient and land competition with *Triodia* grasses in central Australia (Nano and Clarke 2009). In addition to interspecies competition with grasses, the Mulga shrub populations' ability to establish and expand in an arid environment is constrained by wildfires, especially the frequencies and intensities. In a study by Nano and Clarke (2009), researchers found that wildfire frequency and intensity can be influenced by the density and abundance of the grasses in the same area as the Mulga shrubs.

Additionally, the severity of these constraints fluctuates with elevation and rainfall variability. For instance, higher elevation and more rainfall promote more shrubland seedling establishment only if the competitive grasses' return after a fire is disrupted. Moreover, Mulga shrubs grow and mature slowly, while grasses grow and mature rapidly; if wildfires are frequent in the shared habitat, this puts Mulga shrubs at risk for permanent immaturity, but not the grasses. Lastly, the research by Nano and Clarke (2009) found that grasses are more likely to invade shrubland than shrubs are likely to invade grasslands, and that *Triodia* presence significantly lowers all competitor's chances of survival, including shrubs and other grasses.

Although wildfires are typically detrimental to a Mulga shrub population, they can be beneficial if they are of low-grade intensity. Fire-stimulation has been shown to help Mulga seeds germinate; however, this should not be taken as "fire-dependent." Often, Mulga shrub seedlings are observed after heavy rainfall/wet-seasons, which proves the lack of fire-dependency for successful reproduction in this species. More importantly, mature *A. aneura* can be killed off during extreme/intense wildfires; there is a positive relationship between Mulga mortality and fire intensity (Silcock et al. 2017, Figure 5).





Lastly, many herbivorous species graze on *A. aneura*. These species include mammals such as sheep and kangaroos (Terpstra et al. 1989), as well as insectoids such as grasshoppers and termites (Andersen et al. 1990). These species feed on their leaves (phyllodes), the main photosynthetic structure of the Mulga trees. As a defense mechanism, Mulga trees act as a source of nectar for ants, who protect the leaves (phyllodes) of the trees against herbivores, creating a mutualistic relationship between them.

### Conservation and Human Impacts

Based on the current population size (roughly 1.4 million mature individuals), the population's steady annual growth, and the large habitat range of *Geococcyx californianus*, the species is considered "Least Concern" for conservation status (Greater Roadrunner (*Geococcyx californianus*) - BirdLife species factsheet). Because of their preference for woody-shrub ground cover over grassland, Greater Roadrunners are sensitive to habitat fragmentation. This landscape vegetation preference has been observed in both sexes by Kelley et al. (2011); the study of *G. californianus* home ranges concluded that both male and female roadrunners strongly avoid grassy cropland. If agricultural development and urban expansion overlaps with the home range of a local roadrunner population, they are more likely to undergo habitat fragmentation rather than adjusting their home range to be farther away from human activities.

Aside from urbanization, another human factor found to be problematic for Greater Roadrunners has been climate change. In 1973, Robert Ohmart released a paper that studied the breeding adaptations of roadrunners. In this paper he determined that the approach of hot, dry seasons reduced roadrunner clutch size and nestling weights. This adaptation for the roadrunner increases their relative fitness in the fluctuations of desert conditions. However,

as global warming continues at an accelerating pace, clutch sizes and nestling weights will continue to drop, which will impact the reproductive success of the species. Despite the current and potential threats to the Greater Roadrunner, this species has unique adaptations that allows them to thrive in harsh environments and to continue to adapt to the changing conditions of their habitats.

Similarly, *Acacia aneura* has been assigned "Least Concern" status due to the current population of approximately 68,000 mature individuals, its steady annual growth, and the large habitat range of this species (Communications, 2014 Oct. 20). In central Australia, agricultural activities and livestock grazing have increased over the past several decades. Because of the pressure to preserve the land for these activities, routine fire-cleansing has been suppressed (Silcock et al. 2017). Historically, low-intensity fires in the grasslands and shrublands have benefited the arid landscape of Australia. Naturally, fire consumes lots of nutrient resources in an environment; however, when it happens on a relatively small-scale, it has been observed to also free any trapped nutrients to be recycled back into the lowly fertile soils (Morton et al. 2011). So, if the fire-cleansing cycle is interrupted, it leads to more extreme nutrient poverty in the desert soils. More importantly, when older, drier, oily vegetation is not regularly cleared out via smaller wildfires, it results in a buildup of fire-prone biomass that can cause much larger, more detrimental wildfires (Silcock et al. 2017; Dyer et al. 1997). According to a dynamics study conducted by Silcock et al. (2017) in Queensland, *A. aneura* mortality has a positive relationship with wildfire severity (Figure 5). In addition to the threat of wildfires, *A. aneura* is very vulnerable to invasive herbivore species, particularly forging and grazing (Anderson et al. 1997; Brown 1985).

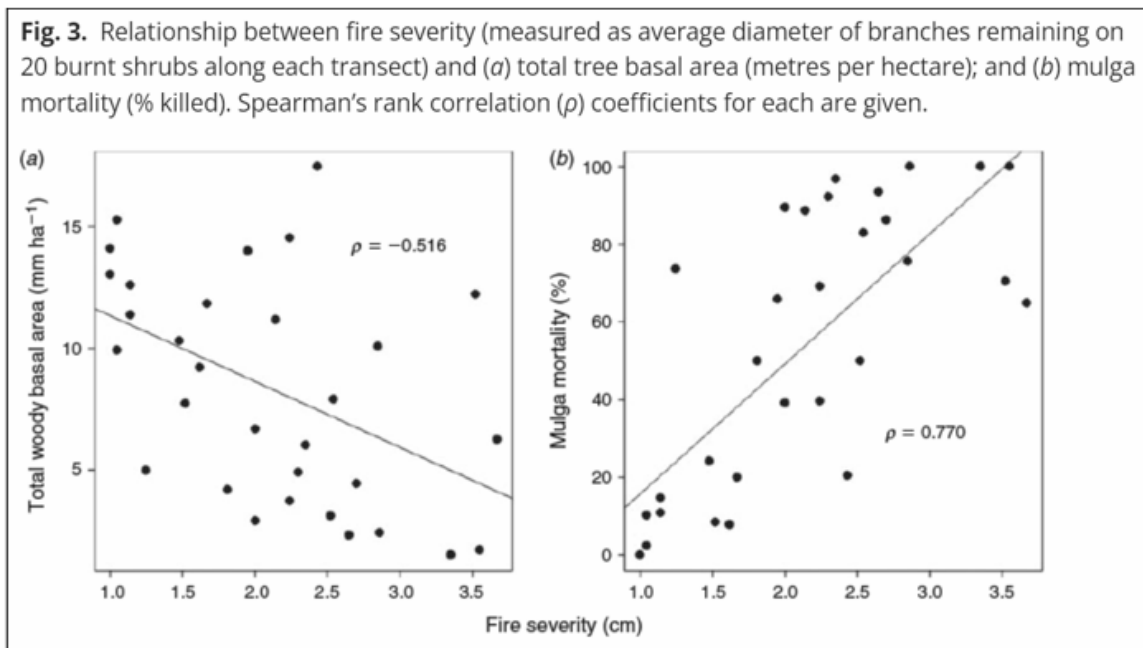


Figure 5: a) Significant, moderate positive correlation between wildfire severity (cm) and total shrubland area burnt ( $\rho = 0.588$ ,  $P < 0.001$ ). b) Significant, strong positive correlation between wildfire severity (cm) and Mulga mortality (%) ( $\rho = 0.771$ ,  $P < 0.001$ ) (Silcock et al. 2017).

### Conclusion

The Greater Roadrunner bird (*Geococcyx californianus*) and the Mulga shrub (*Acacia aneura*) demonstrate the remarkable adaptations that enable survival in the so-called harsh environments of North American deserts and arid regions of central Australia. The extreme adaptations of the Greater Roadrunner, such as salt-secreting nasal glands, and the Mulga shrub, with their modified leaves (phyllodes), underline the complex interaction between species and their environments. These adaptations contribute to the ecological roles of these species, shaping their interactions within their habitats. This paper has highlighted the importance of understanding the complexities of the Greater Roadrunner's and Mulga shrub's roles in their respective ecosystems, showing that there is a fine balance that sustains life in seemingly inhospitable environments.

Moreover, the examination of human impacts on these species highlights the need for

conservation efforts. Habitat degradation due to urbanization presents a significant threat to Greater Roadrunners, disrupting their territories and diminishing essential resources. Similarly, the suppression of routine fire-cleansing in central Australia, driven by agricultural activities, threatens the Mulga shrub's habitat and exposes it to the risks of larger, more destructive wildfires. These findings underline the urgency of addressing man-made impacts and implementing measures to protect the unique adaptations and ecological roles of these species.

### Acknowledgements

We thank our ecology professor for their guidance and support throughout this research project and accompanying presentation.



## References

- Andersen AN, Lonsdale WM. 1990. Herbivory by Insects in Australian Tropical Savannas: A Review. *Journal of Biogeography*. 17(4/5):433–444. doi: <https://doi.org/10.2307/2845374>
- Anderson VJ, Hodgkinson KC. 1997. Grass-mediated Capture of Resource Flows and the Maintenance of Banded Mulga in a Semi-arid Woodland. *Australian Journal of Botany*. 45(2):331. doi: <https://doi.org/10.1071/bt96019>
- Briggs, M.K., Lozano-Cavazos, E.A., Poulos, H.M., Ochoa-Espinoza, J. and Rodriguez-Pineda, J.A., 2020. The Chihuahuan Desert: a binational conservation response to protect a global treasure. *Encycl. Worlds Biomes*, pp.126–138.
- Brown R. 1985. The growth and survival of young Mulga (*Acacia aneura* F. Muell) trees under different levels of grazing. *The Rangeland Journal*. 7(2):143. doi: <https://doi.org/10.1071/rj9850143>
- Communications c=AU; o=The S of Q ou=Department of E and S ou=Corporate. 2014 Oct 20. Species profile | Environment, land and water. *appsdesqldgovau*. [accessed 2024 Feb 14]. <https://apps.des.qld.gov.au/species-search/details/?id=15824>
- Dyer, R.; Craig, A.; et al. 1997. “Fire in northern pastoral lands”. In Grice, T.C.; Slatter, S.M. (eds.). Fire in the management of northern Australian pastoral lands. Occasional Publication. Vol. 8. St. Lucia, Australia: *Tropical Grassland Society of Australia*. doi: <http://hdl.handle.net/102.100.100/221918?index=1>
- Folse LJ, Arnold KA. 1978. Population ecology of Roadrunners (*Geococcyx californianus*) in south Texas. *The Southwestern Naturalist*. 23(1):1. doi: <https://doi.org/10.2307/3669976>
- Greater Roadrunner (*Geococcyx californianus*) - BirdLife species factsheet. *datazonebirdlifeorg*. [accessed 2024 Feb 14]. <https://datazone.birdlife.org/species/factsheet/greater-roadrunner-geococcyx-californianus>
- Groom PK, Lamont BB. 2015 Jan 11. Plant Life of Southwestern Australia. *Adaptations for Survival*. doi: <https://doi.org/10.1515/9783110370195>
- Kelley SW, Ransom Jr. D, Butcher JA, Schulz GG, Surber BW, Pinchak WE, Santamaria CA, Hurtado LA. 2011. Home range dynamics, habitat selection, and survival of Greater Roadrunners. *Journal of Field Ornithology*. 82(2):165–174. doi: <https://doi.org/10.1111/j.1557-9263.2011.00319.x>
- Marazzi B, Bronstein JL, Koptur S. 2013. The diversity, ecology and evolution of extrafloral nectaries: current perspectives and future challenges. *Annals of Botany*. 111(6):1243–1250. doi: <https://doi.org/10.1093/aob/mct109>. <https://dx.doi.org/10.1093%2Faob%2Fmct109>
- Morton SR, Stafford Smith DM, Dickman CR, Dunkerley DL, Friedel MH, McAllister RRJ, Reid JRW, Roshier DA, Smith MA, Walsh FJ, et al. 2011. A fresh framework for the ecology of arid Australia. *Journal of Arid Environments*. 75(4):313–329. doi: <https://doi.org/10.1016/j.jaridenv.2010.11.001>
- Nano CEM, Clarke PJ. 2009. Woody-grass ratios in a grassy arid system are limited by multi-causal interactions of abiotic constraint, competition and fire. *Oecologia*. 162(3):719–732. doi: <https://doi.org/10.1007/s00442-009-1477-8>
- Ohmart, R. D. (1972). Physiological and ecological observations concerning the salt-secreting nasal glands of the roadrunner. *Comparative Biochemistry and Physiology*, 43(NA2), 311–316. <https://doi.org/10.1016%2F0300-9629%2872%2990189-2>
- Ohmart RD. 1973. Observations on the breeding adaptations of the Roadrunner. *The Condor*. 75(2):140–149. doi: <https://doi.org/10.2307/1365861>
- Page GFM, Cullen LE, van Leeuwen S, Grierson PF. 2011. Inter- and intra-specific variation in phyllode size and growth form among closely related Mimosaceae *Acacia* species across a semiarid landscape gradient. *Australian journal of botany*. 59(5):426–439. Doi: <https://doi.org/10.1071%2FBI11057>
- Rylander K. 2002. The Behavior of Texas Birds. Austin, United States: *University of Texas Press*. p. 185–186. <http://ebookcentral.proquest.com/lib/washington/detail.action?docID=3443280>



Lambert, Hakimi, Manning, & Tong

- Schmidt RH. 1979. A climatic delineation of the “real” Chihuahuan Desert. *Journal of Arid Environments*. 2(3):243–250. doi:[https://doi.org/10.1016/s0140-1963\(18\)31774-9](https://doi.org/10.1016/s0140-1963(18)31774-9)
- Silcock JL, Drimer J, Fraser J, Fensham RJ. 2017. Inability of fire to control vegetation dynamics in low-productivity mulga (*Acacia aneura*)-dominated communities of eastern Australia. *International Journal of Wildland Fire*. 26(10):896. doi: <https://doi.org/10.1071/wf17011>
- Smith KG, Neal J, Reynolds J. 2017. Sun-bathing by Greater Roadrunners — A neglected aspect of their range extension. *Journal of the Arkansas Academy of Science*. 71. doi: <https://doi.org/10.54119/jaas.2017.7112>
- Terpstra JW, Wilson AD. 1989. Grazing distribution of sheep and kangaroos in a semi-arid woodland. *Applied Animal Behaviour Science*. 24(4):343–352. doi: [https://doi.org/10.1016/0168-1591\(89\)90061-0](https://doi.org/10.1016/0168-1591(89)90061-0)
- Weiss JL, Overpeck JT. 2005. Is the Sonoran Desert losing its cool? *Global Change Biology*. 11(12):2065–2077. doi: <https://doi.org/10.1111/j.1365-2486.2005.01020.x>
- Winkworth RE. 1973. Eco-physiology of mulga (*Acacia aneura*). *Tropical Grasslands*. 7(1):43–48.
- Wujeska-Klaus A, Bossinger G, Tausz M. 2014. Seedlings of two *Acacia* species from contrasting habitats show different photoprotective and antioxidative responses to drought and heatwaves. *Annals of Forest Science*. 72(4):403–414. doi: <https://doi.org/10.1007/s13595-014-0438-5>





# THE MEXICAN AMERICAN EXPERIENCE: HEALING THROUGH ETHNIC STUDIES AND BILINGUALISM

Amado Chacon

*ABSTRACT: The US education system is a tool used to push the dominant Anglo-American cultures among immigrants and other minoritized cultures within the United States. With their proximity to the US border and historical events, Mexicans living in the United States have faced subjugation and discrimination from the Texas Revolution to the anti-immigrant policies and rhetoric; these educational practices have targeted Mexicans for almost two centuries. This causes a conflict of cultural identity for Mexican youths living in the United States, as they grow up within multiple social spheres that consider them too American to be Mexican yet too Mexican to be American. This conflict of identity has caused multigenerational trauma and is only made worse by the discrimination from the media and the bias of the schools, as these students are forced to look elsewhere to discover their history, such as family or the community. My research study examines the value of ethnic studies and bilingual education practices and how they not only empower these students but gives them the motivation to succeed within an academic setting. This research is based on interviews that I have conducted with Mexican Americans who have experienced the education system during different years, ranging from the 60's to the early 2000's. Furthermore, I examine the autobiography of a prominent Mexican American scholar as I draw scholarship on ethnic studies and bilingual education, criticizing the current education system while offering solutions to address those critiques. Through the interviews I conducted, I found that the people who were most connected to their heritage and the Spanish language, not only experienced more success academically, but were also happier, indicating the need for ethnic and bilingual studies within the K-12 curricula.*

## Introduction

Part of growing up is learning about yourself and finding your identity; that is why the formative years of Middle and High school are essential in preparing a child for adulthood as they become more confident in themselves and discover the path they want to take after graduation. However, a crucial piece in forming identity is often missing for many students: their cultural identity. Cultural identity is formed from a person's family history and nationality. Yet, when the country they live in refuses to accept or acknowledge their family history and those like them, the very idea of cultural identity is shattered as both their cultures fight

against each other. This is prominent among young Mexican Americans, as they are born in a country that refuses them for not being American enough, while their families consider them too American.

For a country that holds itself to be a melting pot of different cultures, there is a clear hierarchy of cultures in America, with Anglo-American culture at the top. This country has been in a culture war since the arrival of the pilgrims in 1620 when they first interacted with the Native Americans, and four hundred years later, the war is still going strong. This is best seen in how the media negatively depicts immigrants, claiming their culture is bringing down the country while



still insisting that all immigrants must assimilate into the Anglo-American culture, a concept that is further pushed by a biased curriculum. One group that has been consistently targeted over the years has been Mexicans; from the Texas Revolution to today, they have been one of the main targets for assimilation, with education being used to guide and facilitate the process from the history taught to the insistence of English only (Gonzalez, 2022).

In the following, I examine the role played by the US education system in attacking Mexican Americans' cultural identity and the intergenerational trauma caused by these educational policies that affect them today. I do so through examining the interviews I have conducted with Mexican-Americans who have experienced the education system during different years, ranging from the '60s to the early 2000s, observing the autobiography of a prominent Mexican-American scholar, and drawing scholarship on ethnic studies and bilingual education. This paper criticizes the current education system and looks at how education can be used to heal the trauma caused within these communities.

### Historical Trauma

Mexicans in the United States have experienced the effects of Colonialism, from the taking of their land to the discrimination they face, and this has resulted in an intergenerational form of trauma known as historical trauma, more specifically, colonial trauma. Latinos are the largest minority group living in the United States, and of that group, Mexicans are the oldest and largest (Gonzalez, 2022; Moslimani, 2023). From the very beginning, the interactions between Mexicans and Americans have been tense, but it was not until the Mexican-American war that the dynamic changed; what once was a relationship among equals became that of Conqueror and the Conquered (Gonzalez, 2022). The war resulted in the loss of Mexican land and rights, and for the next hundred years,

they became second-class citizens in their own lands. This experience has left behind a legacy of intergenerational trauma that still affects young Mexican Americans today, made worse by the biased education system and social pressure to assimilate.

Different from intergenerational trauma, historical trauma is experienced after major historical events that affect an ethnic group, such as slavery, genocide, or colonization. For Mexicans, it was the trauma experienced due to colonial practices of the Spanish and the United States and the scars they left in the Mexican-American community, from the self-discrimination of their race and culture to the way they viewed and taught language. Now, some may ask how something that happened a hundred years ago can still affect people today, yet according to Araceli Orozco-Figueroa in her article "Historical Trauma and Resilience of Individuals of Mexican Ancestry in the United States," "even though such events took place in the distant past, their consequences continue to affect the survivor's descendants" (Orozco-Figueroa, 2021).

Mexicans have lived under colonization for many years; in fact, the creation of the Mexican people was a result of Spanish colonization as Spaniards breed with the natives in what is known as "*El Mestizaje*," a term used to describe the blending of race and culture that created the current people and culture of Mexico. When one nation colonizes another, one of the immediate goals for the invaders is to destroy the original culture and replace it with their own; when the Spanish came to Mexico, they immediately attacked the places of worship and forced them to subscribe to their hierarchy system with the natives subservient to them. As a result of this new Spanish hierarchy, those who still maintained their indigenous heritage were seen as lesser; "denying indigenous heritage by adopting the colonial identity was [not only] a way to ensure survival, [but to also] secure greater social mobility, a survival strategy that [has been]



passed down the generations” (Orozco-Figueroa, 2021). Fortunately, Indigenous Mexicans were able to maintain aspects of their culture by combining small parts with the newer Spanish traditions. Although that still did not negate the effect this cultural submission had on Mexicans, to this day, it is still an insult to be called an ‘*Indio*,’ a word used in Mexican Spanish to call someone poor, stupid, ugly, and worse to some, a native. While those with lighter skin are looked upon more favorably, creating a culture of self-hate and discrimination that was only increased as a result of American colonization.

Almost twenty years after their independence from Spain, many Mexicans found themselves once again under the yoke of colonization, as the Mexican-American war not only cut the country in half but also the people, creating the cultural division we see today between Mexicans born in the United States and those from Mexico. A divide that was only perpetuated by the US, who, unlike the Spanish, was more interested in the complete cultural assimilation of those living under them, sending missionaries and teachers to pave the way for assimilation, attacking the community and family bonds that allowed them to resist the Spanish.

### Response to Historical Trauma

Orozco-Figueroa claims that there are three types of responses to historical trauma: the community response, the family response, and the individual response. The community response often results from social pressure and systemic attacks pointed toward the Mexican American community; this causes the “abandonment of traditional cultural activities, loss of traditional rites of passage, and erasure of traditional values” (Orozco-Figueroa, 2021). While not as prominent as it was thirty years ago, this legacy of erasure and cultural loss can be seen today as many second-generation Latinos often find themselves disassociated from their native culture. The family response is commonly a result of media and education

as the parents (*primarily immigrant parents*), to ensure their children can get ahead, focus on teaching them American values, resulting in “communications impairments [between the family], stress around parenting, and attachment disorders in children” (Orozco-Figueroa, 2021). This can be seen in how often parents would focus on English, encouraging or allowing their children to be English-only. The idea that the children should solely speak and understand English not only divides the family between the generational lines, but it also divides the community, increasing the division between Mexicans mentioned in the paragraph above, as immigrants from Mexico are unable to connect or communicate with Mexican-Americans. Finally, there is the individual response often seen in those who grew up in the United States; this response is “linked to increased vulnerability to behavioral health problems, including...anxiety, depression, and substance use disorder,” all issues that are often associated with those facing a crisis of identity (Orozco-Figueroa, 2021). Each of these traumatic responses is interconnected; without the family response, there cannot be a community response, nor could the family response exist without the individual response; not one response can exist without the others.

### Examples of Responses to Historical Trauma

Of the responses to historical trauma, the individual response is most affected by education. Due to the past and current practices of historical exclusion and language domination, many students are stripped of their cultural identity and pride, leading to the effects mentioned in the section above. Another significant effect of these educational practices is issues in school, as “minoritized students... experience less success in school...lower graduation rates... and suspensions and drop-out rates” compared to white students, and for Mexican-Americans, this is no different (Sleeter, 2021). This is further proven by looking at the college level; while the rates may have increased



## Chacon

in the past decade, only 33% of Hispanics have applied to college. That does not mean that significant issues have changed as, according to the National Center for Education Statistics, only 26.2% of those who received an associate in the year 2021 were Hispanic, while 50.2% were White Americans. These numbers only become more disproportionate when looking at other college degrees (National Center for Education Statistics, 2024). While many often try to attribute the reason for these low rates to race or immigration status, substantial research shows that there is a psychological reason, as many Mexican students grow up thinking they are not able to or cannot afford to go to college.

In the autobiography *Hunger of Memory: The Education of Richard Rodriguez* by Richard Rodriguez, we see how these responses play out in a person's life and how education seems to be the focal point. In the first chapter, "Aria" Rodriguez describes his young life and his relationship with language and how he struggled due to not knowing English, causing his catholic schoolteachers to advise his family to take an English-only approach at home, which the parents did because "How could they have questioned the Church's authority which those women represented?" (Rodriguez, 1982). With the complete abandonment of Spanish at home, the once close family unit was destroyed as Rodriguez "at last, [at] seven years old... came to believe what had been technically true since [his] birth: [he] was an American citizen. But the special feeling of closeness at home was diminished by then" (Rodriguez, 1982). Rodriguez's example shows how important the Spanish language is to the cultural identity and heart of the family unit, and by taking that away, those of the younger generation tend to drift away from their parents who cannot adapt to the new language.

Without the ability to communicate and relate with their parents, those of the younger generations do not have the necessary links to learn about their culture or history. The idea of

English-only divided the Mexican-American community in multiple ways, not only in dividing the generations but also through borders, as those born or raised in the US usually have a hard time communicating and relating to those born and raised in Mexico. Throughout his autobiography, Rodriguez constantly references other Mexicans and how, because of this loss of language, he was unable to associate with the community itself. As his ideas of self shifted from 'Catholic' to 'American' even adopting the Americanized version of "the name [he] carr[ies] from [his] parents—who are no longer [his] parents in the cultural sense.... [he] pronounces it [as]: *Rich-heard Road-ree-guess*" (Rodriguez, 1982). While never said outright, it is clear that Rodriguez himself feels sad and lost at this separation of family and community and how alone he ended up in life, as at the end of his autobiography, "he wonder[s] now what [his] parents silence contains...[and] how [do they] regard the adults [their] sons and daughters have become" (Rodriguez, 1982).

### Defenses For Historical Trauma

When faced with cultural colonization, there are typically three defenses: one is self-segregation; this was quite prominent in New Mexico, where the demographics of Mexicans were the majority well into the 20th century and left to their own devices (*Foreigners in Their Own Land*, 2013). However, this defense is often hard to achieve and can hinder the people's ability to interact within the systems of power, further increasing the inequality gap, due to the difficulty of this defense, we will not be discussing this in further detail. The second and most common defense is assimilation; as mentioned previously, this defense is often done to ensure social mobility. For the longest time, many Mexican families would not even teach their children Spanish due to the belief that they were hindering them, a belief that the church and schools cultivated. The third and final defense is "*Mestizaje*" or cultural blending, which gives





the tools necessary to work within society while maintaining their cultural identity.

Rodriguez is a prominent example of how assimilation is a defense against cultural discrimination, growing up as a “socially disadvantaged child... [and experienced] extreme public alienation” (Rodriguez, 1982). In his autobiography, he demonstrates how isolation from native culture, along with a lack of positive historical and cultural knowledge, makes assimilation almost a guarantee. He even promotes the idea of assimilation as a need to succeed, claiming that “a primary reason for [his] success in the classroom was that [he] couldn’t forget that schooling was changing [him] and separating [him] from the life [he] enjoyed before becoming a student”; referring to family and cultural connections (Rodriguez, 1982). When conducting my interviews, I noticed that those who assimilated fully into US culture typically were the ones most interested in learning more about Mexican culture, each demonstrating sadness and regret that they lost that connection they lost or never had: “I wish I could teach it to my kids you know, because you can’t really teach something you don’t know” (Garcia, 2023). One even went on to express regret at the loss of their original name.

“I went from Ricardo to Richard. I Americanized my name, and I’m not sure if I like it. But at the time, I thought that was the thing to do, and I liked it. Sometimes, I wish I could have kept my name, and I go by different names too...whatever you want to call me, you know, Richard, Ritchie, whatever. And then my fire name is Rico; I go out as Rico.”

-Richard Chacon (2023)

While they did become successful in life, my interviews paint a different picture than what Rodriguez claims, as each demonstrates similar feelings to those Rodriguez expresses at the end of his autobiography: that feeling of loss and separation.

Unlike assimilation, which involves the complete abandonment of traditional values and culture for those of the dominant culture, “*Mestizaje*,” or, to use a more official term, integration, allows someone to blend the two cultures, creating a new one. For Mexicans in the United States, this is often referred to as Chicano/a culture. However, it is not an easy path to take as due to societal and internal pressures, it is often difficult for someone who is a part of both cultures to live between them, especially when they are conflicting cultures with a long history of conflict. Out of the eight people interviewed for this study, those who went to college were typically the ones who felt more secure in their cultural identity; they grew up with the knowledge about their history and culture, something they learned from the community and their families. In her interview, Theresa Saldivar-Nebeker, from Utah, discussed her extended family and how she was raised differently from her cousins, growing up with a “dad [who] loved to tell his history... and always would take [her] to September 16th celebrations” while the others did not (Saldivar-Nebeker, 2023).

“My uncle, he didn’t talk to his kid.... They don’t know much, really. One of my male cousins, and he is older than me, knows a little bit. But they don’t know their father’s story... They listened to my father because my father loved to tell the stories.”

-Theresa Saldivar-Nebeker, 2023.

She later went on to say that out of both sides of her extended family, she was the only one to move on to college to learn about architecture, despite the lack of help from the school and the racial discrimination she faced in her youth. Theresa’s interview highlights how much learning about one’s history can truly change one’s perspective, helping motivate students in school and increasing confident in their sense of self, best seen in the documentary *Precious Knowledge*, which shows how a



class on Mexican studies program can make a significant effect on Mexican students. Ethnic studies programs such as the Arizona program not only motivate their students to do better in school but also encourage them to become more involved with the community, something which is essential for students because overall, “individual efforts, are insufficient to counter systemic issues” (Orozco-Figuroa, 2021).

### **Healing from Historical Trauma**

When looking at the issue of Historical Trauma among Mexican Americans, it is clear that it is rooted in two key issues: lack of historical/cultural knowledge and loss of language. As I have demonstrated throughout this essay, to succeed within the United States, Mexican-Americans must learn how to integrate into US culture while still maintaining their own cultural roots. This challenge is made infinitely more complex by the current US education system; therefore, to address these issues, ethnic studies and bilingualism should be applied nationwide for K-12 education, a process which has already begun, be it very slowly.

Growing up within the American school system, Mexican students are not exposed to many historical or educational role models they can admire who look like them. When they do learn about Mexicans, which is rare, it is often through media outlets that either victimize or vilify them. Since they often only experience official culture recognition through these negative depictions, their sense of self is significantly affected, resulting in the individual response, as described by Figuroa-Orozco. This lack of representation in the schools set a negative precedent for young Mexican Americans, telling them that they are not worth learning about or that they have no place within the US; “if students have been taught implicitly that people like themselves are incapable and unimportant, doing well in school has little meaning,” an issue which can be solved by including ethnic studies at an earlier age

(Sleeter and Zavala, 2020). While ethnic studies is often centered in learning about history and culture, the true purpose of ethnic studies is to “eliminate racism, decolonize students’ minds, and [to] sustain minoritized cultures,” concepts which, even at the most basic level, can make a difference in a child’s lifetime (Sleeter and Zavala, 2020). In the interview with Theresa Saldivar-Nebeker, when asked what inspired her to become an architect, she claimed the root of her drive was learning about Mesoamerican engineering and architecture in the library, pointing at the wonders of Lake Texcoco and the capital of the Aztec Empire Tenochtitlan.

“I remember reading about the Aztecs and how they separated fresh water and salt water, you know, on the same lake, and they still don’t know how they really did that. So that just amazed me what they did and how man made the islands and Mexico City.”

Theresa Saldivar-Nebeker (2023)

Theresa’s achievements show how vital learning a positive example can be to motivate and inspire someone to achieve more. Her example shows how ethnic studies do not need to be rooted in social studies classrooms. In an interview that I conducted with Christopher Betancourt, a middle school Science teacher from San Diego, a primarily Hispanic area, he described how he valued the importance of culture and how “for the sake of the kids... [he would take] like five to seven minutes every day of the week for Day of the Dead... And although it had nothing to do with my science class, a lot of kids were actively engaged” (Betancourt, 2023).

Unfortunately for many Mexican-Americans, they often do not experience cultural learning in school until they get to college, at which point their cultural identity is already established. The individual response to historical trauma is based on how the individual perceives themselves; ethnic studies work as a way to “disrupt the transmission of intergenerational trauma” of



## The Mexican American Experience

self-hate and ignorance that is so prevalent within the Mexican American (Orozco-Figuroa, 2021). K-12 teachers must include aspects of other cultures and peoples in their lessons because “offering a curriculum that is grounded in perspectives of specific racially marginalized groups,” even if it is as simple as explaining a cultural holiday, can (Sleeter and Zavala, 2020). Being more culturally inclusive can make a difference in the lives of these students, defying the established precedents they have lived with their entire lives and rewriting the narrative of the United States so that it includes them.

Like culture, language in the United States has always been a tense subject within the education system, from laws that established English-only rules to teachers who pressure parents to exclude their native language at home. This generated fear and trauma associated with the Spanish language to the point where parents did not share their language with their kids, which in turn spiraled into other responses of historical trauma—demonstrated in the example of Joscelyn Betancourt, a third-generation Mexican-American from San Diego. When asked if she spoke Spanish at home, she responded that, “It was English in my house; I never learned it... I practice a lot of Hispanic cultures, but I do not speak Spanish. I understand enough to get by. But I’ll be honest with you, I’ve felt pressure from family members that I don’t speak it. And so that hinders me” (Betancourt, 2023).

This Mentality of English-only affects not only Mexican-American students who grow up in the United States but also immigrant children as they struggle to learn in a new country. A common practice within US schools is that if students do not speak English, they get separated from the rest to spend more time studying English. However, rather than help these students, these practices hinder them, as “ELL students fall behind mainstream students because they don’t receive [suitable] instructions in key subjects” (Cammarota and Aguilera, 2012). In the

interview with Joscelyn Betancourt, a college graduate and mother of two, she discussed the different bilingual daycare programs in San Diego and the importance of speaking both languages equally in child development.

“What we’re learning from teachers that have taught this program, 50/50 Spanish-English, 90 Spanish 10 English, is that they have a hard time learning English in the literary sense reading because they are 90% Spanish. I guess it doesn’t translate, or...because English is so hard to learn if they are immersed in 90/10.”

- Joscelyn Betancourt (2023)

50/50 bilingual education involves using language as a bridge to learn another language, allowing learners to make connections and subtly absorb the other language as they learn. The US currently teaches English through the idea of English immersion or, in some states, the idea of English majority, and while it can be beneficial, forcing students to get out of their comfort zone, it is not a recipe for success. Therefore, a 50/50 bilingual approach is best for students as it helps immigrant students learn English without the need for separation or having them fall behind their peers. It also helps students who lost their native language connect to their roots. Much research has been done on the topic of bilingualism, as it is seen to enhance cognitive thinking and allow for a better cultural understanding (Mark, 2023). Rodriguez is a prominent example of how a loss of language can result in each response to historical trauma, and while he does advocate for adopting English completely, I am advocating for a change in how the United States views language. While it is beneficial to have a universal language within a society that is so diverse, we also cannot deny the diversity that can be found in the US and all the benefits that can be had with learning another language early on rather than in high school. While it might be a long and challenging process, it will be worth it in the long run as it will produce, and if a majority of Europe can embrace bilingualism, so can we (Devlin, 2018).



## Conclusion

One of the largest and oldest minoritized groups within the United States, Mexican-Americans struggle with issues of cultural identity, which results in the form of intergenerational trauma known as historical trauma, which affects three aspects of the Mexican American life: the individual, the family unit, and the community experienced. While this can all be rooted in both past and current education practices, education can be used in the healing process as well, as the inclusion of ethnic studies and bilingualism will not only stop the continued transmission of historical trauma, but will also motivate them to succeed, bring the socio-economic gap a little closer.

As noted throughout this essay, ethnic studies and bilingualism provide the framework for healing intergenerational trauma, yet why should schools implement these educational practices? Because it has an overall benefit for all students. As mentioned in the acknowledgment, these concepts and claims can be applied to those of other minoritized groups. The US has a long battle with racism in the school system, and Mexicans are not the only group that is ignored by the current educational practices and curriculum in place; “curriculum teaches a way of looking at the world,” meaning that by focusing on only one culture’s ideas and history, we limit ourselves and how we perceive the world (Sleeter, 2021). By learning about other cultures, students expand their worldview, exposing them to other ways of thinking that help them see the world differently, gaining many of the same benefits they would from learning a different language. Other cultures have been discriminated against in this country for so long, with their voices being kept silent; now is the time to allow those voices to be heard and acknowledged and, in the process, benefit all students of all ethnicities.

## Bibliography

- Betancourt, Christopher. Interview. Conducted by Amado Chacon, 24 November. 2023.
- Betancourt, Irma, and Chacon, Amado. Interview. Conducted by Amado Chacon, 24 November. 2023.
- Betancourt, Jocelyn. Interview. Conducted by Amado Chacon, 24 November. 2023.
- Bosch and Company, production company, et al. *Foreigners in Their Own Land*. WETA Washington, DC, 2013.
- Cacari Stone, Lisa, et al. “El Nacimiento del Pueblo mestizo: Critical discourse on historical trauma, Community Resilience and Healing.” *Health Education ;Behavior*, vol. 48, no. 3, June 2021, pp. 265–275, <https://doi.org/10.1177/10901981211010099>.
- Cammarota, Julio and Aguilera, Michelle. “‘By the time I get to Arizona’: Race, language, and education in America’s racist state.” *Race Ethnicity and Education*, vol. 15, no. 4, Sept. 2012, pp. 485–500, <https://doi.org/10.1080/13613324.2012.674025>.
- Chacon, Richard. Interview. Conducted by Amado Chacon, 12 November. 2023.
- Cho, Seonhee. “‘A personal touch of advocacy to my profession’: Counter-narratives of immigrant Latina Teachers in English as a Second language education.” *Explorations in Ethnic Studies*, vol. 39–40, no. 1, 1 Jan. 2018, pp. 19–35, <https://doi.org/10.1525/esr.2018.39-40.1.19>.
- Devlin, Kat. “Most European Students Are Learning a Foreign Language in School While Americans Lag.” *Pew Research Center, Pew Research Center*, 6 Aug. 2018, [www.pewresearch.org/short-reads/2018/08/06/most-european-students-are-learning-a-foreign-language-in-school-while-americans-lag/](http://www.pewresearch.org/short-reads/2018/08/06/most-european-students-are-learning-a-foreign-language-in-school-while-americans-lag/).
- Estrada, Antonio L. “Mexican Americans and historical trauma theory: A theoretical perspective.” *Journal of Ethnicity in Substance Abuse*, vol. 8, no. 3, 18 Aug. 2009, pp. 330–340, <https://doi.org/10.1080/15332640903110500>.





## The Mexican American Experience

- Garcia, Ralph. Interview. Conducted by Amado Chacon, 20 November. 2023
- González, Juan. *Harvest of Empire: A History of Latinos in America*. Second Revised Edition ed., Penguin Books, 2022.
- Mark. "Bilingualism in Early Childhood: Benefits, Challenges & How to Support It." Little Cedars Day Nursery, Mark <https://www.littlecedars.co.uk/wp-content/uploads/2020/10/Little-Cedars.png>, 28 Apr. 2023, [www.littlecedars.co.uk/bilingualism-in-early-childhood/](http://www.littlecedars.co.uk/bilingualism-in-early-childhood/).
- Martín Corredor, Lina, et al. "Mexican and Mexican-American mothers' visions and decisions amidst dual language bilingual education expansion." *Bilingual Research Journal*, vol. 46, no. 1–2, 3 Apr. 2023, pp. 82–99, <https://doi.org/10.1080/15235882.2023.2235309>.
- Mora, Lauren. "The NCES Fast Facts Tool Provides Quick Answers to Many Education Questions (National Center for Education Statistics)." *National Center for Education Statistics* (NCES) Home Page, a Part of the U.S. Department of Education, 7 Oct. 2020, <https://nces.ed.gov/FastFacts/display.asp?id=72>
- Moslimani, Mohamad. "Facts on Hispanics of Mexican Origin in the United States, 2021." Pew Research Center, Pew Research Center, 16 Aug. 2023, [www.pewresearch.org/race-and-ethnicity](http://www.pewresearch.org/race-and-ethnicity)
- National Center for Education Statistics. *Fast Facts: Degrees Conferred by Race/Ethnicity and Sex (72)*. *Fast Facts: Degrees conferred by race/ethnicity*
- Orozco-Figueroa, Araceli. "The Historical Trauma and Resilience of Individuals of Mexican Ancestry in the United States." *Genealogy*, vol. 5, no. 2, 2021.
- Precious Knowledge. Dir. Ari Palos, Eren Isabel McGinnis. *Dos Vatos*, 2011. Kanopy. <https://www.kanopy.com/en/washington/video/155997>
- Rodriguez, Richard. *Hunger for Memory: The Education of Richard Rodriguez*. New York, Bantam Books, 1982.
- Sleeter, Christine E. "Challenging Racism and Colonialism Through Ethnic Studies." *Visioning Multicultural Education: Past, Present, Future*, edited by H. Prentice Baptiste and Haynes Jeanette Writer, Routledge, *Taylor & Francis Group*, New York, 2021.
- Sleeter, Christine E., and Zavala, Miguel. *Transformative Ethnic Studies in Schools: Curriculum, Pedagogy, and Research*, *Teachers College Press*, New York, 2020.
- Saldivar-Nebeker, Theresa. Interview. Conducted By Amado Chacon, 12 November 2023.





# ECHOING ACROSS A NATION: THE NEW WAVE OF GENDERED TERRORISM IN THE UNITED STATES

Brianna Fero

*ABSTRACT: This essay examines the evolution of terrorism in the United States, tracing its trajectory from early instances of global terrorism to the transformative impact of 9/11 and the rise of new wave domestic terrorism during Donald Trump's presidency. With a particular focus on its impact on women, the analysis explores how the post-9/11 era redefined terrorism as an external threat, predominantly associated with Muslim and Arab communities, while overlooking the growing dangers of homegrown extremism. This framing shaped national security strategies and public discourse, allowing domestic terrorism to proliferate unchecked.*

*The discussion then shifts to the Trump era, where misogyny, anti-abortion laws, and anti-LGBTQ+ legislation became embedded in political rhetoric and policy. The essay argues that Trump's leadership not only emboldened extremist ideologies but also fostered a climate where gendered terrorism – violence and systemic oppression targeting women and marginalized communities – flourished. By examining the intersection of political rhetoric, policy, and acts of violence, this analysis reveals how the U.S.'s narrow focus on foreign threats has obscured the real and present dangers within its own borders.*

*Recognizing the deeply embedded nature of domestic terrorism, this essay advocates for a multi-pronged approach to addressing it – one which includes legislative action, social mobilization, and cultural transformation. This essay highlights the urgency of recognizing and confronting domestic terrorism in all its forms, challenging narratives which have allowed it to fester unchecked within American society.*

## Historical Context and Frameworks

For many Americans, terrorism is synonymous with foreign threats – particularly jihadist extremism – an association cemented by the attacks of September 11th, 2001. That day, nearly 3,000 lives were lost as Al Qaeda operatives hijacked four planes and carried out a meticulously planned assault on U.S. soil. This moment would redefine national security and shape the modern Western perception of terrorism. From that point forward, terrorism became exclusively framed as an external, Islamic threat, reinforcing the notion that danger always comes from beyond American borders.

However, this framing is deeply flawed. Long before 9/11, the deadliest terrorist act on American soil was not carried out by Al Qaeda but by a homegrown extremist. On April 19th, 1995, Gulf War veteran Timothy McVeigh detonated a truck bomb outside the Murrah Federal Building in Oklahoma City, killing 168 people, (Federal Bureau of Investigation [FBI], 2016). Motivated by far-right, anti-government ideologies, McVeigh was not part of any foreign terrorist network – he was an American radical shaped by domestic extremism. Yet, despite this, the national discourse surrounding terrorism overwhelmingly fixates on foreign actors while largely ignoring or downplaying threats which emerge from within.



This selective framing of terrorism has had dangerous consequences, allowing domestic extremism to fester in the shadows. Even before 9/11, far-right violence posed a significant threat, and in the decades since, it has only escalated. The rise of white supremacist and nationalist ideologies, often fueled by conspiracy theories and political rhetoric, has created an environment where terrorism is no longer something that happens “over there” but is very much an American reality. And yet, because these perpetrators do not fit the conventional image of a terrorist, acts of violence are frequently dismissed as lone-wolf attacks rather than part of a larger, systemic problem.

This modern wave of domestic terrorism has flourished in recent years, particularly under the leadership of Donald Trump. His presidency was marked by a relentless strategy of “othering” – demonizing immigrants, Muslims, LGBTQ+ individuals, and women while emboldening his supporters to view these groups as existential threats. This rhetoric was not just divisive; it actively fueled extremist violence. When Trump called Mexican immigrants “rapists” (BBC News, 2024), when he banned transgender people from the military (American Civil Liberties Union [ACLU], 2023), when he mocked survivors of sexual assault (Rivera, 2018), he sent a clear message: certain groups are not just lesser – they are enemies. His words carried immense weight, shaping policies, and emboldening violent actors who took his rhetoric as a call to action.

Terrorism is not just a distant, foreign menace – it is deeply embedded in American society, manifesting in mass shootings, hate crimes, and the systemic oppression of marginalized groups. The idea that terrorism must be tied to a particular race, religion, or nationality is a dangerous illusion – one which has allowed an equally sinister form of extremism to flourish in our own American backyard. Gendered terrorism, has become a defining feature of this era, as women, transgender individuals, and

LGBTQ+ people increasingly find themselves the targets of extremist violence and political repression. By failing to call these acts what they are – terrorism – the U.S. continues to ignore a crisis that is unfolding within its own borders.

The rise of gendered terrorism under Trump’s presidency represents a critical yet overlooked dimension of domestic extremism. By tracing its historical roots and analyzing how political rhetoric fuels acts of violence and repression, this analysis challenges the conventional definitions of terrorism and demands recognition of the systemic terror inflicted upon women and marginalized communities in America.

### **Terror In Our Backyard**

The events of 9/11 reshaped not just national security policies but the very fabric of American perception. As Cox (2002) notes, “However, it was not just the collapse of the Twin Towers and the partial destruction of the Pentagon that made the attack internationally significant. It was what followed – first in terms of the US response to the attack and second in terms of the attack’s impact upon the larger international system – that lent the event such importance,” (p. 218). A wave of fear took hold, not just in the United States but around the world, as people grappled with the uncertainty of what would come next. In response, the U.S. government dramatically expanded its role in counterterrorism, increasing airport security, broadening surveillance laws, and intensifying detentions of suspected terrorists (Federal Bureau of Investigation [FBI], 2010). Yet beyond policy changes, the attack also fueled a cultural shift – one that recast terrorism almost exclusively as an Islamic threat, reinforcing a dangerous and misleading narrative.

This framing ignored a critical reality: terrorism is not confined to a single religion, ideology, or region. As legal scholar Maxwell O. Chibundu argues, “Terrorism has always served as a tool of the powerless, Muslim and non-Muslim



alike, and Muslims, whether of the moderate or fundamentalist stripe, like Christians, Jews, Hindus and Atheists, have resorted to terror when it suited their needs” (Chibundu, 2004, p. 889). At its core, terrorism is often an act of desperation, a means for individuals or groups who feel powerless to amplify their message. Many of the most infamous attacks have been justified as acts committed in the “name of God,” yet no religious doctrine truly endorses mass murder. Instead, these violent acts often stem from deeper social and political grievances, where violence becomes a distorted tool for recognition, revenge, or perceived justice.

Terrorism is rarely an isolated act of violence; it is often a strategic tool used to send a broader message, whether political, ideological, or retaliatory. For those who feel powerless, it can be a desperate attempt to assert agency, a final act meant to force recognition of their cause. However, suicide terrorism presents a paradox—why would someone willingly sacrifice their own life for an act of destruction? Research suggests that these attacks are not purely ideological but deeply shaped by systemic and structural conditions. As Harmon et al. (2019) explain, “Piazza does suggest that regime type was related to the perpetration of suicide attacks. Other societal elements such as economy, education, religion, and culture have also been included in theories about the causes of suicide terrorism.” This perspective underscores the reality that terrorism does not arise in a vacuum; rather, it is cultivated in environments where economic instability, political repression, and social alienation create pathways for radicalization.

Extremist groups exploit these vulnerabilities, using psychological manipulation to recruit individuals who may already feel disenfranchised. Brainwashing is a calculated tactic, one that preys on those seeking purpose, belonging, or even financial security. For some, joining a terrorist organization promises protection for their families, access to resources,

or a sense of religious fulfillment—perceived rewards that outweigh their own mortality. These incentives, however, obscure the larger power dynamics at play. Terrorist leaders rarely put themselves in harm’s way; instead, they weaponize the most vulnerable, turning them into tools for ideological warfare.

Despite the common perception that terrorism is synonymous with suicide bombings and large-scale attacks, the reality is far more complex. While the manipulation tactics used by extremist groups are often similar, the outcomes are unpredictable. Terrorism is not confined to a single profile, nor is it limited to those with clear political motives. In theory, anyone can become radicalized under the right (or wrong) conditions—especially when systemic oppression, economic hardship, and ideological propaganda converge to push individuals toward extreme action. Understanding these root causes is crucial, as dismantling the conditions that breed terrorism is far more effective than simply responding to its violent manifestations.

### As American as Apple Pie

The perception that terrorism is inherently tied to jihadist extremism remains deeply ingrained in public discourse, especially in a post-9/11 world. However, this framing ignores the growing reality that terrorism is not confined to any one religion, ethnicity, or ideology. While extremist groups operating in Muslim-majority states continue to be the focus of counterterrorism efforts, domestic radicalization has become a more pressing concern. It is no longer just a matter of Americans joining foreign terrorist organizations—it is about the conditions within the U.S. that are fostering homegrown extremism. As recent studies highlight, the demographic makeup of jihadist terrorists in the U.S. since 9/11 is far more diverse than commonly assumed: “Of the sixteen lethal jihadist terrorists in the United States since 9/11: three are African-Americans, three are from families that hailed originally





from Pakistan, one was born in Virginia to Palestinian immigrant parents, one was born in Kuwait to Palestinian-Jordanian parents, one was born in New York to a family from Afghanistan, two are white converts—one born in Texas, another in Florida—two came from Russia as youth, one emigrated from Egypt and conducted his attack a decade after coming to the United States, one emigrated from Uzbekistan, and one was a Saudi Air Force officer in the United States for military training” (Vidino et al., 2010). These cases reflect the complexity of radicalization, illustrating that terrorism is not a phenomenon limited to specific ethnic or religious backgrounds.

Understanding the conditions that lead to radicalization is essential for effective counterterrorism strategies. Factors such as political alienation, economic instability, social isolation, and exposure to extremist propaganda all contribute to the radicalization process. Yet, public reactions to acts of terror often rely on immediate scapegoating, placing disproportionate blame on Muslim communities while overlooking the more pressing issue of domestic extremism. Many attackers were radicalized within U.S. borders, often exhibiting clear warning signs of their descent into extremist ideologies. Moving forward, addressing terrorism prevention requires more than reactive security measures—it demands a deeper investment in understanding the psychological, social, and political mechanisms that drive individuals toward violence. If the root causes of radicalization are not confronted, the cycle of extremist violence will persist, reinforcing the very conditions that make terrorism a sustained threat.

### **Fine Lines in the Future**

The September 11 attacks profoundly altered the American psyche, introducing an era marked by heightened vigilance and an intensified focus on national security. This seismic event not only exposed vulnerabilities but also sparked critical inquiries into the psychological mechanisms

that drive individuals toward extremist violence. Understanding the pathways to radicalization is imperative; as Borum (2004) elucidates, “Most involvement in terrorism results from gradual exposure and socialization towards extreme behavior” (p. 23). Despite substantial investments in counterterrorism, there remains a conspicuous gap in addressing the evolving nature of domestic extremism. While external threats continue to command attention, the insidious rise of homegrown terrorism necessitates a recalibration of focus toward internal dynamics.

In the aftermath of 9/11, the U.S. government expanded its surveillance apparatus and implemented measures that, while aimed at safeguarding the nation, encroached upon civil liberties. This delicate balance between security and freedom has been a contentious issue, as efforts to thwart terrorism have occasionally undermined the democratic principles they intend to protect. Patterson (2011) observes that “nearly all Americans consider themselves to be very free regardless of class and ethnicity, although what exactly this means, and how it is experienced, has always been strongly contested” (p. 1). This paradox has been further complicated in recent years, as political leaders have invoked national security to justify policies that disproportionately affect marginalized communities.

The urgency to develop predictive models for terrorism is evident, yet the field remains nascent. A more systematic approach—prioritizing comprehensive understanding over reactive policies—is essential to preempt potential threats. This necessitates a paradigm shift in national discourse, recognizing that terrorism is not solely an external menace but one that is deeply rooted within American society. It is within this intricate landscape that the Trump administration’s rhetoric and policies emerge as pivotal factors, potentially exacerbating domestic extremism and reshaping the contours of American terrorism.



### **How Donald Trump Turned 9/11's Legacy Inward**

Terrorism is not a relic of the past, it is an evolving force that morphs with political climates, social unrest, and ideological battlegrounds. While some analysts predict economic growth and youth employment might diminish terrorism's appeal by 2025, history warns against such certainty. Extremism is not easily extinguished; it reshapes itself, adapting to the fears and frustrations of the moment (Bakker, 2012). If global terrorism fades from the spotlight, the urgent question remains: What will take its place?

In the years following 9/11, the United States focused almost exclusively on external threats, directing its military and intelligence resources toward eradicating jihadist networks abroad. This fixation left a dangerous blind spot, allowing homegrown terrorism—fueled by nationalism, white supremacy, and political radicalization—to fester largely unchecked. As Bakker (2012) notes, forecasting terrorism is inherently complex, as it intersects with economic instability, political polarization, and cultural anxieties (p. 72). Yet, while intelligence agencies scrutinized foreign actors, a new brand of extremism was taking root within America's borders, one that did not wear the label of "terrorist" but was no less driven by an ideological pursuit of control, fear, and violence.

This shift reached a critical point during the Trump presidency. Under his leadership, the very definition of terrorism became politicized, weaponized, and distorted to serve partisan agendas. Trump frequently amplified the idea that terrorism was an imported threat, using fear-based rhetoric to justify aggressive policies against Muslim and immigrant communities. Meanwhile, far-right extremism flourished, emboldened by his rhetoric, policies, and refusal to condemn violent nationalist movements (Jones, 2018). The data is stark: between 2016 and 2017, terrorist attacks by

far-right extremists quadrupled in the U.S., yet federal counterterrorism efforts remained disproportionately focused on foreign actors (Jones, 2018).

More than just ignoring domestic extremism, the Trump administration actively fueled it. His refusal to condemn white nationalist violence—most infamously stating that there were "very fine people on both sides" after the 2017 Charlottesville rally—sent a clear message of validation to extremist groups. His administration shifted national security priorities away from white supremacist terrorism, defunded programs that addressed domestic radicalization, and instead directed resources toward targeting leftist and civil rights movements as supposed threats to national security (Miller Center, 2020). In doing so, Trump not only reshaped public perception of terrorism but also provided far-right extremists with the political legitimacy they had long sought.

This evolution of terrorism—from a foreign war to a domestic insurgency—demands a complete reassessment of what constitutes a security threat in modern America. The post-9/11 era framed terrorism as something that happens "over there," a narrative that has allowed an equally dangerous, homegrown form of ideological extremism to metastasize within U.S. borders. While previous administrations failed to adequately address this rising threat, the Trump presidency did not just ignore it—it exacerbated it, making far-right extremism a defining feature of American terrorism today.

### **Make America Terrorists Again**

The war on terror has been turned inward, no longer just a campaign against foreign enemies but a weapon against women, LGBTQ+ individuals, and marginalized communities. Domestic terrorism, once framed as a foreign threat, has flourished within U.S. borders, fueled by far-right radicalization, white supremacy,



Fero

and systemic violence. While mass shootings, hate crimes, and anti-democratic violence surged, political extremism merged with policy, transforming into a systematic effort to strip rights, control bodies, and instill fear.

At the center of this movement is the “Make America Great Again” (MAGA) ideology, which has become more than a slogan—it is a call to arms for extremists. Under Trump, MAGA became a rallying point for violent misogynists, white supremacists, and anti-government radicals, culminating in events like the January 6th insurrection, where far-right extremists and domestic terrorists gathered under its banner (ABC News, 2021). More than just rhetoric, this ideology fueled real-world violence, from mass attacks on marginalized communities to policies targeting women’s autonomy. As Phadke and Boesch (2025) argue, Trump’s administration weaponized deregulation to strip away protections for women and marginalized groups, making their lives more vulnerable under the guise of policy shifts. But these rollbacks were not just political decisions—they were part of a broader movement to institutionalize far-right extremism, legitimizing discrimination and emboldening those who sought to enforce it through violence.

The rebranding of far-right ideology under MAGA has allowed domestic terrorism to thrive. This new wave of gendered and political extremism is not a fringe movement—it is deeply embedded in America’s institutions, laws, and political discourse. While the next section will explore how Trump’s policies systematically dismantled protections for women and LGBTQ+ individuals, it is essential to recognize that this form of domestic terrorism is ideological at its core—one designed to control, silence, and eliminate opposition.

### Pro Life or Pro Control?

Under Donald Trump’s presidency, reproductive rights became a battleground, not just for policy debates but for ideological warfare over bodily autonomy and state control. The administration cut over \$200 million in federal funding for teen pregnancy prevention programs, leaving hundreds of thousands of young people without access to comprehensive sex education (Bassett, 2018). At the same time, employers were granted broad discretion to deny birth control coverage, further limiting reproductive choices under the guise of religious freedom. These policies disproportionately harmed low-income individuals and women of color, who already faced barriers to healthcare and economic independence.

These attacks on reproductive rights extended far beyond access to contraception. In the wake of Trump’s judicial appointments, a wave of abortion bans, criminalization efforts, and legal reinterpretations of reproductive healthcare swept across the country, emboldening conservative lawmakers to further restrict access to life-saving medical care. The Alabama Supreme Court’s 2024 ruling equating frozen embryos to children has already raised concerns that IVF, contraception, and even miscarriage care could soon face severe legal restrictions (Nadeau et al., 2024). The increasing legal uncertainty around reproductive healthcare has left doctors hesitant to provide critical care and patients facing delays and denials for medical procedures once considered standard treatment.

Though framed as efforts to “protect life,” these policies do not improve maternal health outcomes—they do the opposite. The United States already has the highest maternal mortality rate among developed nations, and restrictions on abortion and reproductive care have exacerbated healthcare disparities, particularly for Black and Indigenous women. Meanwhile, many of the same political figures advocating for abortion bans have also supported policies



that gut funding for maternal healthcare, social services, and childcare assistance—revealing a contradiction between rhetoric and reality.

At its core, reproductive oppression has long been a weapon in ideological warfare, shaping who is allowed control over their own future. Trump did not ignite this war—Republican-led efforts to strip reproductive rights date back decades—but he escalated it to an unprecedented scale, giving extremists the green light to push the most extreme policies yet. His judicial appointments paved the way for the overturning of *Roe v. Wade*, state-level abortion bans, and renewed attacks on contraception and fertility treatments. The result? A nation where bodily autonomy is no longer guaranteed but dictated by political ideology and religious conservatism. The long-term consequences of these decisions will not just be measured in legal battles but in the lived experiences of those navigating a landscape where reproductive freedom is increasingly up for debate. The terror Donald Trump escalated rages on, with millions of lives hanging in the balance and devastatingly, many lives lost.

### **The Predator-In-Chief**

Terrorism is often framed as violence meant to instill fear and suppress perceived threats—yet when gendered violence is used to control and subjugate, it is rarely recognized as such. Donald Trump’s presidency did not just embolden misogynists; it institutionalized gendered terror as a political tool. His rhetoric, policies, and judicial appointments systematically dismantled protections for women, reinforcing the idea that their safety, autonomy, and rights were negotiable in the broader effort to restore patriarchal dominance. Trump normalized violence against women through both words and action. His infamous “grab ‘em by the pussy” remark was not an offhand comment—it was a declaration of power over women’s bodies, a signal that dominance and entitlement were acceptable, even celebrated (BBC News,

2016). He dismissed accusations of sexual misconduct against himself and his allies, mocking survivors and reinforcing a culture where abusers faced no consequences. His administration’s legal and political maneuvers eroded protections for sexual harassment victims, rolled back workplace safeguards, and stacked the courts with judges who would later strip away reproductive rights and legal recourse for survivors (Valcore, Asquith, & Rodgers, 2023).

This was not just political negligence; it was ideological enforcement. Far-right movements worldwide have long used violence against women as a means of control, and Trump’s administration mirrored those tactics on a national scale. His policies did not just make life harder for women; they made gendered violence a sanctioned, structural reality. The rollback of Title IX protections, defunding of domestic violence prevention programs, and the elevation of men accused of sexual misconduct into powerful government positions all sent a clear message: women’s pain was not just dismissed—it was politically useful (UNODC, 2024). The effects of this cannot be understated. Studies show that gender-based violence is not just a social issue, it is a precursor to political extremism and domestic terrorism. Trump’s presidency gave rise to a new wave of emboldened far-right misogynists, fueling mass shootings, hate crimes, and organized attacks on women’s autonomy (Hall, 2024). Under his leadership, women are not just marginalized—they are targets.

Trump’s presidency did not just reinforce gendered terror, it simply expanded its scope. The policies that attacked women’s autonomy were not isolated events; they were part of a broader movement that sought to erase, punish, and control those who did not conform to far-right ideals of gender and power. The same administration that rolled back protections for survivors and gutted reproductive rights also launched relentless attacks on transgender





Fero

individuals, LGBTQ+ communities, and anyone who defied traditional gender norms. Violence was not just tolerated, it was encouraged, and legal frameworks were reshaped to make discrimination easier and accountability harder.

Gendered terror was never just about women—it is about enforcing an entire hierarchy of control. What began as a war on women's bodies also quickly expanded into an assault on LGBTQ+ existence, weaponizing policy, courts, and social institutions to instill fear and erase identities. For extremists, policing gender is not just an obsession—it is a foundation of their ideology. Under Donald Trump, it became government policy.

### **Red Hat, Bloody Hands**

Trump's presidency was not just a rollback of LGBTQ+ rights, it was a state-sanctioned campaign to erase, delegitimize, and endanger transgender and queer lives. His administration targeted LGBTQ+ individuals through policy, rhetoric, and executive action, making discrimination not just permissible but encouraged. These attacks were not just about exclusion, but rather controlling, silencing, and the assertion of a far-right vision where gender and sexuality were policed as threats to the nation itself.

One of the most brutal assaults came through healthcare discrimination, where Trump's administration rescinded protections under Section 1557 of the Affordable Care Act (ACA), stripping transgender people of vital safeguards against medical discrimination (Musumeci & Kates, 2020). With these changes, doctors, hospitals, and insurers were empowered to deny life-saving medical care simply because of a person's gender identity. As NPR reported, these policies meant that a transgender man could be refused treatment for ovarian cancer, or a transgender woman could be denied coverage for hormone therapy—even if such denials resulted in death (Simmons-Duffin, 2020). This

was not just a bureaucratic rollback, but it was also the institutionalization of trans erasure through systemic neglect.

Policies were accompanied by a relentless effort to erase trans people from public life. Trump's ban on transgender military service was not simply about national defense, it was a symbolic act meant to reinforce the message that transgender individuals had no place in American society. His administration fueled state-level attacks, backing legislation which sought to block trans youth from receiving healthcare, ban trans athletes from competing in sports, and prevent individuals from legally changing their gender markers (HRC, 2024). These policies were not only about legal classification, but they were also about denying trans people the ability to exist safely and with dignity.

However, policy alone was not enough. Trump's rhetoric ensured the war on LGBTQ+ communities extended beyond the law and into everyday life. His administration's open embrace of far-right, Christian nationalist movements, coupled with his dog-whistle attacks on LGBTQ+ "threats," emboldened extremists who viewed queer and trans existence as a cultural enemy. Hate crimes against LGBTQ+ individuals soared under his leadership, with transgender women of color disproportionately targeted (HRC, 2024). These were not isolated acts of violence, they were the direct consequences of a presidency which legitimized hate, stripped away protections, and left trans communities defenseless in the face of rising extremism.

Trump's anti-LGBTQ+ agenda did not end when he left The White House from his first term. The far-right saw the effectiveness of his attacks and escalated them into full-blown legislative warfare, pushing laws that criminalize gender-affirming care, restrict LGBTQ+ speech in schools, and strip away protections at the state level. These are not just legal battles; , they





are attempts to enforce a world where gender nonconformity is seen as a punishable offense.

The next battleground was not just in law, it was in the streets. With the federal government signaling open hostility toward LGBTQ+ individuals, extremists took it as permission to act. The violence which followed was not an unintended consequence, it was a direct result of an administration who made clear which lives were seen as disposable.

### **Fear On Our Doorsteps**

Violence against women, LGBTQ+ individuals, and marginalized communities has become an integral part of the new wave of domestic terrorism in the United States. While traditional narratives associate terrorism with foreign threats, the reality is that ideological violence—rooted in misogyny, white supremacy, and far-right extremism—thrives within the country's own borders. Donald Trump's presidency created an environment where violence against women and LGBTQ+ people was emboldened, justified, and, in many cases, incited by political rhetoric and policy decisions. The consequences have been staggering: increased domestic violence, a surge in hate crimes, the targeted killings of transgender individuals, and mass shootings disproportionately committed by radicalized young men.

Domestic terrorism is not just about large-scale attacks, it thrives in everyday acts of gendered violence, racial terror, and ideological extremism. Research consistently links domestic violence to mass shootings, with 59% of mass shootings between 2014 and 2019 tied to domestic abuse (Kivisto & Porter, 2021). This violence disproportionately targets women, LGBTQ+ individuals, and people of color, with perpetrators often radicalized through online extremist spaces which glorify misogyny, white nationalism, and homophobic violence. According to the National Coalition Against

Domestic Violence, nearly 20 people per minute are physically abused by an intimate partner in the United States, amounting to over 10 million women and men per year (Bergman, 2023).

Hate crimes have followed a similarly alarming trajectory. Under Trump's leadership, FBI data revealed a nearly 20% surge in hate crimes (Villarreal, 2020). In 2022 alone, there were 11,634 reported hate crime incidents, impacting over 13,000 victims (FBI, 2022). Crimes motivated by sexual orientation increased by 13.8%, while those targeting gender identity surged by 32.9%, showing a clear escalation in anti-LGBTQ+ violence (Human Rights Campaign, 2024). The epidemic of violence against transgender individuals is particularly dire: at least 36 transgender and gender-expansive individuals were murdered in 2023, with Black transgender women comprising 61% of the victims (Hines, 2024). These statistics represent only the known cases, as many anti-transgender hate crimes go unreported due to fear of law enforcement or lack of legal protections.

Islamophobic hate crimes also spiked after Trump's election. His vilification of Muslim communities, particularly women who wear hijabs, fueled an environment of state-sanctioned Islamophobia that emboldened attacks. Reports of violence against Muslim women escalated dramatically after Trump's election, with the Council on American-Islamic Relations reporting widespread fear and harassment directly linked to Trump's rhetoric and policies (SAGE Journals, 2024). This form of terror surrounds making entire communities live in fear for their safety and fits the very definition of domestic terrorism, yet it remains largely absent from mainstream counterterrorism discussions.

The intersection of online radicalization and real-world violence further exacerbates this crisis. Far-right extremist groups have increasingly used digital platforms to recruit and radicalize young men, fueling misogynistic



and white supremacist ideologies that directly translate into real-world attacks. Incels (involuntary celibates), white nationalists, and violent misogynists have repeatedly targeted women and LGBTQ+ people, reinforcing the idea that they are threats to traditional societal structures (FBI, 2022). This weaponization of gendered and racial hatred is a central feature of contemporary domestic terrorism, one which the United States government has consistently failed to confront with the same urgency given to foreign threats.

This epidemic of terror against women, LGBTQ+ individuals, and religious minorities has forced marginalized communities into survival mode. Women increasingly rely on self-defense training, legal advocacy networks, and underground resources to protect themselves. Transgender individuals must carefully navigate healthcare systems which have been stripped of protections under Trump-era policies (Simmons-Duffin, 2020). Muslim communities continue to live under heightened scrutiny, knowing that even their right to exist safely in public spaces remains precarious.

The reluctance to call this violence what it is, terrorism, has allowed it to persist unchecked. These attacks are not isolated incidents, but part of a broader ideological war waged against those who do not conform to the far-right's vision of America. The numbers do not lie: domestic terrorism has been rebranded as "culture wars" when in reality it is an orchestrated assault on marginalized communities. Until violence against women, LGBTQ+ individuals, and racial minorities is recognized as terrorism, meaningful solutions will remain out of reach.

### **Shattering Glass Ceilings While Dismantling Extremism**

Addressing the rise of gendered terrorism in the United States requires more than acknowledgment, it demands targeted and sustained action. The violence and oppression

directed at women, LGBTQ+ individuals, and other marginalized communities are not random but deeply embedded in political, cultural, and economic systems. While these issues have long existed, recent years have seen an escalation in extremist rhetoric, policy rollbacks, and acts of violence which disproportionately harm these communities.

However, the conversation cannot stop at the victims, we must also recognize the growing radicalization of young men who are increasingly drawn into extremist ideologies. Far-right networks, incel culture, and online propaganda machines actively recruit, manipulate, and embolden young men to view feminism, LGBTQ+ rights, and racial justice as existential threats. Such spaces thrive on grievance politics, convincing young men that they have been wronged by progress and violence is a justified response. Left unchecked, this radicalization pipeline feeds directly into domestic terrorism, mass shootings, and gender-based violence. The way forward requires legal, social, and cultural strategies that both protect those at risk and dismantle the conditions which allow gendered terrorism to persist. The solutions outlined below offer a comprehensive framework for reclaiming autonomy, safety, and justice in the face of growing extremism:

1. ***Reclassify Gender-Based Violence as a National Security Concern*** — The rise in mass shootings, hate crimes, and ideological violence linked to far-right extremism and misogyny must be recognized as part of a broader domestic terrorism crisis. National security frameworks should integrate gendered violence into counterterrorism strategies, ensuring that prevention efforts address the radicalization of young men, extremist recruitment tactics, and online networks that encourage violence.
2. ***Strengthen Legal Protections and Reinforce Accountability*** — Laws safeguarding reproductive rights, LGBTQ+ protections,



and protections against gender-based violence must be reinforced and expanded. But legal protections mean nothing without enforcement. Stronger mechanisms for holding perpetrators accountable—whether individuals, organizations, or public officials—are necessary to combat systemic discrimination.

3. ***Disrupt the Radicalization Pipeline for Young Men*** — The normalization of misogyny and extremist rhetoric in online communities must be directly addressed. Social media platforms, gaming spaces, and online forums have become breeding grounds for far-right recruitment. Policies should require tech companies to crack down on extremist propaganda, and schools should implement programs that teach young men to critically engage with harmful ideologies before they take root.
4. ***Expand Survivor-Centered Support Systems*** — Comprehensive resources, including access to emergency housing, financial assistance, legal representation, and mental health care, are essential for those affected by gender-based violence. These supports must be widely available and culturally competent to serve the diverse needs of survivors.
5. ***Address Economic Inequality as a Form of Control*** — Economic instability is often weaponized against women and marginalized communities. Policies ensuring equal pay, affordable childcare, paid leave, and protections against workplace discrimination are essential to reducing financial dependence that can trap individuals in abusive or unsafe situations.
6. ***Counter Extremist Narratives Through Education and Media*** — Extremism grows in the absence of critical thinking. Education systems must include comprehensive sex education, media literacy, and historical

perspectives on gender-based violence, extremism, and discrimination. Promoting accurate and inclusive narratives is critical in challenging far-right propaganda and misinformation.

7. ***Strengthen Community-Based Prevention Efforts*** — Preventing gendered terrorism requires action at the local level. Community-based initiatives, including bystander intervention training, self-defense programs, and mutual aid networks, empower individuals to take proactive steps in fostering safer environments.
8. ***Hold Public Officials and Institutions Accountable*** — Political leaders, law enforcement agencies, and institutions who fail to address gendered violence, or worse, contribute to it through harmful policies, must face consequences. Civic engagement, advocacy, and legal action are crucial tools in ensuring accountability.
9. ***Invest in Research and Data Collection*** — Without a deeper understanding of the root causes and patterns of gender-based violence, solutions remain incomplete. Increased funding for research that examines the intersections of gender, race, class, and extremism can help shape more effective policies and interventions.
10. ***Recognize Gendered Terrorism as a Global Crisis*** — The fight against gender-based violence is not confined to the United States. International collaboration, policy alignment, and pressure on governments that enable oppression are necessary to ensure protections for marginalized communities worldwide.

These solutions are not simply theoretical, they are necessary interventions in a society where extremism continues to evolve and threaten marginalized communities. The fight against domestic terrorism is not only about policy but about dismantling the cultural and ideological



Fero

systems which allow it to flourish. Combating radicalization, protecting vulnerable groups, and reshaping public discourse are essential steps in ensuring future generations do not inherit a nation where terror is tolerated. If these solutions are ignored, the cycle of violence will persist, further embedding domestic terrorism into the fabric of American life.

### **Reigniting Lady Liberty: Forging a Path Forward**

Terrorism in America has never been just a foreign threat, it has always existed within its borders, embedded in laws, institutions, and cultural violence. Today, it does not hide in distant caves but stands on debate stages, sits behind legislative desks, and drafts policies designed to control, punish, and erase. It is the violence in homes, the attacks in the streets, the systematic stripping of rights. To call this anything less than domestic terrorism is to be complicit in its existence.

And yet, the greatest weapon of the oppressor is not just violence, it is the lie that resistance is futile, that this war cannot be won. However, history tells a different story. History does not belong to those who build empires of terror. It belongs to those who burn them down. The first battle is forcing the nation to see terrorism for what it is. Gendered violence, anti-LGBTQ+ laws, the radicalization of young men into extremism—these are not culture wars, they are ideological warfare. The refusal to name them has allowed them to flourish. That silence ends now. Though, naming the crisis is not enough. It must be dismantled. Every law stripping autonomy must be met with greater resistance. The systems radicalizing men into extremism must be broken. The institutions enabling hate must not be reformed but torn down and rebuilt from the ground up. Resistance is not just fighting back, it is ensuring there is nothing left for oppression to return to.

This is not a call for hope without action, because hope alone does not stop violence. Hope alone does not dismantle oppression. What does, is defiance that does not waver, resistance which does not break, and the unshakable truth that no regime, no extremist movement, and no ideology built on control has ever survived the full force of those who refuse to be ruled. History has always belonged to those who dared to take it. From the suffragists who defied the law, to the LGBTQ+ activists who rioted at Stonewall, to the civil rights leaders who forced a nation to confront its own hypocrisy—progress has never been given, only seized.

Angela Davis once said, “I am no longer accepting the things I cannot change. I am changing the things I cannot accept.” And so, we do. Women have never been given history; we have taken it. We have torn it from the hands of those who sought to erase us, shattered the ceilings meant to contain us, and built something stronger in their place. Now, in the face of terror designed to silence and subjugate, we do what we have always done—we turn fear into fire. Let history remember not only the terror that was built, but the hands which set it ablaze, the voices who roared in its place, and the future that rose unchained from its ashes.

The future is not waiting. It is already being written.





## References

- ABC News. (2021). Symbols of hate and extremism on display at pro-Trump Capitol siege. <https://abcnews.go.com/US/symbols-hate-extremism-display-pro-trump-capitol-siege/story?id=75177671>
- Bakker, E. (2012). Forecasting terrorism: The need for a more systematic approach. *Journal of Strategic Security*, 5(4), 69-84. <https://www.jstor.org/stable/26463974>
- Bassett, L. (2018, January 20). In one year, Trump dismantled reproductive rights around the world. *HuffPost*. [https://www.huffpost.com/entry/in-one-year-trump-dismantled-reproductive-rights-around-the-world\\_n\\_5a623b94e4b074ce7a080152](https://www.huffpost.com/entry/in-one-year-trump-dismantled-reproductive-rights-around-the-world_n_5a623b94e4b074ce7a080152)
- BBC News. (2016, October 9). US Election: Full Transcript of Donald Trump's Obscene Videotape. <https://www.bbc.com/news/election-us-2016-37595321>
- Bergman, M. (2023, October 26). Domestic violence: A Q & A with trauma researcher Maja Bergman. *Columbia University Department of Psychiatry*. <https://www.columbiapsychiatry.org/news/domestic-violence-q-trauma-researcher-maja-bergman>
- Borum, R. (2004). Psychology of terrorism (NIJ Grant No. 208551). U.S. Department of Justice, *Office of Justice Programs*. <https://www.ojp.gov/pdffiles1/nij/grants/208551.pdf>
- "Breaking down Trump's Trans Military Ban: ACLU." *American Civil Liberties Union*, February 27, 2023. <https://www.aclu.org/news/lgbtq-rights/breaking-down-trumps-trans-military-ban>
- Chibundu, M. O. (2004). For God, for country, for universalism: Sovereignty as solidarity in our age of terror. *Florida Law Review*, 56(5), 883-920.
- Cox, M. (2002). Paradigm shifts and 9/11: International relations after the Twin Towers. *Security Dialogue*, 33(2), 217-233. <https://doi.org/10.1177/09670106020330020111>
- "Drug Dealers, Criminals, Rapists': What Trump Thinks of Mexicans." *BBC News*. Accessed April 7, 2024. <https://www.bbc.com/news/av/world-us-canada-37230916>
- FBI. (2022). Hate Crime Statistics Report. <https://www.fbi.gov/investigate/civil-rights/hate-crimes>
- Federal Bureau of Investigation. (2010, May 21). Terrorism 2002/2005. <https://www.fbi.gov/stats-services/publications/terrorism-2002-2005>
- Hall, I. (2024, March 7). Donald Trump's Populist Foreign Policy Rhetoric. *London School of Economics*. [http://eprints.lse.ac.uk/105756/1/Hall\\_in\\_search\\_of\\_enemies\\_published.pdf](http://eprints.lse.ac.uk/105756/1/Hall_in_search_of_enemies_published.pdf)
- Harmon, V., Kessler, J., & Mahoney, C. (2019, May 13). Causes & explanations of suicide terrorism: A systematic review. *Homeland Security Affairs*. <https://www.hsaj.org/articles/14749>
- Hines, A. (2024, December 12). Amid a violence epidemic against trans Americans, these groups are fighting back. *Teen Vogue*. Retrieved from <https://www.teenvogue.com/story/amid-an-violence-epidemic-against-trans-americans-these-groups-are-fighting-back>
- Human Rights Campaign. (2024). LGBTQ+ Hate Crime Data. <https://www.hrc.org/resources/violence-against-the-trans-and-gender-non-conforming-community-in-2024>
- Human Rights Campaign. (2024). The real list of Trump's 'unprecedented steps' for the LGBTQ community. Retrieved from <https://www.hrc.org/news/the-list-of-trumps-unprecedented-steps-for-the-lgbtq-community>
- Jones, S. G. (2018). The rise of far-right extremism in the United States. *Center for Strategic and International Studies*. <https://www.csis.org/analysis/rise-far-right-extremism-united-states>
- Kaiser Family Foundation (KFF). (2020). The impact of the Affordable Care Act on LGBTQ+ healthcare access. Retrieved from <https://www.kff.org/racial-equity-and-health-policy/issue-brief/lgbt-health-care-rights-and-discrimination-protections/>





## Fero

- Kivisto, A. J., & Porter, K. E. (2021). Firearm use in intimate partner homicide: A systematic review. *Trauma, Violence, & Abuse*, 22(5), 1253-1267.
- me too. Movement. (2024, December 20). Me Too. Movement. <https://metoomvmt.org/>
- Miller Center. (2020). Donald Trump: Domestic affairs. *University of Virginia*. <https://millercenter.org/president/trump/domestic-affairs>
- Musumeci, M., & Kates, J. (2020, September 23). The Trump administration's final rule on Section 1557 non-discrimination regulations under the ACA and current status. *KFF*. Retrieved from <https://www.kff.org/racial-equity-and-health-policy/issue-brief/the-trump-administrations-final-rule-on-section-1557-non-discrimination-regulations-under-the-aca-and-current-status/>
- Nadeau, S., Shepherd, M., Talukder, S., et al. (2024, July 29). How the Alabama IVF ruling is connected to upcoming Supreme Court cases on abortion. *Center for American Progress*. <https://www.americanprogress.org/article/how-the-alabama-ivf-ruling-is-connected-to-upcoming-supreme-court-cases-on-abortion/>
- "Oklahoma City Bombing." FBI, May 18, 2016. <https://www.fbi.gov/history/famous-cases/oklahoma-city-bombing>.
- Patterson, O. (2011). Freedom and 9/11. *Democracy: A Journal of Ideas*, (21), Summer 2011. [https://scholar.harvard.edu/files/patterson/files/freedom\\_911.pdf](https://scholar.harvard.edu/files/patterson/files/freedom_911.pdf)
- Phadke, S., & Boesch, D. (2025). Women have paid the price for Trump's regulatory agenda. *Center for American Progress*.
- Rivera, Mark. "Rape Victim Advocates: President Trump Mocking Dr. Ford Drives Survivors 'behind Closed Doors.'" *ABC7 Chicago*, October 3, 2018. <https://abc7chicago.com/president-donald-trump-and-women-christine-blasey-ford-dr/4403915/>.
- SAGE Journals. (2024). Trump and Muslims: A critical discourse analysis of Islamophobia. <https://journals.sagepub.com/doi/pdf/10.1177/21582440211004172>
- Simmons-Duffin, S. (2020, June 12). Transgender health protections reversed by Trump administration. NPR. <https://www.npr.org/sections/health-shots/2020/06/12/868073068/transgender-health-protections-reversed-by-trump-administration>
- United Nations Office on Drugs and Crime. (2024, March 2). *Gender Dimensions of Criminal Justice Responses to Terrorism*. [https://www.unodc.org/documents/terrorism/Publications/17-08887\\_HB\\_Gender\\_Criminal\\_Justice\\_E\\_ebook.pdf](https://www.unodc.org/documents/terrorism/Publications/17-08887_HB_Gender_Criminal_Justice_E_ebook.pdf)
- Valcore, J., Asquith, N. L., & Rodgers, J. (2023, February 9). "We're Led by Stupid People": Exploring Trump's Use of Denigrating and Deprecating Speech to Promote Hatred and Violence. *Crime, Law, and Social Change*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9908499/>
- Vidino, L., Pantucci, R., & Kohlmann, E. (2010). Homegrown terrorism in the United States: A comparative study of radicalization processes. *Homeland Security Policy Institute*.
- Villarreal, D. (2020, November 17). Hate crimes under Trump surged nearly 20 percent, says FBI report. *Newsweek*. <https://www.newsweek.com/hate-crimes-under-trump-surged-nearly-20-percent-says-fbi-report-1547870>



# JUDICIAL COMPLIANCE: THE SUPREME CONSTITUTIONAL COURT AND THE MILITARIZATION OF EGYPT'S GOVERNMENT

Hoda El Anany

*ABSTRACT: This paper examines the role of Egypt's Supreme Constitutional Court (SCC) in legitimizing authoritarian rule and reinforcing executive power, despite its formal mandate as an independent judicial body. Through an institutional and political analysis, the study explores the SCC's historical development, its appointment processes, and its jurisdiction over constitutional review. While the SCC was initially established to bolster judicial independence and economic stability, its rulings have consistently served the interests of the military and executive, rather than upholding democratic principles. Three pivotal cases—the 2012 dissolution of the People's Assembly, Law No. 107 of 2013 restricting protests, and the 2017 transfer of the Tiran and Sanafir islands—illustrate how the SCC has facilitated the erosion of political opposition, suppressed civil liberties, and enabled the centralization of power under President Abdel Fattah El-Sisi. The paper argues that the SCC operates less as a guardian of constitutional law and more as an instrument of state control, ultimately undermining the prospects for genuine democratic governance in Egypt.*

## **Egypt Supreme Constitutional Court of Egypt**

Revolutionary Command Council, a governing body established by the Free Officers. In 1956, Nasser became president of Egypt.

### **I. Country Background**

Egypt, located in North Africa, is home to over 100 million people and holds rich history as it's known to be one of the world's first great civilizations. Following its independence from Britain in 1922, Egypt's first constitution in 1923 proclaimed the country to be an independent sovereign Islamic state with an executive in the form of a king. The 1952 revolution was kicked off by the Free Officers Movement, a nationalistic military group led by Colonel Gamal Abdel Nasser to overthrow King Farouk I, ending the monarchy. In 1953, the Arab Republic of Egypt was created and Mohamed Naguib became the first established president. However, in 1954, Nasser held de facto control over Egypt due to ideological and power struggles with the

The highest court in Egypt is the Supreme Constitutional Court, which was formally known as the Supreme Court of Egypt. In 1969, President Nasser established the Supreme Court with the aims of upholding authoritarian rule with a court system he could control. The courts prior to the Supreme Court had judicial review powers, but President Nasser moved those powers and vested them into the Supreme Court, which was strictly under the control of the executive. However, President Nasser didn't have the opportunity to get far with this as he passed away in 1970. Anwar Sadat took his place as president in 1970, who was a strong advocate for economic liberalization through foreign investment. However, investors were skeptical of investing in Egypt due to the political instability in the country and wanted a court



that would define property rights expansively. As such, the Egyptian government created a constitutional court with judges that would uphold this. This was known as the Supreme Constitutional Court, established in 1979.

Egypt has seen several constitutions since its independence in 1922, yet the current one was established in 2014 as a result of the June 30th revolution. The Arab Spring of 2011 played a monumental role in the Middle East in terms of protests and political demonstrations for democracy. While it initially sparked in Tunisia, it quickly spread across the Middle East and North Africa after seeing how successful the outcome was for Tunisia. Egypt, however, was not so lucky. Protests broke out in Cairo that led to President Mubarak's resignation, who'd been in power for 30 years. In 2012, the first democratically elected presidential election brought President Morsi into power which ended over 60 years of authoritarian rule. However, he did not last long in office as protests broke out again due to frustration by civilians of Morsi's inability to solve the economic issues, energy shortages, and more that hadn't been addressed. In 2013, Colonel General Abdel Fattah El-Sisi and the military led a coup d'état which removed Morsi from office and made Sisi de facto leader until 2014. This held strong significance seeing as that the military had overthrown the country's first-ever democratically elected government.

In terms of governmental layout, the 2014 constitution states that the president of the Republic is the head of state and constitutes the executive authority with the cabinet, the head of government. Presidents under this system have 6-year terms and can be extended for an additional term. The Egyptian judicial system is composed of two separate hierarchies in which one deals with civil and criminal, and the other handling administrative law. Egypt has three supreme courts: the Supreme Constitutional Court which handles constitutional matters, the Court of Cassation which is the supreme court of the common court system, and the Supreme

Administrative Court which is the highest court of the administrative court system, the State Council. Other judicial bodies include the State Cases Authority, which represents the state in civil litigation if the state is a party, and the Administrative Prosecution, which handles disputes of financial and administrative irregularities involving government entities and personnel. For the sake of this paper, emphasis will be placed on the Supreme Constitutional Court: the highest court of Egypt.

## II. Institutional Analysis

### a. Structure and Relative Power of the Court

The Supreme Constitutional Court of Egypt is a distinct judicial body and independent of other courts. It has exclusive jurisdiction over constitutional review and operates separately from the regular judiciary. Upon its creation, President Sadat wanted to ensure the court remained independent and uninfluenced from the other branches of government. No other court in Egypt can overrule its decisions and its rulings are binding on all state authorities. The court is designed to function autonomously and independently through by Law No. 48 of 1979, but as I will argue in later sections, hasn't been successful in this case.

For the duration of the section, I will cite relevant parts of the Egyptian Constitution regarding the SCC. However, Law No. 48 of 1979 was created to lay down the rules and policies of the SCC, as it's known as the Supreme Constitutional Court Law. As such, citations of this law may occur more frequently than citations to the Constitution seeing as that the Constitution isn't as detailed for the purposes of this handbook.

### b. Appointments

Egypt uses a civil law system which appoints justices to the Court. As in other civil law systems, the title of a judge indicates they're a part of a lower court which wouldn't apply to



justices as they have constitutional powers and judges don't.

Article 193 of the Constitution states that the Court is composed of a Chief Justice, who is appointed by the president of Egypt, and a sufficient number of deputies to the Chief Justice. Justices are appointed by a presidential decree after consulting with the Supreme Court Council of the Judicial Bodies, as granted by Article 5 of Law No. 48. Among two candidates, who must meet several high requirements, one is chosen by the general assembly of the Court and the other by the Chief Justice. Two-thirds of the appointees to the bench must be chosen from other judicial bodies and the presidential decree that appoints a member indicates their position and seniority on the bench. There isn't a concrete number of judges that must be on the Court, as Article 3 of Law No. 48 states the court is formed of the Chief Justice, who is appointed by a presidential decree per Article 5, and a sufficient number of members. Article 3 additionally states that decisions of the court must be made by at least 7 members, which indicates there could hypothetically be an infinite number of justices.

Article 194 of the Constitution states that members of the Court are independent and immune to dismissal as they are subject to no authority other than the law. As such, once appointed, justices can't be removed prior to the mandatory retirement age except by consent.

#### **c. Review Powers**

Article 192 of the Egyptian constitution grants the SCC the sole jurisdiction in the matter of constitutionality of laws and regulations. Some of the functions of the Court are judicial review in determining if laws are consistent with the constitution, interpreting legal texts, adjudicating requests to suspend the implementation of rulings issued by arbitration bodies with the purpose of adjudicating government and public sector disputes, and handling conflicts of jurisdiction disputes, as backed by Article 25 of Law No. 48.

Article 26 of Law No. 48 grants powers to the Court to provide definitive interpretation of laws enacted by the legislature and presidential decrees to ensure the law is issued in accordance with the Constitution. However, the Court can only hear cases that are brought to them, since the Court has concrete judicial powers. As stated in Article 27 of Law No. 48, the Court can deem a law unconstitutional if it was linked to a dispute under its consideration. In practice, the SCC's ability to deem a law unconstitutional depends on how that law ties into the case that was brought to it and whether it meets the procedural threshold for concrete review.

Seeing as that the SCC has the sole jurisdiction over the constitutionality of laws and regulations, the Court holds a unique position that allows it to influence Egypt's legal landscape. As such, any governmental member or legislative must withstand SCC scrutiny to ensure the policies and laws are in alignment with the Constitution, should a case arise in the future regarding the constitutionality of this law. This shows that the SCC holds an extreme amount of power within the political system to ensure laws are in alliance with the potential of reducing corruption within Egypt. Additionally, the SCC can shape policy indirectly since its interpretations are definitive, serving as a check on legislative and executive power.

#### **d. Access**

Article 29 of Law No. 48 discusses the referral of questions, which states a judge in lower courts who has a constitutional question in their case must refer it to the Court for review. The referral typically occurs when the judge believes the application of a law could violate the Constitution, warranting the SCC to review the matter as it falls within its jurisdiction. This process enables any lower court to pause its proceedings and formally send a referral to the SCC for review, in which the issue of constitutionality is focused on.





Citizens typically can't access the court directly as the SCC must review the concrete dispute from a court of merit. Litigants have the right to raise a constitutional issue and can request a judge to refer the case to the SCC. Upon review, if the judge determines the referral is appropriate, the case will be forwarded to the SCC. Appropriate requests are determined by standing, which is restricted to litigants engaged in a real legal controversy with a stake in the outcome.

Article 29 empowers the Court with concrete review, which enables the Court to oversee constitutional compliance selectively. This somewhat restrictive form of access limits the Court's direct involvement in broad political challenges yet grants it a strategic position to impact political matters when a relevant case is forwarded. This form of cooperation adds to the legitimacy of the SCC's decisions and increases the odds of compliance. The SCC does not have the power to try cases if it is not brought to them; the constitutional question must be forwarded by a court of merit before the Court can do anything. This shows how the SCC is somewhat limited in scope as it relies on other courts to bring their questions to the Court. Additionally, the SCC's constitutional rulings set binding precedents, which affects the future political landscape by shaping the interpretation of laws. This Court has potential to bring meaningful, positive change if it truly devotes itself to upholding the Constitution. Should the Court have another motive, these precedents remain binding but steer lower courts in the wrong direction and towards the path of corruption.

### III. Case Studies

While the Supreme Constitutional Court was created to be independent from other branches of government and free from influence, the reality of the political sphere in Egypt is that the Court has enabled authoritarian rule and the militarization of the government. Since Egypt's independence in 1922, power has

typically been consolidated with one person. Egypt had a monarchy from 1922 until 1953 as a result of the military, specifically Gamal Abdel Nasser, overthrowing King Farouk I with aims of eliminating the monarchy. In his place, President Nasser established authoritarian rule that lasted long after his term. The brief break in authoritarianism came during the time of the Arab Spring in 2011, in which President Mubarak stepped down from office due to protests calling for his resignation, bringing President Morsi into power through Egypt's first electoral democracy. A year later, General Sisi took control of the government through a coup d'état, in which he is still president to this day. The way President Sisi took control set the stage for the years to come, as the executive branch has heavy influence on the militarization of the judiciary. Sisi has increasingly used the judiciary to legitimize actions taken by military and the executive. The SCC, in turn, has enabled this behavior by legitimizing the actions of the executive and political interests of the state, deeming these policies to be constitutional. The three main cases I will be using to argue this is the SCC's role in the dissolution of the People's Assembly of 2012, Law No. 107 of 2013, and the transfer of the Tiran and Sanafir islands.

#### *The Supreme Constitutional Court's Role in the Failed Democratic Revolution of 2011*

To set the political climate, Egypt was facing the upcoming elections after President Mubarak's resignation. The Supreme Council of Armed Forces (SCAF) played the role of overseeing the country until elections occurred. They created the March Constitutional Declaration (MCD), which was a set of amendments to Egypt's constitution until a new one were to be drafted, as the public was discontent with the former. Articles 56 and 57 of the MCD granted the SCAF broad legislative, executive, and administrative powers, foreshadowing the power the military would hold in the near future. The lack of a viable constitution with upcoming elections caused high tensions in the





political climate, as the elected official would hold significant influence over the newly drafted constitution and push their own agenda.

The Muslim Brotherhood, (MB), an Islamist political group, held significant political power and was popular among the public following the 2011 revolution. However, the SCC dissolved Egypt's People's Assembly in 2012 after ruling that one-third of the seats in parliament had been filled improperly. The Court found that a provision of the electoral law, which allowed independent candidates to run for individual seats while limiting political party affiliated candidates for others, was unconstitutional. This provision had allowed many candidates affiliated with the MB to win seats as "independents," thus their positions were invalidated. The SCC's decision to dissolve the parliament, despite its minimal legal justification, was viewed as a biased attempt to weaken the Islamist party. From the beginning of its modern history, Egypt's government had strong opposition to Islamist parties it was viewed to be a threat to its secular vision. The Muslim Brotherhood, for example, was very popular among Egyptian citizens which posed a challenge to the Egyptian government as it would be a barrier to its military based, authoritarian rule. It served as a reminder that the MB could mobilize significantly against the regime, especially among the poor and working class. As such, the SCC had to ensure the MB was weakened and off to a poor start in an attempt to hold authoritarian and militaristic rule. The ruling was a significant blow to the Muslim Brotherhood, as it lost its dominant presence in the Parliament.

In contrast, Ahmad Shafiq, President Mubarak's former prime minister, gained an advantage in the 2012 presidential election despite Law No. 17 of 2012. This law had the intent to bar figures from the former regime from holding public office. Specifically, it suspended the political rights of anyone 10 years prior to 2011 who held any leadership roles in the Republic, whether that be president, vice

president, prime minister, etc. Under this law, Shafiq should not have been able to run either as he was a former member of the Republic as President Mubarak's prime minister. This caused significant unrest with the public as it was an early sign the country would fall back into its authoritarian history.

Prior to the dissolution of the People's Assembly in June of 2012, Ahmad Shafiq's case was brought before the SCC in February of that same year. Shafiq challenged Law No. 17 of 2012 on the basis of the law not applying to him, as he was not in a leadership role for the full 10 years prior to the 2011 election. The Court ruled in his favor, based on Article 7 of the MCD. Article 7 provides equality before the law and non-discrimination on the basis of "race, origin, language, religion, or creed" (ICJ, 2012). The Court's decision did not adequately explain why the entire law, and therefore election results, had to be taken down instead of requiring new elections for those seats where party candidates ran against independent party candidates. As such, the Court's enabled military objectives by weakening the likelihood of a strong democratic state under the MB. The SCC was quick to ensure the People's Assembly could be dissolved to make it harder for the MB to win due to illegal seating, yet Shafiq was able to run despite serving under Mubarak's regime and could easily influence the politics of the country to bring back authoritarian rule.

#### ***Case No. 234 of 36 – Constitutionality of the Law No. 107 of 2013***

The coup d'état that resulted in President Morsi being overthrown held strong significance for the Egyptian public, as this was the country's first election. Protests had broken out for the reinstatement of the MB leader, in which Law No. 107 of 2013 was passed. This law grants security officials discretion in banning any protest on vague grounds and imposes strict punishment such as large fines and lengthy prison sentences for violators of this law.



Article 7 of the law states “Participants in public meetings or processions or protests are prohibited to disrupt public security or order or obstruct production...” Throughout the remainder of this article, vague terms appear such as “affecting the court of justice”, “hamper citizens’ interests” and “subjecting human life or public or private property to danger.” This allows police to criminalize legitimate peaceful protests on the basis of the vague wording of Article 7, essentially making it open to interpretation and acting as they deem necessary. Article 8 requires protestors to notify the ministry of any public gatherings of more than 10 people at least three days in advance. This article also requires the notice to include detailed information on the nature of the public meeting, such as interests, demands, and the name of the organizers. As such, these requirements are designed to create obstacles for people desiring to protest peacefully.

The nature of this law is designed to create strict and unproportionate punishments to those who deviate from the law. Article 12 gives security forces the authority to handle non-responsiveness of participants using water cannons, tear gas canisters, and using batons. Article 13 serves as a backup plan to Article 12, which allows security forces to fire warning shots, sound or gas bombs, rubber cartouche bullets, and non-rubber cartouche bullets. Chapter Three of Law No. 107 specifies penalties for protestors who don’t comply, which can range from fines of 30,000 to 300,000 Egyptian pounds and prison sentences from two to seven years.

This law was challenged before the SCC, who deemed Article 10 to be unconstitutional. Article 10 allowed the Interior Ministry the authority to cancel or postpone a protest without judicial review, which doesn’t align with Article 73 of the Constitution. Article 73 guarantees the right to organize publicly, provided no weapons are carried and that prior notification is given, as regulated by law. Additionally, Article 93 of

the Constitution states that the Egyptian state is bound by the international human rights conventions and the treaties that it has ratified. Specifically, all human rights grant the right to protest and peaceful assembly and prevent states from undermining this right with domestic legislation that contradicts the international provisions. As such, Article 10 was amended in 2017 which allowed the ministry to cancel or postpone a public meeting if it submits a request to the judiciary for review, which must be approved.

While the SCC deemed Article 10 to be unconstitutional, it failed to ensure that human rights were being upheld and enables the effects of the same policies that Egyptians were once oppressed by. The Assembly Law of 1914 took place during Britain’s colonization of Egypt, which restricted gatherings and imposed severe penalties on the participants. This law additionally imposed mass punishment, as an entire group could be punished for something a single individual did, evident in Law No. 107. The Assembly Law’s legacy haunts Egyptian civil society today, as it serves as the basis for strict protest laws, offers framework as precedent, and used by courts to draw on its principles to justify punitive measures under newer laws. Judges are known to have cited the Assembly Law in jailing opposition activists and regularly citizens for protesting against President Sisi in addition to issuing mass death sentences (Reuters, 2017).

This presents a concerning parallel, as Egypt continues to enforce strict protest laws that echo those used during British rule to suppress Egyptians. Instilling fear through harsh penalties and creating numerous barriers for civilians to exercise their rights enables the authoritarian control President Sisi has maintained since coming to power. Meaningful change cannot be expected from the government, but from the courage and determination of the people. If the highest court in the country fails to uphold constitutional rights, the sole purpose



of its creation, it raises questions about the true purpose of guaranteeing those rights to the population.

***Case No. 37 & 48 of 2018 – Ceding of Tiran and Sanafir Islands***

In 2017, Egypt signed a contract with Saudi Arabia to transfer the Tiran and Sanafir islands for \$22 billion in economic assistance, which rightfully sparked outrage across the country. These islands held geopolitical significance as it granted Egypt strategic presence over the Strait of Tiran, in addition to control over access through the Gulf of Aqaba to Israel and Jordan. Tiran and Sanafir were a main cause of the outbreak of the 1967 Israel-Arab War, as Saudi Arabia initially transferred them to Egypt for safekeeping in the 1950s to prevent Israel from occupying the islands. Additionally, Saudi Arabia had wanted these islands to leverage diplomatic relationships between Israel and Saudi Arabia, which did not sit right with the Egyptian public.

President Sisi argues that there was no constitutional violation for ceding territory to Saudi Arabia, since the islands were originally under Saudi sovereignty according to the 1950 Saudi-Egyptian Accord. Specifically, he states “We have not relinquished or ceded one grain of Egyptian sand to Saudi Arabia. There were security and political considerations that led Egypt to keep the islands, and now we have given them back to their rightful owner who has asked for their return.” This accord doesn’t take into consideration the centuries of historical and political evidence of Egyptian sovereignty over the islands. For one, Saudi Arabia wasn’t established until 1932 by King Ibn Sa’ud, as prior to this the region composed of nomadic tribes with no unified state. This indicates Saudi Arabia could not have had sovereignty over the islands if it didn’t exist until 1932. Egypt, however, is unique from the Arab world following the dissolution of the Ottoman Empire, as it has maintained its continuous

and stable territory over its dynamic history. Records indicate that Egypt controlled the Red Sea from the fifteen century B.C, during Queen Hatshepsut’s reign. Furthermore, the Egypt-Palestine border imposed on the Ottoman Empire by the British in 1906 shows formal political recognition of Egyptian sovereignty over the Sinai Peninsula and the Gulf, which includes Tiran and Sanafir. Saudi Arabia argues that by Egypt acknowledging Saudi sovereignty over the islands in the 1950 Saudi-Egyptian Accord waived Egypt’s territorial rights to Tiran and Sanafir. However, in 1954, the Egyptian Delegate explicitly stated to the Security Council that “The islands have in fact been occupied since 1906, and it is an established fact that from that time on they have been under Egyptian administration” (U.N. SCOR, 9th Sess., 659th mtg., 1954.)

Opponents of the contract argued it broke many laws in the Constitution, as it bars the surrender of any territory. Article 151 of the Constitution states that “no treaty may be concluded which results in ceding any part of state territories.” The agreement between Saudi Arabia and Egypt resulted in Egypt ceding its own territory, which is unconstitutional. As shown in the previous paragraph, Egypt had sovereignty of Tiran and Sanafir and Saudi Arabia did not have a legal basis to claim sovereignty.

Article 139 of the Constitution defines the responsibilities of the President as the head of executive power. The President shall “care for the interests of the people, safeguard the independence of the nation and the territorial integrity and safety of its lands, abide by the provisions of the Constitution, and assume his authorities as prescribed therein.” As President, Sisi had the responsibility to care for the interests of the people, who were extremely opposed to the contract regarding Tiran and Sanafir. Mass protests broke out across the country, in which hundreds of people were arrested, and several websites were taken down that criticized President Sisi for signing this



deal (Human Rights Watch, 2017). By selling the islands for \$22 billion in economic aid, President Sisi threatened the integrity of the nation's territory. Additionally, this contract leaves Egypt financially dependent on Saudi Arabia, positioning Egypt to be politically subordinate to Saudi Arabia. Finally, as stated in the previous paragraph, Article 151 explicitly prohibits any treaty that would result in ceding of Egyptian territory. While President Sisi claimed he did not give up any territory, there is substantial evidence that points to Egypt having sovereignty over Tiran and Sanafir.

Initially, this case was taken to the First Circuit Court for Administrative Justice in 2017, who issued an injunction against the agreement. The Court of Urgent Matters quickly reversed the injunction, allowing Prime Minister Sherif Ismail to sign off on the agreement and send it to parliament for ratification. In 2017, The Supreme Administrative Court upheld the deal was unconstitutional and reinstated the injunction against the agreement. The Supreme Constitutional Court got involved in the latter half of 2017 and suspended all lower court decisions on the agreement. The SCC upheld that these courts did not have jurisdiction of the matter, which allowed President Sisi to sign the agreement into effect three days later.

The interesting aspect of the SCC's decision, which upheld that the agreement was constitutional, is that the basis of the decision was focused on the lower courts involvement as they did not have jurisdiction for constitutional matters. Specifically, the Court stated "Accordingly, this Court has decided not to accept the dispute, since the decision to request a stay of execution of the ruling has become irrelevant." The Court is essentially flexing its muscles and showing no other court has the jurisdiction to handle constitutional matters, paying little attention to the dispute at hand. However, the SCC paid some attention to the constitutional aspects of the case, in which it supported the contract as the deal was down to

Egypt's legislative body. Seeing as that Prime Minister Ismail signed the treaty, it fell under joint purview of the executive and the legislative. No account was shown for the other articles in the Constitution that were clearly violated.

### Implications of the SCC

As discussed, the SCC since President Sisi's term has upheld decisions that are beneficial to the military and executive, but not to the people themselves. The SCC's lack of transparency and legal reasoning for completely dissolving the People's Assembly rather than reforming the parts that needed to be fixed shows how the creation of a successful democratic state was not the intent of the Court. Rather, the SCC continued to uphold policies that favored the military, seeing as that Shafiq was able to run in the elections despite his time as Prime Minister under President Mubarak. Consider the success of the revolution if the SCC aided in creating strong democracies and ensuring transparency was a part of the judicial reasoning, as it had substantial impacts on the election. It could be argued that the SCC's role had a minimal impact on the big picture, since President Morsi was elected as president, who was a part of the Muslim Brotherhood. However, President Morsi only lasted one year in office. In his place came the power of the military, with yet another coup d'état, to bring in President Sisi to office. From the start, the concept of democracy wasn't the priority nor the goal if the highest court in the country was passing decisions that benefited the military, which holds significant influence today.

Furthermore, the SCC's aid in limiting the powers of the people to free speech and protests highlights how the executive branch holds strong influence over the Court, despite its claims to be fully independent. What is the purpose of protesting? Protesting is a form of advocating for serious change, often a reflection of how unhappy the people are under a president and government. If the people are not allowed to





protest or must comply with laws such as Law No. 107 that impose several barriers and severe punishments for noncompliance with the law, the people are silenced and the purpose of the government no longer aligns with serving the people, but the people serving the government. The Court has allowed this law to remain in effect, despite its connections and eerie resemblance of the Assembly Law of 1914, which was created by the very same people the Egyptians fought for independence from a little over a century ago. Preventing the people from protesting has the exact same effect of eliminating political opponents in presidential elections, as seen with the People's Assembly dissolution in 2012, as there is no threat and no competition to the same candidates who stemmed from high authoritarian, militarized practices.

Finally, the SCC has shown itself to function to uphold the motives of President Sisi. The support of the SCC for the transfer of the Tiran and Sanafir islands in exchange for billions of dollars in economic assistance show the Court was willing to push constitutionality aside for the president. The Constitution explicitly stated treaties shall not be based on the ceding of territory and not to undermine the political integrity of the country. President Sisi was able to do both of those with the backing of the SCC, as the islands clearly were under Egyptian sovereignty since ancient times, which he was willing to cede in exchange for money. The Constitution also stated the President has the responsibility to represent and uphold the needs of the people, who in this case, were strongly opposed to the transfer. Rather than engaging in meaningful conversations with the public, El Sisi had hundreds of protestors locked up and several websites censored as they went against his rule. This also goes hand in hand with Law No. 107, as it's used to his benefit to ensure that he is not to be crossed and what he says goes. What good is free speech if it's incredibly specific and limited in scope, requiring it to align with government interests?

#### IV. Summary

The Supreme Constitutional Court of Egypt has the sole responsibility of upholding and interpreting the laws of the Constitution. No other court in Egypt has this power, which vests significant power to the Court. Meaningful changes could have occurred had the SCC followed the Constitution for what it says, not offering limited transparency regarding the basis of its rulings to fit the needs of the executive and military. Had the SCC ordered the proportion of the seats in Parliament that had been compromised to be reformed rather than resolving the whole People's Assembly, Egypt could have been better prepared to evolve into a strong democracy. Had the SCC prevented Shafiq from running in the election despite his clear affiliations with the authoritarian regime the people had revolted against, the remaining parties could have had a fair shot at forming a strong democracy. Had the SCC upheld that Law No. 107 was unconstitutional as it severely restricts the right to protest and free speech, meaningful change could have occurred as the purpose of protesting is to put pressure on the government to change and do better. Had the SCC upheld the explicit laws in the Constitution that stated ceding territory for economic gain was a clear violation, the SCC could have proven itself to be a legitimate and transparent institution.

This goes to show that the SCC does not fit the needs of the people in alliance with the Constitution as its main function. The SCC is not for the people; rather it's to manipulate the law to serve the president's interests. Both the Constitution and Law No. 48 of 1979 have made it explicitly clear that the Court is completely independent and is free from political interference. However, the Court has had a pattern of upholding rights that are beneficial to the executive at the expense of the civilians.





Revolutions are single handedly the most influential events to facilitate social and political change. While Egypt's civilization has had several revolutions throughout its modern history, it has not gotten far due to the overwhelmingly strong presence of the military and authoritarian rule. Several scholars question why the Court was established under an authoritarian regime, as judicial review isn't a pressing topic to authoritarian leaders. If a constitutional court, such as the SCC, operates under an authoritarian regime and constantly upholds authoritarian policies that strengthen the executive and military, it becomes extremely clear the Court operates as a way to legitimize authoritarian interests. As a reminder, the Supreme Court of Egypt was established by President Nasser to vest all judicial review in that court under authority of the executive himself. President Sadat created the SCC to please foreign investors and foster economic development in Egypt. With foundations of judicial review set to push an agenda under an authoritarian leader, constitutional review will never be successful unless the purpose of the Court is explicitly stated to uphold the rights of the people, fostering success and prosperity for every person in the country. Unfortunately, the people are often an afterthought for authoritarian leaders. Needless to say, the Egyptian population have endured a lot and are resilient people, often living under stressful conditions due to the economy and lack of human rights. I have faith that a revolution will occur in which the public unites to reach a common goal: creating a government and selecting leaders who will uphold human rights, fighting for a better life for the Egyptians.

## V. Works Cited

- Blow to Transition as Court Dissolves Egypt's Parliament—*The New York Times*. (2012). Retrieved November 11, 2024, from <https://www.nytimes.com/2012/06/15/world/middleeast/new-political-showdown-in-egypt-as-court-invalidates-parliament.html>
- Council, A. (2016, June 24). What Was in the Egyptian Court's Reasoning in the Tiran and Sanafir Case? *Atlantic Council*. <https://www.atlanticcouncil.org/blogs/menasource/what-was-in-the-egyptian-court-s-reasoning-in-the-tiran-and-sanafir-case/>
- Egypt court upholds Tiran, Sanafir transfer to Saudi Arabia | News | *Al Jazeera*. (n.d.). Retrieved November 11, 2024, from <https://www.aljazeera.com/news/2018/3/3/egypt-court-upholds-tiran-sanafir-transfer-to-saudi-arabia>
- Egypt: Deeply Restrictive New Assembly Law | *Human Rights Watch*. (2013, November 26). <https://www.hrw.org/news/2013/11/26/egypt-deeply-restrictive-new-assembly-law>
- Egypt Judiciary—An Overview. (2010). Egypt Justice - Expert Insight Into the Egyptian Judiciary and Exploration of Egypt's Justice System. Retrieved November 10, 2024, from <https://egyptjustice.com/egypt-judiciary-an-overview>
- Egypt: Law No. 107 of 2013 For organizing the right to peaceful public meetings, processions and protests. (2013). Refworld. Retrieved November 11, 2024, from <https://www.refworld.org/legal/legislation/natlegbod/2013/en/104525>
- Egypt: Supreme Constitutional Court Decision Dissolves One-Third of the Parliament. (n.d.-c). [Web page]. Library of Congress, Washington, D.C. 20540 USA. Retrieved November 11, 2024, from <https://www.loc.gov/item/global-legal-monitor/2012-06-18/egypt-supreme-constitutional-court-decision-dissolves-one-third-of-the-parliament/>
- Egypt's top court upholds law restricting protests | News | *Al Jazeera*. (2013). Retrieved November 11, 2024, from <https://www.aljazeera.com/news/2016/12/3/egypts-top-court-upholds-law-restricting-protests>



- Egypt's new constitution: a flawed process, uncertain outcomes. (2009). [Dataset]. [https://doi.org/10.1163/2210-7975\\_HRD-0088-0336](https://doi.org/10.1163/2210-7975_HRD-0088-0336)
- Fadel, M. H. (2018). The sounds of silence: The Supreme Constitutional Court of Egypt, constitutional crisis, and constitutional silence. *International Journal of Constitutional Law*, 16(3), 936–951. <https://doi.org/10.1093/icon/moy069>
- Hearst, D., & Hussein, A.-R. (2012, June 14). Egypt's supreme court dissolves parliament and ousting Islamists. *The Guardian*. <https://www.theguardian.com/world/2012/jun/14/egypt-parliament-dissolved-supreme-court>
- Kittiwanch, K. (2022). Between Revolution and Counterrevolution: The Role of the Supreme Constitutional Court of Egypt in the Post-Uprising of 2011 [Ph.D., *The University of Manchester* (United Kingdom)]. <https://www.proquest.com/docview/2861335849/abstract/57BDAB83C1DC4D93PQ/1>
- Law used to imprison Egyptians draws scrutiny | Reuters. (n.d.). Retrieved November 11, 2024, from <https://www.reuters.com/article/world/law-used-to-imprison-egyptians-draws-scrutiny-idUSKBN15K0DO/>
- Lewis, A. (2023, December 18). Egypt's Sisi: Authoritarian leader with penchant for bridges. *Reuters*. <https://www.reuters.com/world/africa/egypt-sisi-authoritarian-leader-with-penchant-bridges-2023-12-08/>
- Moustafa, T. (2007). The Struggle for Constitutional Power: Law, Politics, and Economic Development in Egypt. *Cambridge University Press*. <http://ebookcentral.proquest.com/lib/washington/detail.action?docID=311278>
- Risley, D. (2016, December 3). Supreme Constitutional Court Rules Portions of Protest Law Unconstitutional. Egypt Justice - Expert Insight Into the Egyptian Judiciary and Exploration of Egypt's Justice System. <https://egyptjustice.com/analysis/2016/12/3/supreme-constitutional-court-rules-portions-of-protest-law-unconstitutional>
- Sixty Years of Egyptian Politics: What Has Changed? (2018, May 16). *The Cairo Review of Global Affairs*. <https://www.thecaireview.com/essays/sixty-years-of-egyptian-politics-what-has-changed/>
- Sounds of Silence: The Supreme Constitutional Court of Egypt, constitutional crisis, and constitutional silence | International Journal of Constitutional Law | Oxford Academic. (n.d.). Retrieved November 11, 2024, from <https://academic.oup.com/icon/article/16/3/936/5165822?login=false>
- Supreme Constitutional Court. (2013). Retrieved November 10, 2024, from [https://www.sccourt.gov.eg/SCC/?SCCPORTAL12C-JSESSIONID=sulZXU5dm1DB-m2WaafVzV\\_FFoP6oN-Fx2a\\_f2i-wyoo7jtfTh\\_!574228873#](https://www.sccourt.gov.eg/SCC/?SCCPORTAL12C-JSESSIONID=sulZXU5dm1DB-m2WaafVzV_FFoP6oN-Fx2a_f2i-wyoo7jtfTh_!574228873#)
- Supreme Constitutional Court. (2012). Egypt Justice - Expert Insight Into the Egyptian Judiciary and Exploration of Egypt's Justice System. Retrieved November 10, 2024, from <https://egyptjustice.com/supreme-constitutional-court>
- Supreme Constitutional Court validates Tiran and Sanafir treaty, overturns previous rulings. (2019). Mada Masr. Retrieved November 11, 2024, from <https://www.madamasr.com/en/2018/03/04/feature/politics/supreme-constitutional-court-validates-tiran-and-sanafir-treaty-overturns-previous-rulings/>
- Taha, N. H., & Khalil, A. (2020). "In the Name of the People?" Understanding the Role of Egypt's Supreme Constitutional Court in Times of Political Crisis. *Middle East Law & Governance*, 12(2), 222–246. <https://doi.org/10.1163/18763375-01202004>
- Tiran & Sanafir. (2019, March 31). Texas Law Review. <https://texaslawreview.org/tiran-sanafir/>
- Toward the Emancipation of Egypt: Egypt's Assembly Law illegally imprisons thousands of Egyptians, 89 years after its official repeal. (2017, February 1). PR Newswire Africa, English Ed. <https://www.proquest.com/docview/1863818567/citation/8F42BA1818524BA6PQ/1>





# EVOLUTION OF AMERICAN FOREIGN POLICY: THE CREATION OF A GLOBAL SUPERPOWER

Hoda El Anany

*ABSTRACT: This paper examines the evolution of American foreign policy and its transformation from isolationism to global superpower status. By analyzing key historical developments, including 19th-century expansionism, involvement in the World Wars, and post-war international leadership, the paper explores how the United States strategically balanced isolationist tendencies with interventionist actions to secure its national interests. This study argues that territorial expansion, economic influence, and military engagements shaped America's rise, culminating in its dominant role in world affairs. Through foreign aid, military alliances, and global governance initiatives, contemporary U.S. foreign policy continues to reflect the nation's long-standing principles of power projection and exceptionalism.*

## Introduction

Regardless of the founders' intent, the United States was bound to become a global superpower. One of the first indications of this was through John Winthrop's "City Upon a Hill," which advertised the expectation of the Massachusetts Bay colony shining as an example to the world. This same ideology has been present throughout American history, whether through the manifestation of American responsibility to intervene in humanitarian crises or asserting its dominance as a global superpower to all nations, weak and powerful.

Initially, America did not have deeply connected international relations. Following its establishment, the United States adopted an isolationist approach, emphasizing the avoidance of entangling alliances, as advised by President George Washington in his farewell address. The isolationist approach entails that a country should focus on its own affairs and avoid forming alliances with other countries. Washington advocated for policies of friendly neutrality to prevent the creation of implacable enemies or dubious international friendships, thus avoiding foreign entanglements. The United States was seen as a social experiment,

with the world anticipating its failure due to its unique government structure. This isolationist stance allowed the newly established America to strengthen internally and avoid unnecessary wars.

The purpose of this paper is to analyze the role of expansionism and isolationism in the growth of American foreign policy and how it enabled the country to become a global superpower, despite their contradictory implications. The paper is organized into three sections, each with multiple subsections. The first section introduces American expansionism in the 19th century, focusing on the role of the Monroe Doctrine, expansionism across North America, and the transition to imperialism in the Pacific region. The second section discusses the role of World War I and World War II, with an emphasis on the Progressive Era's influence on America's involvement in World War I, how the impacts of World War I correlated directly to America's success in World War II, and an analysis of what both World Wars meant for the country's status as a global power. The third section discusses the influence of historical America on contemporary U.S. foreign policy, particularly in foreign aid and how it has been perceived by the American public. This paper



## El Anany

argues that America's emergence as a global superpower was significantly shaped by its strategic focus on national interests, including territorial expansion and imperialist pursuits. By avoiding unnecessary conflicts in its earlier history, the United States was able to consolidate its power and leverage its growing influence to secure a dominant role during the World Wars. This approach not only fortified the nation's global standing but also facilitated its rise as a superpower through a combination of territorial acquisition and strategic global positioning.

### American Expansionism in the 19th Century

#### Monroe Doctrine

The dissolution of the Franco-American Alliance of 1778, a military alliance between France and America against the British, due to French interference with American vessels bound for Britain in its European conflict, underscored the need for an isolationist approach. President Washington's farewell address urged neutrality and avoidance of European entanglements. Throughout the late 18th and early 19th centuries, the U.S. adopted a unilateralist policy, engaging in international trade while remaining politically detached from European affairs (Kaufman, p.33, 2021). This approach allowed the U.S. to achieve its national interests and protect itself from European conflicts. The Louisiana Purchase of 1803 marked the beginning of American expansionism, doubling the nation's size and facilitating westward growth.

The Monroe Doctrine of 1823 further exemplified American exceptionalism by asserting dominance in the Western Hemisphere. At a time when several Latin American countries were gaining independence from Spain, the U.S. expressed concerns about European interference in the region. The Doctrine articulated a policy aimed at protecting these new nations from European colonial ambitions, reflecting America's desire to promote its democratic

ideals and assert its influence. As Kaufman notes, "the U.S. would continue to stay removed from European affairs but, in turn, the European powers were expected to stay out of the New World, which the United States declares was within its own sphere of influence" (Kaufman, p. 47, 2021). This policy not only asserted America's sphere of influence but also laid the groundwork for American exceptionalism by positioning the U.S. as a leader in protecting democratic values and regional stability.

#### Expansionism Across the Americas

##### *Louisiana Purchase of 1803:*

France's North American territory, known as Louisiana, encompassed what are now 15 different states. With the U.S. primarily settled on the East Coast and surrounded by French territory to the West, Latin America to the South, and British territories to the North, the U.S. was surrounded by foreign powers. Louisiana was particularly significant because President Jefferson viewed New Orleans as crucial. According to the National Archives, "Whoever owned it would be America's natural enemy because that nation would control the channel through which produce from more than a third of the United States had to pass." Controlling this channel would enhance U.S. international trade and provide valuable lands and resources for economic growth. In 1803, the U.S. purchased the Louisiana Territory from France for \$15 million, acquiring 828,000 square miles stretching from the Mississippi River to the Rocky Mountains and from the Gulf of Mexico to the Canadian border (National Archives, 1996).

However, not all territorial acquisitions were through purchase as with the Louisiana Purchase. Much of the additional territory acquired by the U.S. came through war, which conflicted with the isolationist principles advocated by President Washington. These wars were justified by the U.S. as necessary for national





interest, aiming to reduce foreign influences and assert dominance over the land, despite its impact on the indigenous peoples. This was a direct contradiction of its isolationist stance seeing as that it required further interactions with multiple foreign powers rather than remaining in isolation from the rest of the world. During the first half of the 19th century, the U.S. expanded its territory to include Texas, Oregon, and regions now known as California, Nevada, Arizona, parts of Utah, and Colorado (Kaufman, p. 48, 2021). This westward expansion set the stage for future conflicts, including the Mexican American War.

### ***Mexican American Relations***

The acquisition of Texas was a significant demonstration of American exceptionalism. When American settlers in Texas rebelled against Mexican rule in 1835, they fervently sought the integration of Texas into U.S. territory. This concept, known as the Texas Creation Myth, justified the colonization of Texas by American settlers, who claimed the land was unsettled and that Mexicans needed protection from the “savage” Indians. Stephen F. Austin, often called the “Father of Texas,” argued for Texas ownership by stating, “Texas was a wilderness, the home of the uncivilized and wandering Comanche and other tribes of Indians, who waged a constant warfare against the Spanish settlements...The incursions of the Indians also extended beyond and desolated that part of the country. In order to restrain the savages and bring them into subjection, the government opened Texas for settlement...American enterprise accepted the invitation and promptly responded to the call” (Austin, 1835). This rhetoric framed the colonization of Texas as a civilizing mission, where American intervention was deemed necessary for development and protection from other indigenous groups.

This mindset reflects the core of American exceptionalism: the belief that Native Americans and indigenous civilizations required American

guidance to resolve their conflicts and develop their land. This belief laid the groundwork for the Mexican American War in 1846. When negotiations with Mexico for additional territory failed, President Polk declared war, leading to a conflict that significantly shaped American development. The U.S. acquired 529,000 square miles of territory, including California, which was crucial for economic development through increased international trade and commerce (Kaufman, p. 50, 2021). Prior to this, America had already expanded through the Louisiana Purchase (1803), the annexation of Texas (1845), and the Oregon Treaty (1846). The Gadsden Purchase (1853) further solidified U.S. territorial gains.

The Mexican American War marked America’s first international war of aggression, signaling to the world that the nation was rapidly growing and expanding its influence. This war had signaled to the international community that the U.S. was rising as a strong power, capable of overpowering other nations should it need to. The acquisition of this territory further secured the U.S. against potential threats, and with the continent largely settled, America was poised to begin its imperialistic ventures in the Pacific.

### **Imperialism in the Pacific**

During this period, the U.S. increasingly deviated from the isolationist policy initially advised by President Washington. In 1853, Commodore Perry’s arrival in Japan marked a significant shift. Perry presented Japan with an ultimatum: trade with the U.S. or face war. When Japan declined, Perry returned in 1854 with a fleet of ships, leading Japan to grant the U.S. access to the ports of Shimoda and Hakodate (Kaufman, p. 53, 2021). By 1856, the U.S. had established ports in Japan, and a similar approach was taken in Korea in 1882. This demonstrated that the U.S. was adopting a foreign policy centered on its national interests, engaging internationally when it suited its convenience.



## El Anany

However, this approach was not sufficient to satisfy American ambitions. The U.S. turned its attention to Spanish territories in the Pacific, including the Philippines, Guam, and Puerto Rico. The Spanish-American War of 1898 was sparked by the explosion of the U.S. battleship *Maine* in Havana Harbor. Initially attributed to an underwater mine, later investigations suggested an internal malfunction. Despite this, the press and public outcry demanded war with Spain, fueled by American interests in Cuban sugar and political instability. When President McKinley requested intervention, Spain perceived it as a declaration of war, leading to Spain's formal declaration against the U.S.

Following a decisive American military presence in both the Atlantic and Pacific, the Treaty of Paris was signed in December 1898. This treaty granted Cuba its independence, ceded Guam and Puerto Rico to the U.S., and included the purchase of the Philippines for \$20 million. The war significantly altered America's global standing, marking its emergence as an imperial power rivaling major European nations. This marked a clear shift from the earlier unilateralist policy, as the U.S. now had colonial projects in the Pacific, necessitating increased involvement in global affairs to protect and maintain its new territories.

### World War I & World War II

#### World War I

The 20th century marked a profound shift in American foreign policy, reflecting a transition from isolationism to global dominance. At the dawn of the 20th century, the United States had transformed from a collection of 13 colonies into a formidable power with control over the entire North American continent and several Pacific territories. This expansion, achieved through the displacement of Native Americans, wars with Mexico, and territorial acquisitions from European powers, contributed to America's emergence as a leading global economic force.

By the early 20th century, the U.S. had developed one of the world's strongest economies, setting the stage for its dominant role in the post-World War I era.

Economic changes post-Spanish American War were particularly striking. In the late 19th century, India, China, and Europe each contributed about 23% of the world's GDP (Kaufman, p. 61, 2021). By the early 20th century, the U.S. had eclipsed former economic powerhouses, with Europe alone accounting for 60% of global manufacturing output and the U.S. reaching 20% (Marks, 2002). This shift underscored the U.S.'s emergence as a dominant economic force. The Progressive Era from 1900 until World War I further reshaped U.S. foreign policy, as the country increasingly engaged internationally to support its business interests and assert its influence.

American exceptionalism became a central theme in early 20th-century foreign policy. Under President Wilson, the U.S. expanded its military presence in Asia, Latin America, and the Caribbean, reflecting a departure from isolationism. As Kaufman notes, Wilson's administration extended U.S. influence to protect or maintain order in these regions, embodying the belief that America had a moral duty to support and stabilize these areas (Kaufman, p. 76, 2021). Wilson's justification for involvement in World War I highlighted this exceptionalism: America's role was framed as a moral obligation to supply essential materials to allies fighting Germany, reinforcing the U.S. as a superior force with a duty to lead and assist (Wilson, 1917).

Despite efforts to remain neutral, America's involvement in World War I became inevitable. Germany's aggressive actions, including the sinking of American ships and the Zimmermann Telegram—which proposed Mexican support in exchange for regained territories—intensified American sentiment towards war. This culminated in a declaration of war and



eventual involvement in the Treaty of Versailles negotiations, where the U.S. and its allies imposed reparations and territorial changes towards Germany (Kaufman, p. 63, 2021).

The conclusion of World War I marked America's transition into a global superpower. The U.S. emerged economically stronger with minimal war damage, contrasting with the devastation faced by European nations. This economic advantage, coupled with its growing military and political influence, positioned the U.S. as a leader in World War II. The shift from isolationism to active global engagement was evident as America leveraged its strength to shape international politics and economics. This transformation laid the foundation for U.S. leadership in World War II and established its role as a key player on the world stage, aligning with the thesis that America's evolving foreign policy was driven by strategic interests and a growing sense of global responsibility.

## World War II

Despite significant growth in American industrial strength and military power after World War I, driven by the material needs of its European allies, the U.S. began reverting to isolationist tendencies. The Harding administration prioritized economic growth and limited international engagement to disarmament conferences, believing that limiting weaponry would prevent wars. However, during the 1930s, the rise of fascism in Germany, Italy, and Japan, with their militaristic and expansionist goals, contradicted American values. The American public, preoccupied with domestic issues, was uninterested in foreign conflicts, as Mandelbaum notes: "...the consuming need to fight the effects of the Great Depression made battles elsewhere seem, if not foolish, then at least luxuries the United States could not afford." By this time, nearly 14 million Americans were unemployed, and industrial output had plummeted by 60% (Kaufman, p. 76, 2021). Despite these isolationist tendencies,

the U.S. played a crucial role in the war and in future global affairs, underscoring a shift in foreign policy from isolationism to a more assertive global stance.

Initially, the U.S. maintained neutrality in the war, but the 1939 Neutrality Act allowed belligerents to purchase war munitions and materials on a cash-and-carry basis (Kaufman, p. 79, 2021). This policy aimed to balance isolationist principles with economic interests, permitting sales of military equipment while avoiding direct involvement. However, as the war progressed, the Lend-Lease Act represented a significant shift, allowing the U.S. to provide war equipment to countries deemed vital to American defense. This move indicated a departure from strict isolationism, aligning with the thesis that strategic national interests began driving American foreign policy, transitioning from a policy of avoidance to one of active engagement.

The U.S. remained officially neutral until the Japanese attack on Pearl Harbor in 1941, which led President Roosevelt to declare war on Japan. This declaration prompted Germany and Italy to declare war on the U.S., marking a pivotal moment in U.S. foreign policy. The subsequent alliance with the Soviet Union and the defeat of Germany demonstrated a shift from isolationism to internationalism. The attack on Pearl Harbor highlighted American vulnerability amid rapid technological advancements. The Manhattan Project's development of atomic bombs, leading to their use on Hiroshima and Nagasaki, showcased America's newfound military dominance and technological prowess. The use of atomic bombs, resulting in over 210,000 civilian deaths and long-term radiation effects (International Campaign to Abolish Nuclear Weapons, 2017), signified a strategic consolidation of power that supported the thesis: America's involvement in World War II and its use of advanced technology solidified its role as a global superpower.



World War II had profound implications for America's global role. The Atlantic Charter laid the groundwork for the United Nations, reflecting a shift from isolationism to a more active international stance, aligning with Wilson's earlier vision but with greater commitment. The UN's establishment in 1945 marked America's transition to internationalism, requiring active participation in global affairs. The unprecedented use of atomic bombs further solidified the U.S. as a superpower, demonstrating its unmatched military and technological capabilities and compelling global recognition of its dominant geopolitical influence.

Post-World War II, while Europe and Japan focused on recovery, the U.S., less affected by the war's devastation, embraced American exceptionalism. The Marshall Plan aimed to support European reconstruction, expanding markets for American goods and establishing stable trading partners, contributing to the formation of the European Union (Kaufman, p. 117, 2021). The Truman Doctrine, in which President Truman declared that the U.S. would assume the role of global leader previously held by Britain, exemplified the shift from isolationism to an active global leadership role. This transition demonstrated that the U.S. had moved from avoiding global conflicts to shaping international affairs, as seen in Truman's statement during that same speech: "As in the case of Greece, if Turkey is to have the assistance it needs, the United States must supply it."

World War II also set the stage for the Cold War, as the wartime alliance between the U.S. and the Soviet Union unraveled due to ideological differences. The division of Europe, especially Germany, into spheres of influence, and disagreements on post-war reconstruction fueled mutual distrust and rivalry. The emergence of nuclear weapons and the quest for global dominance intensified this geopolitical tension, marking a clear departure from earlier isolationist policies and affirming America's new role as a global superpower.

## **Influence on Contemporary American Foreign Policy**

### **Foreign Aid**

The U.S. has been known to provide foreign aid to its allies and developing nations as a form of American exceptionalism, embodying the belief that with its unique powers comes the moral responsibility to lead and support global stability and development. This principle has guided American foreign aid policy from the mid-20th century to the present day. While foreign aid was notably prominent in the aftermath of World War II under the Marshall Plan, its roots can be traced back to earlier ideologies and policies. The Marshall Plan, launched in 1948, was a landmark initiative that provided over \$12 billion (equivalent to about \$130 billion today) in economic assistance to help rebuild Western European economies devastated by the war. This initiative not only facilitated economic recovery but also aimed to prevent the spread of communism by promoting political stability and economic prosperity in Europe. The success of the Marshall Plan set a precedent for using foreign aid as a strategic tool to promote both humanitarian and geopolitical interests.

Since then, the U.S. has continued to provide foreign aid, driven by a combination of altruistic values and strategic imperatives. One of the most significant recipients of American foreign aid has been Israel, which has received about \$310 billion in total economic and military assistance since its creation in 1948 (Council on Foreign Relations, 2024). This substantial support underscores the strategic alliance between the U.S. and Israel, reflecting both a commitment to Israel's security and stability and a broader strategic interest in maintaining influence in the Middle East. American foreign aid extends beyond Israel and includes a wide array of programs and initiatives aimed at addressing global challenges. For instance, the U.S. provides significant aid to countries in Africa, Latin America, and Asia to combat





poverty, promote health, and support economic development. Initiatives like the President's Emergency Plan for AIDS Relief (PEPFAR) and contributions to international organizations like the World Health Organization (WHO) and the United Nations illustrate the ongoing commitment to addressing global health crises and fostering development.

Moreover, foreign aid is often used to support countries facing humanitarian crises caused by natural disasters, conflicts, or economic instability. The U.S. Agency for International Development (USAID) plays a central role in these efforts, delivering emergency assistance, supporting long-term development projects, and promoting democracy and governance. In addition to humanitarian and developmental goals, foreign aid remains a crucial component of U.S. national security strategy. By providing aid to strategically important countries, the U.S. aims to foster stability, prevent the rise of hostile regimes, and build alliances that can support American interests globally. This strategic use of aid helps to create a network of allies and partners, enhancing U.S. influence and promoting a stable international order.

### Immigration Policies

The Immigration Act of 1924 and the Muslim Ban of 2017 reflect similar patterns in U.S. immigration policy, driven by fears of perceived external threats and ideological subversion. The 1924 Act was designed to restrict the entry of individuals from Eastern and Southern Europe, as well as Asia, who were suspected of harboring communist sympathies during the era's Red Scare (Kaufman, p. 73, 2021). This legislation significantly limited immigration from these regions, aiming to prevent the spread of communism and other radical ideologies within the United States. Similarly, the Muslim Ban, officially known as Executive Order 13769, targeted travelers from several predominantly Muslim countries, citing concerns over terrorism and national security. This executive

order sought to prevent potential terrorist threats by restricting entry from nations perceived as high-risk, despite the lack of evidence linking individuals from these countries to terrorism in the U.S.

Both policies were controversial and criticized for their discriminatory nature, as they disproportionately affected specific ethnic and religious groups under the guise of protecting national security. The Immigration Act of 1924 reflected deep-seated xenophobia and racial prejudices, aiming to preserve the ethnic composition of the United States, while the Muslim Ban was seen as a response to Islamophobic sentiments and post-9/11 fears. These measures illustrate how the United States has periodically resorted to restrictive immigration policies during times of perceived threat, often conflating national security with broad exclusions of certain groups. In both cases, the policies sparked significant legal and public opposition, highlighting ongoing debates about the balance between security and civil liberties in American society.

### Conclusion

The evolution of American foreign policy from isolationism to global dominance reflects a complex interplay of expansionist ambitions and strategic restraint. Initially, the United States adhered to an isolationist stance, focusing on internal consolidation, and avoiding European entanglements as advised by President George Washington. This period of isolation allowed the nation to grow economically and territorially, laying the groundwork for future expansion.

The 19th century marked a significant shift with the advent of American expansionism. The Monroe Doctrine asserted dominance in the Western Hemisphere, and territorial acquisitions through the Louisiana Purchase and the Mexican American War facilitated westward growth. This expansionist drive, though sometimes contradictory to isolationist





## El Anany

principles, was justified by national interests and the belief in American exceptionalism. The 20th century saw America's transition from regional power to global superpower, driven by its involvement in World War I and World War II. The Progressive Era's influence on America's entry into World War I and the economic and military mobilization during World War II underscored the nation's growing international influence. Post-war, America embraced its role as a global leader, demonstrated by initiatives like the Marshall Plan and the establishment of the United Nations.

Contemporary U.S. foreign policy continues to reflect the historical themes of expansionism and interventionism. Through foreign aid and international alliances, the United States maintains its influence and promotes stability worldwide. The strategic focus on national interests, including economic and territorial gains, has been a consistent driver of America's rise to global dominance.

Former Senator Vandenberg once stated, "We have thrown ourselves squarely into the power politics and power wars of Europe, Asia, and Africa. We have taken the first step upon a course from which we can never hereafter retreat." From its earliest interactions with Native Americans to its pivotal role in the establishment of the United Nations, America has consistently embraced an internationalist stance. This trajectory was not merely a matter of foreign policy but a fundamental aspect of the nation's identity, forged through colonization, territorial expansion, and global engagement. Over the years, the nature and degree of these internationalist interactions have evolved, reflecting shifts in political, economic, and social landscapes. Today, elements of U.S. foreign policy continue to echo its historical roots, underscoring the foundational principles upon which the country was built. This enduring legacy of internationalism highlights America's long-standing commitment to global involvement, balancing national interests

with broader international responsibilities. As a result, modern U.S. foreign policy remains deeply intertwined with its historical experiences, demonstrating a continuous thread of engagement that has shaped and will continue to shape its role on the world stage.

## Sources

- De Cesar, W. (2003). Jefferson buys Louisiana Territory, and the nation moves westward. *National Archives and Records Administration*. <https://www.archives.gov/publications/prologue/2003/spring/louisiana-purchase.html#:~:text=Jefferson's%20men%20were%20in%20Paris,United%20States%20had%20to%20pass.>
- DeLay, B. (2010). The U.S.-Mexican American War: Forgotten Foes. *Center for Latin American Studies*. <https://clacs.berkeley.edu/publications/us-mexican-war-forgotten-foes>
- Elmerraji, J. (2023, July). Countries sanctioned by the U.S. and why. *Investopedia*. <https://www.investopedia.com/financial-edge/0410/countries-sanctioned-by-the-u.s.-and-why.aspx>
- International Campaign to Abolish Nuclear Weapons. (2017). Hiroshima and Nagasaki bombings - ICAN. *Hiroshima and Nagasaki Bombings*. [https://www.icanw.org/hiroshima\\_and\\_nagasaki\\_bombings](https://www.icanw.org/hiroshima_and_nagasaki_bombings)
- Kaufman, J. P. (2021). A concise history of U.S. foreign policy (5th ed.). *Rowman & Littlefield*.
- Mandelbaum, M. (2010). The four stages of American foreign policy: Weak power, great power, superpower, hyperpower. *Oxford University Press*.
- Masters, J. (2024). U.S. aid to Israel in four charts. Council on Foreign Relations. <https://www.cfr.org/article/us-aid-israel-four-charts>



National Archives and Records Administration. (1996). American Originals . *National Archives and Records Administration*. [https://www.archives.gov/exhibits/american\\_originals/loupurch.html#:~:text=In%201803%20the%20United%20States,Mexico%20to%20the%20Canadian%20border](https://www.archives.gov/exhibits/american_originals/loupurch.html#:~:text=In%201803%20the%20United%20States,Mexico%20to%20the%20Canadian%20border).

Thompson, J. (1992). Another Look at the Downfall of “Fortress America.” *Journal of American Studies* . <https://www-jstor-org.offcampus.lib.washington.edu/stable/27555685?seq=1>

Truman, H. S. (1947, March 12). Address before a joint session of Congress. In *Truman Doctrine*. Received from <https://history.state.gov/milestones/1945-1952/truman-doctrine>

U.S. Department of State. (n.d.). 1830–1860: Diplomacy and Westward Expansion. *Office of the Historian* . <https://history.state.gov/milestones/1830-1860/foreword>

Washington, G. (1796). Farewell address. In J. Kaufman, Concise history of U.S. foreign policy (pp. 43-45). *Rowman & Littlefield*.





# REBRAND OR RE-BLAND? HOW BRAND IMAGE REFLECTS APPRECIATION FOR CONSUMERS

Stephen Lovas

*ABSTRACT: In recent years, many companies' brandings and outward appearances have become rather alike, following trends of minimalism, such as flat shapes and basic colors. This has mostly been pioneered by tech companies such as Google and Microsoft but is now also being seen in other businesses like PayPal or Jaguar. These new rebrands being adopted by companies wildly contrast with many of the detailed and unique aesthetics seen in previous decades, which in turn has spawned backlash. Many detractors view these rebrands as boring, unimaginative, and inferior compared to what came before it. This paper aims to explore what factors have pushed this recent trend as well as the overall effect these rebrands have on consumers and even employees. Do they truly help to revitalize a company's brand, or are they a sign of a growing disconnect between companies and their customers?*

Beginning around the early-to-mid-2010s, many big companies such as Google and Microsoft started steering away from stylized, detailed aesthetics in their branding and shifting toward flatter, geometric minimalism. Minimalist styles are nothing new, being seen within American architecture, clothing, transportation, and visual art as early as the 1920s. Said rebrands have also been rather common throughout American history, such as within the telecommunications industry. However, the current era of branding and visual design tends to be seen in a much more negative light than those that have come before it, with many people critiquing recent rebrands as being bland, oversaturated, or simply unnecessary. Despite this, the trend seems to be continuing within an increasing number of corporations and industries. This has led some to wonder: what does the corporate fascination with rebrands and subsequent consumer reactions tell us about companies' perception of their customers? Based on research conducted, as well as testimonies from those within the marketing industry, the recent influx of overly neutral or negative feedback towards companies rebranding signals a growing disconnect between them and their consumer base.

As most may know, the purpose of branding, or brand image, is to give an entity, service, or product a distinct design for the sake of promotion, advertising, and public perception. Like how a picture or painting might illicit an emotional reaction in its viewer, branding serves to similarly portray a certain feeling toward its target audience(s), whether it be calm, exciting, fun, or serious. Some may wonder why companies look to change their branding in the first place. In an article for Forbes, titled "Everywhere You Look Companies Are Rebranding—But Why?", Jim Heininger discusses what the most common reasons for rebranding are based on inquiries made to his own branding firm from companies looking to rebrand. Aside from a "need" to rebrand due to a merger, poor brand reputation, or similar circumstances, Heininger cites "opportunistic reasons...includ[ing] a new strategic growth vision, changes to products or services, or other meaningful corporate changes". He also credits the pressure to rebrand on wanting "reduced fear", by which he means companies looking at other companies ("their peers") rebranding and not wanting to be left behind (Heininger, 2023). These reasons in particular hold interesting implications related to the many rebrands seen



so far in the 2020s, suggesting that rebranding has become even more of a strategic maneuver in response to evolving market dynamics and competitive pressures. Companies are no longer content to rest on their laurels; instead, they actively seek to redefine their brand identity to stay relevant and appealing in an ever-changing landscape. This trend reflects a broader shift in corporate strategy, where agility and innovation are prioritized to maintain a competitive edge. This sudden drive to shift and “update” branding to reflect changing brand attitudes may leave little room for refinement in the turbulent business world, which as will be shown later, could lead to underwhelming results.

While many, even within these businesses, might see brands as merely another form of advertising, they actually serve a much greater purpose than just being eye candy. In the article “Do Logo Redesigns Help or Hurt Your Brand? The Role of Brand Commitment,” by Michael F. Walsh et al., the team sought to figure out how changes to a company’s logo affect consumer attitude toward the brand. A study was conducted in which a group of 632 college students’ reactions were evaluated based on custom changes made in two iconic brands’ logos, Adidas, and New Balance. The respondents were given three versions of the logos: the original, one altered to be slightly rounder, and one made significantly rounder. The data collected showed that those more familiar with the shoe brands reacted more negatively to the redesigns presented to them compared to those with less of a bond. From this, Walsh et al. argue that “Consumers who are strongly committed to a brand evaluate logo shape redesign more negatively and have a lower brand attitude” and vice versa (78). “Strongly committed” describes customers who are very loyal to a brand; those who stick almost exclusively with a certain brand based on experience, familiarity, tradition, etc. One’s bond with a brand defines their “brand attitude,” or their thoughts and reactions toward the brand as a whole. Not even taking into account the

quality of the products or services of a company itself, the rounding out of their logo will result in poorer perception of the brand from its most loyal customers, a vital core of their consumer base. Walsh et al. further conclude based on the emotional correlations they gathered that “[t] hose with strong brand commitment will see the original brand logo – and the associations – as representing themselves and the integral relationship they have with the brand” (78). This concept implies branding and logos as acting as a metaphorical bridge between the business and the consumer, a representation of the company’s intended audience and a unique signifier for the consumer to associate with their services, reflected in the emotional effects observed in the results of the study. Given this purpose, a company’s decision to change their logo and the degree to which they change it could suggest how much the company cares about its most faithful customers. For example, a company rebranding but choosing to keep the shape of their logo mostly the same suggests a retained appreciation and acknowledgement to long-term customers. On the other hand, completely revamping their image into something unrecognizable suggests a desire to seek a new audience, possibly abandoning the consumers who cared the most.

The report’s findings reflect the very common feeling of discomfort or confusion one might get when something familiar is made unfamiliar. With the average person’s life surrounded by and reliant on so many products and services, it’s natural to develop connections and familiarity with their brand images. Therefore, when a brand changes its image, it’s not uncommon for those who had gotten used to their previous look to not immediately welcome it with open arms. Walsh et al. introduces a unique perspective as to what a brand’s visual identity represents, framing it as more than a regular element of business, but arguably the most important factor in drawing in customers and establishing long-term consumer relationships that develop positive reputation. Taking into account that the





more brand-loyal respondents were the most opposed to the Adidas and New Balance logo changes, it proves that the original branding clearly had a strong effect on many customers, and the changing of those familiar identifiers disturbed the relationship that was established from their notability. The status of branding as a symbol for a company-consumer bond can help gage a company's appreciation for their customers. This serves as an insightful indicator as to whether a company wants to retain its most devoted customers, keeping with their heritage or tradition, or attempt to steer their operations or image in a different direction.

With this crucial responsibility in mind, it adds tremendous weight to a company's handling of their branding and could even reveal missteps within the company itself if a shift in branding does not pan out. Wendy Bolhuisa et al. bring this exact consequence to light in their research article "Corporate Rebranding: Effects of Corporate Visual Identity Changes on Employees and Consumers." In their research, the authors split the complicated process of rebranding into three core components to better grasp the myriad of effects rebrands have on business and what factors affect others. In their study, Bolhuisa et al. focus on four different Dutch companies who all underwent changes to their corporate visual identity, or "CVI." They surveyed both employees and customers of these four companies with the three "variables" of stakeholder type (employees vs. consumers), the company itself, and communication about the CVI change in mind. Their findings varied across each company surveyed; for example, one company became more distinct in the eyes of consumers but less distinct to employees with their rebrand, while another company netted exact opposite results. Although no solid conclusion is made about a right or wrong way to do a rebrand based on their findings, as it largely depends on the type of company, the industry they're involved in, and other similar circumstances (Bolhuisa et al., 13). Bolhuisa et al. do confidently report that "[t]he lack of

a significant three-way interaction effect with organization shows that the importance of communicating about a CVI is important in all organizational contexts" (11). This is referring to data which showed that rebrands from companies who did not clearly communicate with customers and employees ahead of its implementation were usually met with less of a positive reception from both parties. In a broader sense, this trend noted by Bolhuisa et al. emphasizes the importance of communication throughout the corporate pipeline in terms of rebranding. A company's willingness to keep an open mind, both from the inside and outside, is integral to efficient business and uplifting morale, and according to these survey results, can be reflected in what changes they make to their brand image and the universal reception that follows.

Bolhuisa et al.'s ideas are expanded upon through similar findings in "Corporate Rebranding: Destroying, Transferring or Creating Brand Equity?", written by Irish marketing researchers Laurent Muzellec et al. Muzellec et al. utilize general observation and case studies to analyze the anatomy of rebrands not only to examine the effects, but to understand the most common reasons for them happening. As part of their research, they conducted a case study into two telecommunications companies (the industry most prone to rebrands at the time of research) which underwent rebrands, Vodafone and eircom, and compared the varying results for both. Some concepts derived from this report are similar to ones seen in the two aforementioned reports; for example, Muzellec et al. observed that companies retaining notable brand cues even after a rebrand returned more positive reactions from customers (819), reminiscent of Walsh et al.'s observations. However, they seem to have a slightly different take to one akin to that presented by Bolhuisa et al., that being with consumer/employee communication. While Bolhuisa et al. refer to employees solely as a part of a three-way business communication cycle, Muzellec et al. look specifically at employees'



reception of rebrands and in two ways: “a high degree of acceptance for a new name, and a high degree of [internalization] of brand values” based on research showing that consumer’s perception of brand image is heavily influenced by employees themselves (819). They go on to clarify that employees’ acceptance alone isn’t enough to make a rebrand succeed, rather “for the rebranding to be accepted, both employees and customers must accept and understand the need for change” (819-820). By “accepted,” Muzellec et al. mean “successful” or generally looked at positively by employees and consumers alike. Their separation of employee rebrand perception into acceptance and internalization provide an added layer of complexity to Bolhuis et al.’s ideas, that being the deeper integration of the new branding into the employees’ performance. This concept has strong implications about employees’ roles in strengthening a rebrand; just as branding acts as a metaphorical bridge from the company to its customers, employees act as more of a direct connection, both metaphorically and literally. As mentioned, employees themselves strongly influence consumers’ views of a brand, so if a rebrand is tough or outright not able to be adapted (not just accepted) by them in their environment, that might result in less positive brand reception across the board. Therefore, insurance of a brand’s ability to not only appeal to consumers but adapt with employees is an often overseen but crucial part of effective rebranding.

These findings draw similarities to many discussions about brand image you can witness in reality and online. As Bolhuis et al. mention, there is a clear distinction between one’s appreciation and their overall judgement of a company (12); in particular, a rebrand might make some more appreciative of a company, like if their branding now looks more appealing than before, but won’t change their overall judgement, like if that company is known for controversy. Nowadays, their feelings towards companies in the modern

day are more indifferent than anything. With social media providing constant, up-to-date information about happenings around the world, thriving especially off drama and controversy, it’s not difficult to find immoral or questionable practices from within a given company (i.e., Nestle, McDonald’s, Starbucks). Therefore, with this widespread information in mind, it can be exceptionally tough for some companies to win over many potential investors, even if their outward appearance is appealing. Instead of looking at the rebranding process as simply a single, momentary corporate decision or event, Bolhuis et al. dissects this, splitting the process out into several branches that each serve an important purpose in accomplishing a refined image. Muzellec et al. then introduces deeper subtexts about employees’ roles in rebrands, which circles back to affecting the consumer, emphasizing just how connected a company has to be with its constituents to uphold a well-rounded brand. These unique ways of portraying the inner workings of a rebrand not only help both groups of authors better organize their findings but also provide readers with deeper insight on a subject not usually seen by the average consumer. As a whole, Bolhuis et al.’s findings from this study imply that while rebrands can be wildly unpredictable, there are methods in which a rebrand can be steered in the right direction, such as through strong internal and external communication. They also show that a company’s botching or denial of these methods directly affects the rebrand as well as general perception of it, thereby framing it as a sign of ignorance or being out-of-touch (in other words, a poor rebrand could imply poor company outreach, or lack thereof entirely). Muzellec et al.’s broader argument reinforces the unpredictability of rebranding effects but also sheds light on the ever-changing landscape that is corporate structure under capitalism as well as the industries more subject to it. With company mergers and divisions in some industries being a regular occurrence (like telecommunications; i.e. AT&T and its “Baby Bells” even to this day), the reflection in the



change in management and company goals/values in their brand identity could say a lot about an entity's view on their customers in terms of loyalty, target demographic, etc.

An infamous example of a botched rebrand that highlights these ideas in action comes from the iconic Floridian fruit juice company Tropicana. In the article "What to Learn from Tropicana's Packaging Redesign Failure?", by Marion Andrivet, she details the plight of Tropicana losing sight of the importance and complexities of good branding through their disastrous 2009 rebrand. Andrivet uses the story of the rebrand as a cautionary tale of a company tackling a rebrand in an alienated manner, making note of detrimental decisions made such as Tropicana changing too many elements of the new juice cartons and reducing the presence of symbols synonymous with their brand, like the iconic orange with the straw poking out. In describing the carton in particular, Andrivet calls packaging "the silent salesman," as it "is the last communication channel brands have with consumers in the purchasing decision process" (The Branding Journal, 2015). With it being a physical representation of the product, and likely the last thing a customer sees before deciding to purchase, she argues that it plays a larger part in advertising and promotion than most may think. While one may think a package's purpose is no different than a poster's or billboard's, the main distinction that is implied is that a package is the product, not just an advertisement for it, thus the usage of the term "silent salesman." Andrivet's analysis shows that packaging has a larger impact on brand equity than many companies may think, signaling ignorance or obliviousness if a package redesign is rather sloppy or hastily handled. She also proves that within the marketing industry, there are still many who care about delivering high-quality rebrands that properly resonate with consumers. Her insight on packaging also ties in similarly with implications seen in the other sources discussed, with the failure of packaging to bring in customers suggesting a

disconnect of sorts between a company and their target audience, and the company's feelings toward said audience. as a whole. Therefore, in trying to understand what company's mindsets might be when rolling out rather dull looking rebrands, this article helps further bolster Walsh et al.'s idea of branding as a personal connection between sellers and buyers.

To conclude, the constant result of rebrands lacking any positive impact on many consumers nowadays showcases a serious lack of care from companies toward their core stakeholders. As shown throughout the studies and scenarios discussed, a brand is a sacred piece of a corporation, one that represents the bond they have with the group that powers their whole operation. It is also a very complicated part of doing business, as it not only has to satisfy customers, but adapt well within the company in order to thrive. Despite the difficulties that come with developing a memorable brand identity, many companies have successfully achieved doing so in the past. Notable brands like Coca-Cola and Heinz, who still prominently use logos and iconography first introduced in the early-to-mid 20th century, prove that keeping with tradition is entirely possible in maintaining a well-known brand. However, the recent neglect of many other companies to introduce worthy successors to their older branding reveals major cracks in that said sacred bond. The insistence of brands like PayPal to stick with unappealing rebrands that in little to no way retain the appeal or notability of their already-established image reflects a growing indifference companies have between their consumer base, and vice versa. Ironically, despite this growing resentment, we are advertised at constantly in our daily lives now more than ever, and the corporatization of many companies' brandings is a trend that can be seen by anyone. Marketers and executives in the American business world, though they shouldn't have to be told, would benefit from the findings of these reports that all point toward listening more to the consumer. This would benefit the consumer as well, resulting



Lovas

in more relatable, enjoyable, or at the very least tolerable branding, upholding that crucial connection that drives engagement and sales. Luckily, there are a select few rebrand efforts in recent times that take pride in their history and have seemingly done well in satisfying old and new buyers, such as with Mountain Dew. However, if most of corporate America wants to try winning the hearts, or wallets, of more potential customers, they should look towards the part of their business that most people see more than anything: their branding. If they decide to overhaul their image to an unrecognizable degree, assumedly for the sake of consumers, it should be made known what we as consumers think of it. Whether they like it or not, hearing out the millions of people who make their entire operation possible should be branding priority number one, as they are trying to market directly to us. If advertisements are looking to infiltrate every facet of our lives, then can they at the very least be pleasant to look at?

## Works Cited

- Andrivet, Marion. "What to Learn from Tropicana's Packaging Redesign Failure?" *The Branding Journal*, 1 May 2015, [www.thebrandingjournal.com/2015/05/what-to-learn-from-tropicana-packaging-redesign-failure/](http://www.thebrandingjournal.com/2015/05/what-to-learn-from-tropicana-packaging-redesign-failure/).
- Bolhuis, Wendy, et al. "Corporate Rebranding: Effects of Corporate Visual Identity Changes on Employees and Consumers." *Journal of Marketing Communications*, vol. 24, no. 1, Feb. 2018, pp. 3–16. EBSCOhost, <https://doi-org.offcampus.lib.washington.edu/10.1080/13527266.2015.1067244>.
- Heininger, Jim. "Council Post: Everywhere You Look Companies Are Rebranding-but Why?" *Forbes Magazine*, 12 July 2023, [www.forbes.com/councils/forbesagencycouncil/2023/07/12/everywhere-you-look-companies-are-rebranding-but-why/](http://www.forbes.com/councils/forbesagencycouncil/2023/07/12/everywhere-you-look-companies-are-rebranding-but-why/).
- Muzellec, Laurent, and Mary Lambkin. "Corporate rebranding: Destroying, transferring or creating brand equity?" *European Journal of Marketing*, vol. 40, no. 7/8, 1 July 2006, pp. 803–824, <https://doi.org/10.1108/03090560610670007>.
- Walsh, Michael F., et al. "Do Logo Redesigns Help or Hurt Your Brand? The Role of Brand Commitment." *Journal of Product & Brand Management*, vol. 19, no. 2, Feb. 2012, pp. 76–84, <https://doi.org/10.1108/10610421011033421>.



# FAMILY PERSPECTIVES OF ALZHEIMER'S DEMENTIA PROGRESSION & TYPE OF CARE: A QUALITATIVE METHODS APPROACH

Robin Stone

*ABSTRACT: In just under forty years from now, the United States will be faced with a crisis of dementia as our generations continue to age. Alzheimer's Dementia and its related diseases require around the clock care as the disease progresses in the brain of many older adults, and abuse is a well documented issue in facilities that provide long term care for these patients. Documentation however is much more scarce for people receiving treatment at home. In order for families to have a broader understanding of how they can get proper and dignified care, research on the difference of experiences dementia patients get from their caregivers is essential. Using a qualitative method study design with narrative approaches, one-on-one interviews will be conducted on family members of patients with Alzheimer's Dementia to analyze any possible differences in quality and scope of care, with the hope that this research can highlight inequities when receiving long term care.*

## Introduction & Background

### Overview

**D**o you believe you will get diagnosed with Alzheimer's Disease in your lifetime? What is your plan of care if it happens? Where will you go to get help? Will you be treated well? In the United States alone, these questions have been asked by over six million people who are suffering from Alzheimer's Disease; a brain disorder that diminishes the cognitive ability, memories, and even personality of those affected (HHS, 2023). According to the Centers for Disease Control (CDC), that number is expected to nearly triple in the next 40 years (CDC, 2018). With five million people being diagnosed with Alzheimer's in the United States alone, rising numbers create a fast-increasing demand for nursing homes, caregivers, and long-term care infrastructure for the elderly population.

"Dementia" is typically used as an umbrella term for multiple types of neurodegenerative disorders, notably including Alzheimer's,

Parkinson's, Lewy Body, and Huntington's disease, among others. Dementia typically only affects people who are 65 and older, an already rather vulnerable population here in the US. This risk is also known to increase due to several factors, ranging from alcohol use and diabetes to depression and sleep problems (Mayo Clinic, 2023). Alzheimer's Dementia & Related Diseases (or ADRD) is what this paper primarily relates to. For the purposes of this paper, Dementia will be defined in the same category as Alzheimer's, with Frontal Lobe Dementia being the most common.

The majority of popular culture depicts white people as predominantly suffering from ADRD. Horror films like *The Visit* show a very surreal version of "sundowning," with feces filled diapers and extreme vomiting from the protagonists' white grandparents in their summer home. The 2018 drama film *What They Had* features the caregiving struggles of a predominantly white family in Chicago concerning their Alzheimer's stricken mother. Many more depictions of ADRD exist, but it would be easy to think that white people are the only people that deal with





Stone

the disease. However, that is far from the case in the US. Racial background plays a major role in the prevalence of Alzheimer's, with a study looking into the effects of dementia stating the racial disparities in how prevalent Alzheimer's and related dementias are over a 10 year period,

with Black Americans showing the highest rate of Alzheimer's Dementia despite having a population that is over five times less than Non-Hispanic Whites (Mayeda et al, 2016). Figure 1 shows their findings below.

Figure 1: Race	
Race/Ethnicity	Cumulative incidence (%)
Non-Hispanic White	17.78
African American	19.12
Latino	14.98
Asian	12.51
Native American	18.99
Footnotes: (Mayeda et al, 2016)	

While the exact reason as to why the racial disparity is so high is not proven, a 2021 meta-analysis of over 185 publications showed that air pollution was a major risk factor in the development of ADRD (Zhao et al, 2021). It is well documented that many people of color, particularly Black folk, often deal with polluted communities, with the Environmental Protection Agency (EPA) releasing a statement, "Exposure to Air Pollution Higher for People of Color Regardless of Region or Income" (EPA, 2021).

In recent years, Dementia has been given a spotlight in research, and many of the symptoms have been categorized into stages. As shown in Figure 2, there are five main stages in the development of Alzheimer's disease, progressing from preclinical to severe dementia. (Mayo Clinic, 2023).

These stages listed in Figure 2 come and go at a rather rapid pace. The Mayo Clinic also states that "On average, people with Alzheimer's disease live between three and 11 years after diagnosis. But some live 20 years or more. The degree of impairment at diagnosis can affect life expectancy." (Mayo Clinic, 2023) There is currently no treatment or cure to eliminate or even reverse the disease's effects, only few treatments exist that slow down the progression of the stages.

### Alzheimer's on the Family

This strain is something that not many other diseases share. Quite often spouses or children end up becoming informal caregivers for people with the disease, and as a result, often develop depression, anxiety, and overall fatigue. This is defined by the American Medical Association (AMA) as "caregiver burnout" (AMA, 2018). The effect that caregiver burnout has on the quality of care has not been studied very



Figure 2: ADRD Stages	
<b>Preclinical</b>	<ul style="list-style-type: none"><li>• No visible symptoms</li><li>• Only identified through preventive screening</li></ul>
<b>Mild cognitive impairment (MCI)</b>	<ul style="list-style-type: none"><li>• Forgetting mundane things like appointments or upcoming events.</li><li>• Poor time management</li><li>• May make more impulsive decisions</li></ul>
<b>Mild Dementia</b>	<ul style="list-style-type: none"><li>• Memory loss of recent events</li><li>• Difficulty with problem solving and complex tasks.</li><li>• Lack of emotional regulation (personality changes)</li><li>• Difficulty expressing thoughts.</li><li>• Easily getting lost or misplacing belongings</li></ul>
<b>Moderate Dementia</b>	<ul style="list-style-type: none"><li>• Memory loss of key information about their life. (Such as their address, phone number, or where they grew up)</li><li>• Daily confusion. (Mixing up close family members and will wander around)</li><li>• Mild loss of autonomy (Will need help with hygiene, eating, and getting dressed).</li><li>• Paranoia</li><li>• Mild audio or visual hallucinations</li></ul>
<b>Severe Dementia</b>	<ul style="list-style-type: none"><li>• Near complete loss of communication skills</li><li>• Complete loss of autonomy (requiring around the clock care).</li><li>• Rapid loss of motor functions. (Walking, sitting upright, swallowing, bladder/bowels)</li></ul>
<b>Footnotes:</b> (Mayo Clinic, 2023)	

in depth, especially in the U.S; although a recent trial aimed to study the effects of a community-based intervention called “MIND at Home” which was developed by Johns Hopkins University (Tanner et al, 2014). The intervention itself involves the pairing of a community member, called a “memory care coordinator” and an informal caregiver. The job of the memory care coordinator is to help direct the informal caregiver and the care recipient to resources that will help reduce caregiver burnout, increase quality of care, as well as being present to provide advice and

tips for staying organized when providing care. The study itself yielded inconclusive results, reflecting how little research has been conducted regarding caregivers, as opposed to other important methods such as curing ADRD.

There are many other strains that the disease has on the family, not just with caregiving. ADRD care can be incredibly costly and financially devastating for many. A study published by researchers from the Alzheimer's Association wanted to look at just how much it costs to get full time care at a nursing home.



They collected and analyzed over a year's worth of medical and billing data from 3,500 people in Minnesota, and found that on average, people with dementia have to pay over \$76,000 per year in just care alone, not accounting for other costs such as medications or out-patient procedures (Long et al., 2022). This number often varies from state to state as well, with different laws and costs of living affecting how much families are required to pay for full time care.

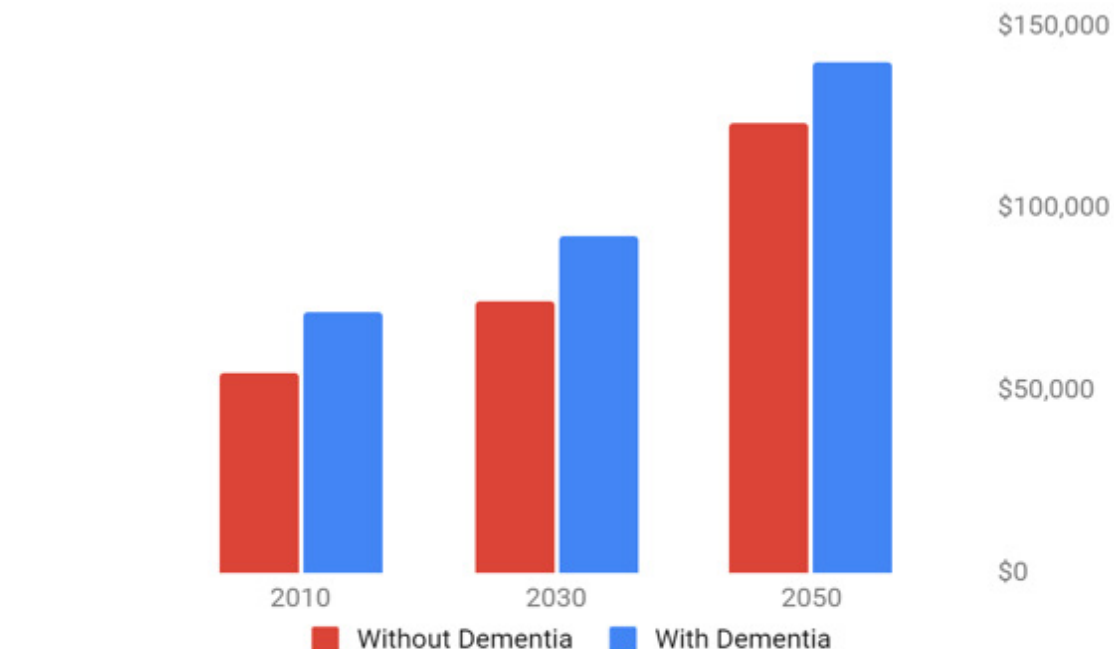
There are a great number of documented strains that have affected families of ADRD sufferers, but curiously, there does not seem to be a substantial change in attitudes for care when it comes to how severe the strain is. Researchers for the Japanese Journal of Public Health proved this by researching the attitudes of care for families and medical providers and if they had different attitudes based on the severity of ADRD. The participants were shown to have

no change in attitudes when it came to care strategies such as nursing homes, life support, or ventilation, even when it related to people who may or may not need life support. (Miyata et al., 2007).

### Alzheimer's on Society

The cost of Alzheimer's disease on individual families is not mutually exclusive, it puts a strain on the rest of the population, even individuals who do not have family members with Alzheimer's. While the average annual cost of full-time nursing home care was already discussed, just how much exactly does the US spend on nursing home care as a whole? The Centers for Medicare and Medicaid Services recently answered that question by providing their own data, showing that the total amount that the US pays in nursing home care is over 547 million dollars. (CMS, 2023). As shown in

**Figure 3: Per Capita Annual Caregiving Costs of Persons 70+ With & Without Dementia**



Footnotes: (Aranda et al., 2022)



## Family Perspectives of Alzheimer's Dementia Progression

Figure 3, those numbers are only expected to go higher and higher, according to a review from the Journal of the American Geriatric Society, the annual cost of care is projected to nearly double in less than 30 years (Aranda et al., 2022).

### Issues in Long-term Care Facilities

While Nursing Homes (NH) have no concrete definition, it would be generally defined as; Long-term care facilities that have been developed to provide long-term, around the clock care to residents experiencing ongoing physical or mental illnesses. This includes nursing homes that provide intensive care for patients, separating them from retirement communities or boarding homes. For many with Alzheimer's and other, related dementias, nursing homes are a permanent solution, especially when their close friends or family are unable to provide constant and consistent care.

Though prevalence of dementia in Black Americans is just over 19%, they make up to be just over 28% of residents in American nursing homes, according to a 2015 study (Rhamen et al, 2015). This has deep implications when it comes to quality of care that often have to do with lasting segregation and low nurse to patient ratios; and while nursing home care is helpful, and at times essential, they also have a reputation for providing substandard care if not endangering the welfare of residents. It is notoriously difficult to gauge just how prevalent patient abuse or neglect occurs in Nursing homes due to doctor/patient confidentiality and the often isolating nature of many of these homes. The non-profit organization Human Rights Watch published a report in 2021 on several nursing homes across the country; they interviewed over 61 people, most notably over 30 close family members, six nursing home residents, and many other advocates, investigators, and lawyers. These interviews "revealed concerns including extreme weight loss, dehydration, untreated bedsores, inadequate hygiene, mental

and physical decline, and inappropriate use of psychotropic medications among nursing home residents" (HRW, 2022). Suffice to say, there is a reason why many people might not want to put their loved ones into a home.

Various researchers in the past have sought to answer the problem of abuse and quality of life in general, mostly through integrated programs within nursing homes throughout the country. One of the programs that was researched is the Namaste Care Program in early 2020, located in the Netherlands. The care program in question was meant to make care between caregivers and patients more intimate and patient centered, but the study comparing over twenty-one different nursing homes found that any changes (positive or not) on quality of life were inconclusive at best (El Elali et al., 2020). Another study did not seek to research a particular program, but on caregiver education. The study in question, conducted in 2009, wanted to assess if it was possible to reduce the prevalence of malpractice in nursing homes using educational interventions. Of a study pool of eighty people, it found that the education intervention for nursing home caregivers reduced accusations of malpractice by over 25% (Arcand et al., 2009).

### Issues in the Home & Professional Caregivers

For ADRD patients who have a close circle that have the ability to care and support them, many might choose to opt out of the nursing home environment and bring a healthcare provider to their own residence to care for them. These people are typically called Professional Caregivers (PC) as opposed to informal caregivers such as family or close friends who often do not have prior medical experience. There are many known benefits for choosing a PC at home, namely ensuring that the patient is less confused about where they are if they are in their own home, helping to keep them as comfortable as possible with their disease. Another known benefit is that the family has



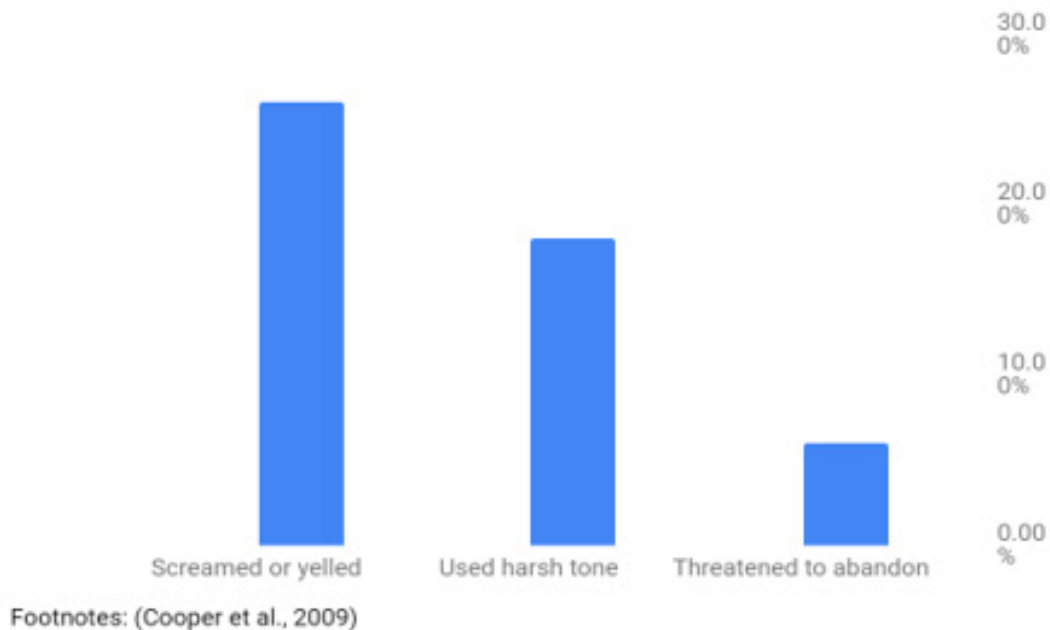
Stone

much more control over the ADRD patient's hygiene, diet, and overall quality of life.

However, the well documented challenges of abuse in NHs are often still prevalent for

people receiving Home Care (HC), with a study on home care abuse showing that over 25% of caregivers have screamed and yelled at ADRD patients within the last three months (Cooper et al., 2009). Figure 4 below shows their findings.

**Figure 4: Percentage of Family Caregivers Prevalence of Abuse to Care Recipients Within Last Three Months**



Unfortunately, there has not been a lot of research conducted on the quality of care that PCs give, or if there are any significant gaps in care that ADRD patients receive compared to their counterparts in NHs. One study, however, sought to understand how various types of care can help reduce cognitive decline for in-home ADRD patients. They wanted to compare if having home based occupational therapy would help reduce cognitive decline compared to patients who do not have the same intervention. The results presented were inconclusive at best, showing no significant difference in cognitive decline between each group (Callahan et al., 2016).

### Gaps in Current Knowledge

The studies that have been reviewed so far mainly only wanted to learn more about ways to improve the quality of care in nursing homes, home care aids, and other medical providers, but none of them sought to answer whether the type of care that Alzheimer's patients do receive are even quality in the first place. Does the disease progress through it is stages faster or slower in a nursing home? Does abuse in nursing homes accelerate through these five stages? Does the familiarity of a person's home play a role in the quality of care a person receives? None of these questions seemed to have been definitively answered by credible, reliable, and recent sources.





This gap in knowledge can be hard to understand, and it is even harder to see the effects that this gap has on the larger society in the United States, and the effects that it will have on the growing number of citizens with ADRD. Perhaps the often cold and isolating feeling that the medical environment provides in NHs contributes to the cognitive decline in patients. Or the often fluctuating and inconsistent quality of care that ADRD patients receive at home can contribute more to cognitive decline.

### Research Question and Hypothesis

There is very little evidence that suggests that nursing homes or home care aids are helping or hurting people with ADRD, and with the number of cases increasingly getting larger and larger as the decades go by, learning about any possible harms that patients and family would be putting themselves through is crucial for reducing suffering and ensuring the safety, dignity, and happiness of those suffering from dementia. The question this study is aiming to ask is: "Do perceptions of dementia progression change for family members change based on the type of care received?"

The researchers hypothesize that perceptions of those who stay in nursing homes go through the Alzheimer's stages listed in Figure 2 at a faster rate than those who receive care at their own homes, possibly due to changing environments, isolation, and different forms of abuse.

### Research Approach

#### Research Design

The design of this study will be qualitative, and more specifically take on a twin analysis approach, namely narrative and phenomenological. This design was important because the interviews that will be conducted are meant to understand the greater shared experiences of different groups, hopefully

answering the question of how fast cognitive decline is between NH and HC patients. In order to understand the nature of a phenomena such as ADRD, the chosen population for study will accordingly be close family members of people who have passed away from ADRD within the last five years. Many people in the chosen population will be people of color, particularly those of African American descent due to a statistically significant prevalence of ADRD in the population (See Figure 1). While the study doesn't primarily seek to research race, it should be noted that it plays a very noticeable role in how many patients receive care.

### Study Population and Sampling

Our study population will include close family members of patients who have recently passed away due to complications with ADRD. Family members will be defined as the closest next of kin, such as spouses, children, or anyone who may otherwise be considered their guardian. It should be noted that patients that are currently suffering from ADRD were considered for participation in the interviews, but it was soon concluded that there are too many ethical ambiguities when it comes to directly studying people with heavy cognitive impairment.

The sample population should be between 30-50 residents from Washington State within the US. This is to allow for equal representation when it comes to responses. The sample pool should also have a 50-50 ratio of family members who chose NH or HC. This is probably the most important factor for choosing respondents, as the entire study focuses on the differences and similarities between patients who received NH vs HC based care. The population will possibly be reached through social media, inquiries with NHs and PC organizations, and by recruiting via snowball sampling.



### Data Collection

Data collection will consist of providing a list of interview questions to the sample pool consisting of open-ended questions. The interviews will be recorded to allow for transcription, and the interviewees will be given informed consent regarding recording. The questions will be broken up into four main subgroups. Six of the questions will relate to cognitive decline, three of the questions will relate to perceived abuse, three will relate to

perceived isolation, and three will relate to the qualifications of caregivers (either NH or HC caregivers). The three extra categories are meant to analyze any possible reasons for the speed of cognitive decline, though it should be noted that these are obviously not all possible reasons. During the interview, the participants will be given the list of questions to refer to as well as Figure 2 to help them visualize what stages of cognitive decline there are. A rough sample of the survey questionnaire is shown below in Figure 5 but can be modified.

**Figure 5: Interview Questions**

Perceived Cognitive Decline	<ul style="list-style-type: none"><li>• How old was (the patient) at the time of diagnosis?</li><li>• Do you recall when (the patient) started to forget things about their life or started to become lost?</li><li>• Do you recall when (the patient) started to have trouble with personal grooming and hygiene?</li><li>• Do you recall when (the patient) started to have noticeable personality changes?</li><li>• Did you ever consider looking into nursing homes? [if patient was HC] or Home Care [if patient was NH]?</li><li>• Was there a big reason why you didn't choose Nursing Homes? [if patient was HC] or Home Care [if patient was NH]?</li></ul>
Perceived Abuse	<ul style="list-style-type: none"><li>• Have you ever lost your patience with (the patient) and got angry or physical with them?</li><li>• Did you ever notice or suspect abuse or neglect while they were with another professional caregiver?</li><li>• Did (the patient) ever seem agitated or upset around certain professional caregivers?</li><li>• Did you ever feel like the caregiver had personal prejudice with the (patient)? Did you feel like they might have received different care based on their race?</li></ul>
Perceived Isolation	<ul style="list-style-type: none"><li>• How often did (the patient) go outside during a typical week?</li><li>• Did (the patient) have a lot of visitors or talk to a lot of people?</li><li>• Was (the patient) often left alone during the day or were they always with someone?</li></ul>
Caregiver Qualifications	<ul style="list-style-type: none"><li>• How involved were you in selecting the people who cared for (the patient)?</li><li>• Do you feel like the people who oversaw (the patient's) care did their best?</li><li>• Who were the people who cared for (the patient)? Were they CNAs, Nurses, or were they something else?</li></ul>



## Family Perspectives of Alzheimer's Dementia Progression

### Data Analysis

The data, once collected, will all be analyzed using both coding as well as thematic analysis from the interview transcripts as well as any notes taken by the researcher. Each of the

responses will be put into their own categories to gauge any specific themes that arose. Figure 6 below will show an example response and an appropriate theme.

Figure 6: Thematic Analysis			
Question	Interview Response	Researcher Notes	Formulated Theme
How involved were you in selecting the people who cared for Bob?	"Oh, I wish that I was more involved than I was, I felt like I didn't have much control over who cared for Bob, there was always such a long process when looking for a good home for him."	<ul style="list-style-type: none"><li>• Close to immediate response</li><li>• Thoughtful and emotional demeanor</li><li>• Honest</li></ul>	Lack of control; Low involvement in selecting PC. Burnout

### Ethical Considerations

In order to maintain patient centered ethics throughout our research, in addition to IRB approval, we will be submitting our proposal to be reviewed by the American Psychological Association to ensure that it complies with their guidelines relating to evaluating dementia (Mast et al., 2021). This is especially important because it not only helps us define dementia and the stages of cognitive decline, but it also allows us to protect the safety, privacy, and dignity of those with cognitive decline. Any of the stories shared with the public from this research will be presented with placeholder names to ensure that their true identities remain confidential. Participants will receive a \$25 gift card to thank them for their time and cover minimal transportation costs.

Each of the 50 or so participants will be provided with a list of interview questions beforehand, so that they may prepare for the interview in advance. Participants will be asked to provide both written and verbal consent before the interview is conducted. Participants may opt out of answering any questions that they see fit

and will be encouraged to share their story and describe their experiences without researcher motives or agendas. Before beginning the interview, the interviewer will remind the participant that responses are confidential, but that they will/may be quoted in the study using placeholder names.

Ultimately, individual participants will have control over their narrative when it comes to publishing and will furthermore have the ability to read, edit, and/or veto their manuscript in case the researcher made mistakes, misheard, or took any interviewee answers out of context.

### Discussion

#### Significance

As the world population continues to age with time and ADRD diagnosis continues to skyrocket, it is imperative to understand how Western society's solution for dealing with ADRD is affecting those it is meant to care for. Until a cure for the disease is found, the need to protect the safety, dignity, and health of society's most vulnerable and forgotten is incredibly



important. Many people often do not worry about being affected by ADRD, saying that it is just a disease that only the weak and elderly get, but it is often not considered by people that they will also become elderly themselves, and thus put them at risk for developing ADRD. What happens to people who do not have a support system with them? What happens to people who are forgotten by society?

### Limitations

This study has a few glaring limitations in its design, namely that it can be very difficult for the population interviewed to recall important information regarding ADRD progression and cognitive decline, even if it is only a few weeks after the person in question has passed away. Emotions can also play a role in how responses are made. Respondents might be reluctant to tell the truth regarding their experiences with abuse, skewing the results.

Another limitation considered is it can be difficult to prove or disprove the hypothesis without proper responses, which could very well happen in the interview process. Correlation does not imply causation, so if there is a correlation between ADRD progression and type of care received, then there could be a number of reasons why that is that the researchers haven't examined.

### Future Directions

Assuming that the hypothesis is proven, it opens up a number of other questions that should be answered, namely why exactly ADRD progression is faster in nursing homes. Could it be due to possible abuse and isolation? Could it be due to the unfamiliar medical environment in a nursing home? Ideally, this research would prompt other researchers to figure out why exactly ADRD progresses at a faster rate in nursing homes and hopefully learn valuable lessons in helping to protect the safety, dignity, and health of the most vulnerable.

### References

- American Medical Association. (2018). *Caring for the caregiver: A Guide for Physicians*. AMA. <https://www.ama-assn.org/sites/ama-assn.org>
- Aranda, M. P., Kremer, I. N., Hinton, L., Zissimopoulos, J., Whitmer, R. A., Hummel, C. H., Trejo, L., & Fabius, C. (2021). Impact of dementia: Health Disparities, population trends, care interventions, and economic costs. *Journal of the American Geriatrics Society*, 69(7), 1774–1783. <https://doi.org/10.1111/jgs.17345>
- Arcand, M., Monette, J., Monette, M., Sourial, N., Fournier, L., Gore, B., & Bergman, H. (2009). Educating nursing home staff about the progression of dementia and the Comfort Care Option: Impact on family satisfaction with end-of-life care. *Journal of the American Medical Directors Association*, 10(1), 50–55. <https://doi.org/10.1016/j.jamda.2008.07.008>
- Callahan, C. M., Boustani, M. A., Schmid, A. A., LaMantia, M. A., Austrom, M. G., Miller, D. K., Gao, S., Ferguson, D. Y., Lane, K. A., & Hendrie, H. C. (2016). Targeting functional decline in alzheimer disease. *Annals of Internal Medicine*, 166(3), 164. <https://doi.org/10.7326/m16-0830>
- Centers for Disease Control. (2018, October 9). Alzheimer's Disease and Related Dementias. *Centers for Disease Control and Prevention*. <https://www.cdc.gov/aging/publications/features/alzheimers-disease-dementia>
- Centers for Medicare & Medicaid Services. (2023, July 31). *NHE Fact Sheet*. CMS.gov. <https://www.cms.gov/Research-Statistics-Data-and-Systems>
- Cooper, C., Selwood, A., Blanchard, M., Walker, Z., Blizard, R., & Livingston, G. (2009). Abuse of people with dementia by family carers: representative cross sectional survey. *BMJ* (Clinical research ed.), 338, b155. <https://doi.org/10.1136/bmj.b15>



- El Alili, M., Smaling, H. J., Joling, K. J., Achterberg, W. P., Francke, A. L., Bosmans, J. E., & van der Steen, J. T. (2020). Cost-effectiveness of the Namaste Care Family Program for nursing home residents with advanced dementia in comparison with usual care: A cluster-randomized controlled trial. *BMC Health Services Research*, 20(1). <https://doi.org/10.1186/s12913-020-05570-2>
- Environmental Protection Agency [EPA]. (2021, September). Study finds exposure to air pollution higher for people of color regardless of region or income | US EPA. *US EPA*. <https://www.epa.gov/sciencematters/study-finds-exposure-air-pollution-higher-people-color-regardless-region-or-income>
- HHS. (2023). Alzheimer's Home Page. *Alzheimers.gov*. <https://www.alzheimers.gov/alzheimers-dementias/alzheimers-disease>
- Human Rights Watch. (2021, May). US: Concerns of Neglect in Nursing Homes. *Human Rights Watch*. [https://www.hrw.org/sites/default/files/world\\_report\\_download.pdf](https://www.hrw.org/sites/default/files/world_report_download.pdf)
- Long, K. H., Smith, C., Petersen, R., Emerson, J., Ransom, J., Mielke, M. M., Hass, S., & Leibson, C. (2022, March). Medical and nursing home costs: From cognitively unimpaired through dementia. *Alzheimer's & dementia : the journal of the Alzheimer's Association*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8897513>
- Mast, B. T., Benitez, A., Levy, S.-A., Machulda, M. M., Smith, G. E., & Thomas, K. R. (2021, February). APA Guidelines for the Evaluation of Dementia and Age-Related Cognitive Change. *American Psychological Association*. <https://www.apa.org/guidelines-dementia-age-related-cognitive-change.pdf>
- Mayeda, E. R., Glymour, M. M., Quesenberry, C. P., & Whitmer, R. A. (2016). Inequalities in dementia incidence between six racial and ethnic groups over 14 years. *Alzheimer's Dementia*, 12(3), 216–224. <https://doi.org/10.1016/j.jalz.2015.12.007>
- Mayo Foundation for Medical Education and Research. (2023, June 22). Alzheimer's Stages: How the Disease Progresses . Mayo Clinic. <https://www.mayoclinic.org/diseases-conditions/dementia>
- Miyata, H., Aita, K., Shiraishi, H., & Kai, I. (2014, July 3). Understanding treatment attitudes toward dementia: Differences among community residents and Health Care Professionals. *Nihon Koshu Eisei Zasshi (JAPANESE JOURNAL OF PUBLIC HEALTH)*. [https://doi.org/10.11236/jph.54.4\\_254](https://doi.org/10.11236/jph.54.4_254)
- Rahman, M., & Foster, A. D. (2015). Racial segregation and quality of care disparity in US nursing homes. *Journal of Health Economics*, 39, 1–16. <https://doi.org/10.1016/j.jhealeco.2014.09.003>
- Tanner, J. A., Black, B. S., Johnston, D., Hess, E., Leoutsakos, J. M., Gitlin, L. N., Rabins, P. V., Lyketsos, C. G., & Samus, Q. M. (2015). A randomized Controlled trial of a community-based dementia care coordination intervention: effects of MIND at Home on caregiver outcomes. *The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry*, 23(4), 391–402. <https://doi.org/10.1016/j.jagp.2014.08.002>
- Zhao, Y., Qu, Y., Ou, Y., Zhang, Y., Tan, L., & Yu, J. (2021). Environmental factors and risks of cognitive impairment and dementia: A systematic review and meta-analysis. *Ageing Research Reviews*, 72, 101504. <https://doi.org/10.1016/j.arr.2021.101504>







# THE IMPACT OF SOCIAL MEDIA ON TEEN MENTAL HEALTH: A MIXED-METHOD INTERVENTION

Kelsey Sugita

*ABSTRACT: This mixed-method study investigates how social media interactions—particularly social comparison and online validation—affect adolescent mental health. With smartphones and social media now deeply embedded in teen life, concerns have grown about their psychological impact, including links to depression, anxiety, and low self-esteem. While existing research suggests that reducing social media use can improve well-being, little is known about how specific engagement behaviors (likes, comments, shares) influence mental health outcomes.*

*This study will recruit 150–200 high school students (ages 13–17) in Renton, Washington, to explore these dynamics through surveys, journal entries, and interviews. Mental health will be assessed using various scales measuring depression, anxiety, and self-esteem, while qualitative data will capture personal experiences with social media. Statistical analysis will identify correlations between engagement patterns and mental health, while thematic coding will uncover emotional and behavioral responses.*

*The findings may reveal that certain types of social media interactions—especially those tied to comparison and validation—negatively impact teen mental health. This research could inform interventions, such as digital mindfulness tools or policy changes, to promote healthier online habits. While self-report biases and sampling limitations exist, this study lays groundwork for future longitudinal research on social media's evolving role in adolescent development.*

## Background & Introduction

Over the years of technological evolution and increased social media usage, various mental health issues among teenagers have risen. Studies have found that 95% of American teenagers have a smartphone, and 45% of them use their phone ‘constantly’ for over six hours daily (Ghaemi, 2020). This extensive usage underscores the significant role smartphones play in teenagers’ daily lives and raises concerns about the potential mental health impacts of such prolonged screen time. With the rise of technology usage, we have also seen a correlation to mental health disorders, such as depression, anxiety, and various psychiatric symptoms, which include lower levels of self-esteem, life

satisfaction, and perceived happiness. It has been found that 22% of adolescents have shown depressive symptoms (Ghaemi, 2020). This suggests that nearly one in four teens may be struggling with depression, emphasizing the need to investigate contributing factors such as social media usage. Many teenagers have even expressed negative attitudes about their experience with social media while also being “highly motivated to use aspects of social media by aspects they experienced as positive” (Hjetland, 2021). This duality highlights the complex relationship teenagers have with social media, where the benefits often coexist with significant drawbacks. With technology growing, we must find a balance between using social media while also finding ways to be



disconnected in an attempt to eliminate these negative outcomes (Hjetland, 2021). Social media interactions, particularly those involving social comparison and online validation, significantly impact adolescent mental health outcomes. By examining these relationships, we can develop targeted interventions to mitigate the negative effects of social media on teenagers' well-being.

## Social Media

Social media has become a growing norm among teenagers and young adults over the years, especially during the pandemic. In a 2021 study, it was found that nine out of ten youths use social media daily on various platforms, such as YouTube, Snapchat, Facebook, and Instagram (Henzel, 2021). This immense growth over the years has left us with many questions about its mental health effects. In a 2020 survey, users most used YouTube at 85%, Instagram at 72%, Snapchat at 69%, Facebook at 51%, and Twitter at 32% (Ghaemi, 2020). These statistics illustrate the dominance of visual and interactive platforms in teenagers' social media habits, which may have unique implications for their mental health. This information could also eventually help us understand if there is a specific platform that may be the most harmful. "TikTok has also experienced an exponential increase of 7.5 million users during COVID-19" (Lambert, 2022). This reveals the large impact of social media use during the pandemic and how many may turn to this as a remedy for loneliness. In a 2021 study, it was found that 50-74% of participants showed high levels of emotional distress and high-frequency use of social media after the COVID-19 outbreak. They examined how high-frequency social media users had poorer mental health via General Health Questionnaire ratings (Geirdal et al., 2021). This wide range suggests that a significant majority of individuals may have turned to social media as a coping mechanism during the pandemic, potentially exacerbating mental health challenges. This further proves

that social media was one of the main causes of poor mental health and how this issue may have worsened due to the pandemic. Therefore, understanding this complex relationship is crucial to mitigate negative effects, especially following this pandemic. Social media can have a number of negative effects on mental health, one of them being self-worth through social comparison.

## Social Comparison Theory

A large component of social media may have to do with social comparison theory. This theory suggests that individuals evaluate their own opinions and desires by comparing themselves to others (Festinger, 1954). An example of this would be teens comparing 'follower' numbers to their peers, which may result in them feeling like they are not enough. Comparison comes in two forms: upward and downward. Upward comparisons occur when people compare themselves with others who are deemed socially above them in some way and downwards act in the opposite direction (APA, 2018). In the context of social media, constant exposure to others who have an 'idealized follower or like 'count' may lead to low self-esteem (upward), and comparing oneself to those with a 'low following count' may temporarily raise self-esteem (downward). This low self-esteem can have a large impact on mental health, including depression and anxiety.

## Mental Health in Teenagers

Teenagers and young adults struggle with various mental health challenges, which have become more common every day. Around the world, one in seven 10-19-year-olds experiences a mental health disorder (WHO, 2024). This statistic underscores the widespread nature of mental health challenges among teenagers and the urgent need for effective interventions to address these issues. The commonality of this issue can be alarming at such a young age, which can play a larger role in their future, such as substance abuse, chronic health problems,



and suicide. Poor mental health may also lead to a lack of academic motivation, leading to absences or dropping out, social problems leading to loneliness, and substance abuse, which can result in health issues in the future or even overdose. Poor mental health may also cause a lack of healthy habits such as hygiene, eating, and more, which can have long-term effects. A study that measured emotional symptoms, conduct problems, peer relationship problems, and hyperactivity or inattention that surveyed participants every year for 10 years found that poor mental health scores increased every year (Plackett, 2023). Although this may be due to various reasons such as childhood trauma, this growth has sparked interest in whether the increase in social media usage and mental health issues is associated.

### Connection Between Mental Health and Social Media

Various past studies have further proved the correlation between mental health and social media by using questionnaires and interventions. An intervention involving a week-long break from social media revealed significant improvements in the intervention group's well-being, depression, and anxiety levels. Using the Warwick-Edinburgh Mental Well-being Scale, the group's well-being score improved to 55.93, while their depression and anxiety scores, measured by the Patient Health Questionnaire-8 and Generalized Anxiety Disorder Scale-7, decreased to 4.84 and 3.88, respectively. In contrast, the control group's scores remained unchanged at 45.05, 6.95, and 5.94 (Lambert, 2022). This suggests that even this small break from social media positively impacted the participants' mental well-being. To be more specific, it was found that those who frequently posted and viewed social media posts had more mental health problems than those who rarely viewed or posted on social media, with 0.31 scores higher on the General Health Questionnaire (Yu, 2024). This finding highlights the potential risks of high social

media engagement and underscores the need for further research into the mechanisms driving these outcomes. This also suggests that we may be able to combat this issue with further regulations.

### Regulation

There are various ways we can fight this issue, which does not include getting rid of social media. A study found that "mindfulness-based mobile apps led to a reduction in students' anxiety and enhancement of well-being" (Sun, 2023). Given this information, we can consider implementing this application into teenagers' and young adults' phones as a step to aid their well-being. This proves that smartphone applications can be used positively, and we can apply this to future interventions. While these apps may play a positive role in users' lives, breaks from smartphones entirely are very beneficial. As previously acknowledged, taking breaks from social media is good for your mental health. This information plays a critical role in finding the next steps to take in terms of regulation and intervention. Parents can contribute to stopping this issue by further monitoring social media use until they are adults and also by promoting healthy social media habits. Policymakers can help by implementing policies that further protect the youth from social media.

### Gaps in Knowledge

While this research has revealed various correlations between social media usage and mental health outcomes, there is little information on how specific types of engagement—such as likes, comments, shares, and views—impact mental health. Understanding how these interactions influence anxiety, depression, self-esteem, and self-worth is critical because it can help identify the specific mechanisms contributing to the mental health outcomes associated with social media usage. This gap in knowledge highlights the need for further research to explore these nuanced relationships.



## Research Question and Hypothesis

The rapid growth of social media usage has raised concerns about its impact on teens' mental health. In a 2021 study, it was found that time spent on instant messaging services and psychological distress were positively correlated (Henzel, V., & Håkansson, 2021). This is significant because this distress can lead to various mental health issues that can have a lasting impact on teens' future and growth, including academic performance, social relationships, career opportunities, and substance abuse. Despite this information, we still lack an understanding of the impact of specific interactions on social media, such as 'likes' and comments. This leads us to ask, how do social media interactions, particularly those involving social comparison and online validation, impact adolescent mental health outcomes? This mixed-method study will be conducted by recruiting teenage participants in various high schools in the area. Quantitative data will be collected through surveys to measure levels of mental health symptoms and social media engagement. Qualitative data will be collected through interviews and journal entries to explore personal experiences and emotional responses. These methods will be integrated to provide a bigger picture: the quantitative data will help show patterns and correlations, while the qualitative data will offer deeper insights into how and why social media affects teens' mental health. I believe that this study will reveal a strong correlation between social media interactions and mental health.

## Research Approach

### Research Design

This study will take a mixed-method research approach to explore the relationship between social media interactions, particularly 'likes,' and mental health outcomes with the consideration of the social comparison theory.

This theory hypothesizes that people evaluate their abilities and attitudes in relation to those of others in a process that plays a significant role in self-image and subjective well-being (APA, 2018). A mixed-method design combines both quantitative and qualitative research methods in a single study to provide a more comprehensive understanding of an issue. This design allows for an in-depth understanding of teenagers' personal experiences as they navigate social media among fellow content creators.

### Study Population and Sampling

Participants will be aged 13-17 recruited from high schools in Renton, Washington, who post on social media and are willing to participate in the study. The sample group will consist of 150-200 participants to maintain a diverse range of teenagers while also ensuring a thorough understanding of each participant. This study will also be using a simple random sampling approach by having a computer randomly selecting students from the schools' registry and send emails asking if they would like to take part. If accepted, emails to parents will then be administered. This ensures equal chance among the population, a wide variety of participants and eliminates bias.

### Organization and Measurement

This study will be made up of three phases. In the first phase, participants will be asked to post on social media and document their feelings and thoughts every day for a week. At the end of the week, phase two will begin, where participants will then take a remote online survey asking them various questions about their latest social media post interactions and how it made them feel in terms of self-esteem and anxiety. Mental health outcomes will be measured through various questionnaires and scales to examine each one. Depression will be measured through the Patient Health Questionnaire-9 (PHQ-9), Anxiety will be measured through the Generalized Anxiety Disorder-7 (GAD-





## The Impact of Social Media on Teen Mental Health

7), and self-esteem will be assessed using the Rosenberg Self-Esteem scale. The initial survey format allows participants to be comfortable with their answers without the intimidation of an interviewer. In the third phase, participants will then be called in a couple of days after they have taken the survey to talk to an interviewer. This allows us to gain more insight and ask follow-up questions if needed.

### Data Collection

Data will be collected through journal entries that participants will fill out throughout the week with their thoughts and feelings on the interactions on their social media posts. After the week is over, emails will be sent out with surveys for participants to fill out, which consist of 3 questions for each of the measures mentioned previously. These questions will gain quantitative data via number scales. Interviews will then be conducted the following week, which will consist of qualitative questions based on survey answers.

### Data Analysis

Pearson correlation, linear regression, and t-tests will be used to assess quantitative data. Qualitative data will undergo thematic analysis. Transcripts from interviews and journal entries will be documented digitally, which will then be filtered and labeled with various key phrases and grouped into categories with open coding. Researchers will then find patterns in participants with various 'like-to-follower ratios.' All data will also be thoroughly analyzed by 3 different researchers separately to ensure quality and consistency.

### Ethical Considerations

This research will also need to be sent and approved by the Institutional Review Board (IRB). Each participant will be able to withdraw from the study at any time if needed. Prior to consent, participants will be given a clear idea

of what will be conducted. Written and verbal informed consent will be required from both participants and parents or guardians of those participants in order to take part in the data collection. All data will remain confidential, and results will be deidentified before the research section of this study. Prior to the study, participants will be reminded of their confidentiality and their right to withdraw at any point. If at any point participants would like to withdraw after the data collection is complete, all statistical data will be scrapped. As the participants are minors, parents or guardians may also be able to withdraw their child at any given point.

### Discussion

#### Significance

This study is important because it targets a more specific topic of the impact of social media on teenagers' mental health. With the growing evidence to prove the negative impact of social media, it is important that we take steps to find the 'why?' of this issue. This study will be going into the idea of engagement and comparison. Researching these specific aspects of social media will contribute to future regulations that may be implemented in order to eliminate the negative effects of social media. Mental health affects millions of teenagers everywhere, and it is crucial that this is not overlooked as a 'minor issue.' This is also critical in informing parents, guardians, educators, and policymakers of what to look for and how to approach this going forward.

#### Limitations

There are several limitations that should be considered when conducting this study. One is response bias, which occurs when participants do not provide fully accurate and honest responses. Since this study relies on self-reported surveys and journal entries, participants may feel pressured to give responses that they believe are



socially acceptable in fear of looking bad rather than telling the truth. Another is sampling bias, which is the fact that the uneven variability of participants may falsely represent the teenage population due to sampling methods. Self-selection bias may also be present in this study, as participants who choose to volunteer might not represent the broader teenage population. For example, teenagers who are less concerned about social media engagement or who use social media infrequently may be more likely to participate, while those who are heavily invested in social media might avoid the study. This could skew the results, as the sample may overrepresent lighter social media users. To mitigate this, the study will emphasize confidentiality and encourage participation from a diverse range of social media users, including those who are highly active on these platforms. Volunteer bias is another potential limitation, as participants who choose to join the study may differ from those who do not. For instance, teenagers who volunteer might be less invested in social media or less affected by its negative aspects, such as social comparison. This could lead to an underrepresentation of heavy social media users or those who experience significant mental health challenges related to social media. To fight some of these biases, ensuring confidentiality can encourage participants to answer honestly. In an attempt to eliminate sampling bias, we chose Renton, Washington, as the location due to its diverse population, representing various races, incomes, and backgrounds. By acknowledging these limitations, we can contribute to a more comprehensive understanding of the complex relationship between social media and mental health.

### Future Directions

The data collected from this study will be used to further research the long-term effects of social media engagement, such as changes in the relationship between social media and users as they get older. A longitudinal study—a research

design that follows the same participants over an extended period—could provide valuable insights into these trends. By tracking teenagers over several years, researchers can observe patterns in social media usage and mental health outcomes, identifying critical periods when social media may be most damaging. For example, such a study could reveal whether early adolescence, ages 11-14, or later teenage years, ages 15-18, are more vulnerable to the negative effects of social media. This will help parents or guardians find out when social media should be introduced to their children and what regulations they should implement in the future, such as time limits, usage monitoring, and having open conversations about the potential risks of social media.

### References

- American Psychological Association. (n.d.). Apa Dictionary of Psychology. *American Psychological Association*. <https://dictionary.apa.org/social-comparison-theory>
- Ghaemi, S. N. (2020). Digital Depression: A new disease of the millennium? *Acta Psychiatrica Scandinavica*, 141(4), 356–361. <https://doi.org/10.1111/acps.13151>
- Henzel, V., & Håkansson, A. (2021). Hooked on virtual social life. Problematic social media use and associations with mental distress and addictive disorders. *PloS one*, 16(4), e0248406. <https://doi-org.offcampus.lib.washington.edu/10.1371/journal.pone.0248406>
- Hjetland, G. J., Schønning, V., Hella, R. T., Veseth, M., & Skogen, J. C. (2021). How do Norwegian adolescents experience the role of social media in relation to mental health and well-being: A qualitative study. *BMC Psychology*, 9(1). <https://doi.org/10.1186/s40359-021-00582-x>



## The Impact of Social Media on Teen Mental Health

- Lambert, J., Barnstable, G., Minter, E., Cooper, J., & McEwan, D. (2022). Taking a One-Week Break from Social Media Improves Well-Being, Depression, and Anxiety: A Randomized Controlled Trial. *Cyberpsychology, Behavior and Social Networking*, 25(5), 287–293. <https://doi-org.offcampus.lib.washington.edu/10.1089/cyber.2021.0324>
- OpenAI. (2024). ChatGPT (Version 4.0) [Large language model]. <https://chat.openai.com/chat>
- Plackett, R., Sheringham, J., & Dykxhoorn, J. (2023). The longitudinal impact of social media use on UK adolescents' mental health: Longitudinal observational study. *Journal of Medical Internet Research*, 25. <https://doi.org/10.2196/43213>
- Sun L. (2023). Social media usage and students' social anxiety, loneliness and well-being: does digital mindfulness-based intervention effectively work? *BMC psychology*, 11(1), 362. <https://doi-org.offcampus.lib.washington.edu/10.1186/s40359-023-01398-7>
- World Health Organization. (n.d.). Mental health of adolescents. *World Health Organization*. <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health>





# BREAST CANCER: A QUALITATIVE STUDY ON WHY BARRIERS PREVENT NORTH AFRICAN WOMEN WITH STAGE III BREAST CANCER FROM SEEKING MAMMOGRAPHY SCREENING AND HOW TO OVERCOME IT

Muhy Hussein

*ABSTRACT: Breast cancer is the leading cause of cancer-related deaths among women worldwide, with particularly high mortality rates in North Africa due to late-stage diagnoses. Despite the growing availability of mammography services, many North African women are diagnosed at Stage III, when treatment options are limited, and survival rates decrease significantly. This study aims to explore the barriers that prevent North African women from seeking mammography screening and to identify culturally appropriate strategies to overcome these challenges. Using a qualitative phenomenological approach, the study will involve in-depth interviews with ten North African women diagnosed with Stage III breast cancer. The research focuses on understanding their lived experiences, perceptions, and the socio-cultural and systemic factors that contributed to delayed diagnosis. Anticipated themes include limited awareness of breast cancer symptoms, mistrust in the healthcare system, financial constraints, cultural beliefs, lack of female healthcare providers, and fear of stigma. By identifying these barriers, the study seeks to inform future intervention strategies that promote early detection and reduce disparities in breast cancer outcomes. The findings aim to support the development of targeted public health campaigns, increase access to screening, and improve healthcare provider education in North African communities. Ultimately, this research contributes to the global effort to reduce breast cancer mortality through early diagnosis and equitable access to care.*

## Introduction/Background

### Breast Cancer

Breast cancer represents a global health concern; the disease is the leading cause of cancer mortality rate in women worldwide. The incidence rates are broadly rising in cases in the Northern African population. This population faces limited availability of breast therapy, insufficient access to medications, a lack of cancer care professionals, and cultural beliefs. Due to barriers, breast cancer is the top cause of death among women in developing nations, affecting them from accessing mammography screening, which puts their health at high risk.

Researchers and health care workers aim to reduce death caused by delaying diagnosis. According to reports, breast cancer is rising in low- and middle-income nations like North and South Africa. Due to the aging population, decreasing mortality from infectious diseases, and changes in lifestyle risk factors such as reproductive patterns, cigarette use, and obesity. Breast cancer is anticipated to rise globally during the next two decades. According to the most recent global predictions, breast cancer is expected to cause 2.2 million new cases and 700,000 cancer-related deaths in 2020 (The International Agency for Research on Cancer, 2020).





Breast cancer is caused by cells growing and dividing uncontrollably, resulting in a lump of tissue known as a tumor. Breast cancer can spread and expand into the tissue surrounding the breast, and it can also spread to other places in the body, resulting in additional tumors known as metastasis. Early diagnosis is important because breast cancer is less likely to spread outside the breast if detected early. There are more therapy options available and a higher likelihood of survival. In the first five years, women with early-stage breast cancer have a survival rate of 93 percent or higher (The International Agency for Research on Cancer, 2020). Once metastasis happens, cancer cells break away from the original tumor in the breast and travel to other body parts. The outcome is that the disease is more likely to come back more than five years after diagnosis.

The risk of developing breast cancer is due to several factors such as being unable to have regular checkups with primary doctors, not being physically active, being overweight, consuming alcohol, and breast cancer running in the family. Breast cancer is the most frequent cancer in both developed and developing countries, with roughly 690,000 new cases diagnosed in developed countries and 92,000 in Africa each year (Keane, Moore, Leamy, Scally & McEntee, 2021). It is a common cause

of death worldwide (Keane, Moore, Leamy, Scally & McEntee, 2021). Moreover, death rates are higher in developing countries, and this disparity could be due to various reasons. Women in Africa are more likely to present with late-stage disease, with 5-year relative survival rates of less than 50%, barriers for screening should be identified so women can be diagnosed earlier for better outcomes (Pinder, Nzayisenga, Shibemba, Kusweje, Chiboola, Nymamongo, Kapambwe, Mwaba, Lermontov, Mumba, Tillman & Parham, 2018).

Lack of access to mammography screening for early diagnosis can result in North African women developing later stages of cancer, which puts health at a high risk. Breast cancer at stage 3 is also called locally advanced breast cancer (Vilaprinio, Forné, Carles, Sala, Pla, Castells, Domingo, Rue & Interval Cancer, 2014). Early identification is crucial in improving the outcome of various cancers, including breast cancer.

Breast cancer incidence and mortality among women in North Africa faces several issues; such as tumor biology, race, rurality/geography, social determinants of health, access to care, clinical enrollment chances, and unemployment (Brady, Berhalter, Schad, Bentham, Vitale, Norton, Noronha, Swanger & Morley, 2021).

**Table: Breast cancer stages & survival rates**

Breast Cancer Stages	Survival Rates
Stage 0- ductal carcinoma in situ (DCIS)	100%
Stage I- Early-stage breast cancer	63%
Stage II- Invasive breast cancer	63%
Stage III-locally advanced breast cancer	29%
Stage IV-Metastatic breast cancer	6%

*Table Source:* Vilaprinio et al., 2014.



## Barriers of North African Women Seeking Mammography Screenings

Unemployment is higher among Northern African women than white women in the US. Population-based incidence rates of cancers that are negative for the estrogen receptor, progesterone receptor, and HER2/neu, also known as triple-negative breast cancer, are twice as prevalent among North African women (Joffe, Ayeni, Norris, McCormack, Ruff, Das, Neugut, Jacobson & Cubasch, 2018). The North African population also has a greater rate of inflammatory breast cancer than white women in the US. Barriers to cancer care are driven by racism, poverty, and social, economic, and structural variables, which are sometimes referred to as the social determinants of health. Social determinants of health in Africa are associated with undernourishment, a lack of clean water, inadequate sanitation, lack of access to sophisticated health care services. These variables are urgent health risk factors for poor people in Africa and have been documented as significant causes of disease and fatality. This study focuses on understanding Northern African women's barriers from their experience to overcome those issues.

A common factor contributing to the late identification of Breast Cancer is patients' delay in recognizing breast cancer disease and seeking their first medical treatment; thus, later Stages of breast cancer occur. Around 20–30% of women with breast cancer symptoms wait three months or more before seeking medical help and screening (Raymond, Osman, O'Brien, Ali, Kia, Mohamed, Mohamed, Goldade, Pratt & Okuyemi, 2014). Insufficient knowledge of breast cancer affects women's attitudes toward screening, resulting in many women receiving late diagnoses. Fear, humiliation, lack of faith in health care, and lack of information have all been identified as barriers to African women. In a cultural context, religion can also play a role, and these situations impact women's health, life, their children, families, communities, and the country as a whole. Furthermore, religion influences a strong preference for female providers and religious concordance. Female

circumcision can be a barrier to mammography screening in the Northern African community when it comes to screening. Previous research found that women who had female circumcision expressed concerns about pain and provider perception. (Romieu, Biessy, Joffe, Cubasch, Norris, Vorster, Krugell, Gunter & Rinaldi, 2021). Furthermore, some women may be uninformed of the benefits of mammography screening or believe that it is not necessary for their circumstances. Another issue that North African women face is access to care, the expense of treatment, and screening. Mammography screening is challenging for women in North Africa due to a lack of healthcare infrastructure and financial capacity to pay for the treatment and screening. Cultural factors make it much more difficult for women to seek medical help. Some women, for example, may be hesitant to get a mammogram because they are afraid of being diagnosed with cancer. These barriers include fear of diagnosis, stigma, religious or cultural beliefs, lack of awareness about the importance of early screening, preferences for female providers, cost of screening, and limited access to healthcare infrastructure such as clinics or trained providers.

The most effective strategy for early diagnosis of breast cancer and lowering mortality rates is regular mammography screening. Furthermore, successful therapy may benefit in the reduction of breast cancer death rates followed by mammography screening. The benefits of getting an early diagnosis are early-stage cancers are easier to treat and have a better chance of survival than later-stage tumors (Smit, Coetzee, Roomaney & Swartz, 2021). When cancer is detected before it has spread too far, treatment is more likely to succeed. When cancer treatment is delayed or inaccessible, there is a reduced likelihood of survival, more treatment complications, and higher treatment expenses. Early detection improves cancer outcomes by allowing patients to receive treatment at the earliest feasible stage, thus a critical public health approach is needed for all settings. Stage



3 breast cancer patients' lives can be saved, the personal, social, and economic expenses of cancer care can be lowered by effectively implementing early detection approaches.

Breast cancer mammography screening for women in Northern Africa must be expanded as part of establishing preventative measures. There are approaches to improve women's screening, such as identifying barriers to early detection of stage 3 breast cancer in North African women. Various treatments are being researched and developed to enhance breast cancer mammography screening for North African women. Various methods are being explored and designed to improve breast cancer mammography screening for North African women. One type of intervention that could be done is to increase the availability of healthcare infrastructure. Two strategies for achieving this goal are to increase the number of mammography screening facilities in Northern Africa or to provide financial assistance to women who require mammography screening (Smit, Coetzee, Roomaney & Swartz, 2021). Another option is to provide financial aid to women who wish to have their breasts screened with mammograms. Grants or even distribution of money to cover the cost of the screening, as needed, could be used to do this.

A third action is to raise knowledge of the advantages of mammography screening among women and practitioners. This could be performed by providing educational materials about mammography screenings or training healthcare providers on the benefits of mammography screenings. Fourth, women in North Africa need greater access to healthcare services, and the number of mammography screening clinics in Northern Africa may be increased. Finally, cultural disparities must be addressed. Offering mammography screening information in their native languages or teaching healthcare practitioners the benefits of mammography screenings for North African women are two examples of achieving this goal.

Community-based health workers must address women's health to ensure they have high-quality care to improve their health and their families.

Mammography screening plays a vital role in the early detection of breast cancer, resulting in faster diagnosis and improved interventional outcomes. This study aims to deepen our understanding of the Northern African population's barriers and attitudes towards breast cancer and mammography screening. The study focuses on the differences in knowledge, attitudes, and beliefs between younger and older North African women with stage 3 breast cancer living in North Africa. Understanding women's subjective experiences with recurrent breast cancer, particularly in developing countries, is a substantial gap that needs to be addressed. The researcher would use the data to develop intervention strategies to increase breast cancer mammography screening and reduce health disparities in the Northern African community. Disparities may be attributed to social, economic, and behavioral factors. African Women are more likely to have diabetes, heart disease, and obesity, which are all risk factors for breast cancer. They are more likely than white women to have insufficient health insurance or access to healthcare facilities, impacting screening, follow-up, and therapy completion.

Despite existing literature highlighting disparities in breast cancer care, there remains a significant gap in developing targeted intervention strategies for North African women. Current research suggests that limited awareness among healthcare workers, insufficient diagnostic infrastructure, and a lack of culturally tailored health education contribute to late-stage diagnoses. While the expansion of mammography facilities is vital, such resources are ineffective if women remain unaware of their existence or importance. Additionally, studies often generalize findings across Africa without accounting for the cultural and systemic differences specific to North African populations.



## Barriers of North African Women Seeking Mammography Screenings

This study aims to address this gap by exploring the lived experiences of North African women diagnosed with Stage III breast cancer to understand better the barriers that prevented them from seeking earlier screening. The insights gathered will inform the development of culturally appropriate interventions to promote mammography screening and reduce breast cancer disparities in the region.

### Research Question & Hypothesis

There are substantial health disparities between North African women with stage 3 breast cancer in Northern Africa (Raymond, Osman, O'Brien, Ali, Kia, Mohamed, Mohamed, Goldade, Pratt & Okuyemi, 2014). This is true to the extent that the percentage of breast cancer rates has been increasing dramatically in African Women in Northern Africa more than in other races such as Indian, Asian and Hispanic (Raymond, Osman, O'Brien, Ali, Kia, Mohamed, Mohamed, Goldade, Pratt & Okuyemi, 2014). Few studies have been conducted to indicate the long-term health risk and survival rates of those exposed to breast cancer without primary care, mammography screening, and the barriers impacting them from getting screened. This study will highlight barriers that will be identified to understand the lack of access to mammography screening and develop intervention strategies to overcome those issues.

Developmental trends of breast cancer will help inform future health intervention initiatives to reduce long-term health risk decrease and disease development rates. Moreover, to provide resources and ways for all breast cancer patients to receive effective mammography screening, treatments, and therapies. The qualitative research will explore the relationship of barriers that significantly impact North African stage 3 breast cancer patients to receive mammography screening. By interviewing North African women with stage 3 breast cancer to understand what prevents them from getting earlier

diagnoses. Understanding their experience, thoughts, and feelings would help improve their access to screening. Additionally, developing intervention strategies based on the patient's barriers will help overcome the obstacles to access mammography screening.

The research question is: what are the barriers affecting North African women with stage 3 breast cancer from getting mammography screening, and how to overcome those issues to reduce breast cancer rates? The hypothesis is that if intervention strategies are developed based on North African women's needs to overcome the barriers preventing them from seeking mammography screening, then women could get diagnosed earlier to get treatment and live longer. The study examines possible contributing factors such as lack of healthcare access, inability to afford treatment, and other barriers affecting survival rates.

### Research Methodology

#### Study Design

For this proposal, a phenomenological qualitative, exploratory design will be used. A phenomenological qualitative method is most appropriate for this proposal because it describes the lived experiences of individuals with breast cancer stage III to learn more and understand their thoughts and opinions on barriers. To figure out how they could have been diagnosed earlier for women who have lived with stage 3 breast cancer without an early diagnosis. Information and data will be gathered through semi-structured interviews with participants who have shared experiences with stage 3 breast cancer without an early diagnosis. Open-ended questions will be asked, and patterns identified will be shared among those interviewed. Furthermore, it can be helpful to understand participants' experiences of treating individuals in the future. This proposal will examine the relationship between the barriers that North African women face with stage 3 breast cancer



Hussein

that prevents them from getting mammography screening and how to overcome them by developing intervention strategies based on participants' needs and for all women in the community to prevent the same issues again.

### Population and Sampling

The target sample population for this study is 10 Northern African women diagnosed with stage III breast cancer disease in Northern Africa. The participants will be selected through snowball sampling from the Northern African population with the highest breast cancer rates. There will be two groups, five of each individual who are 35-45 and 45-60 years of age with stage 3 breast cancer will be eligible for participation. The age that is being selected is noted for the highest risk of stage 3 breast cancer development. Participants will be recruited through face-to-face interactions. Participants will also be recruited with referrals from the participants who have read the study and are willing to participate using snowball sampling. Participants will then be offered the option of following an online link and submitting an online application to participate in the study. Participants are chosen based on their ability to contribute to the research questions, improve understanding of the topic under investigation, and speak about their experiences. Participants will be interviewed about their experiences being diagnosed with breast cancer stage III and the barriers affecting them from receiving mammography screening. Selected participants will receive an email with instructions confirming their acceptance and access to the study.

### Measures and Variables

There are a set of questions that the ethics committee approves, and these were on knowledge of breast cancer, views on healthcare, experience, opinion, and barriers to mammography screening. Open-ended questions will allow participants from both

groups to answer the following questions about their thoughts on why their breast cancer went undetected. As well as their recent experience with being diagnosed with stage 3 breast cancer, their knowledge about the disease, thoughts, and feelings about the barriers that are affecting them from access to mammography screening. Therefore, open-ended questions will help see the participants' perspectives, knowledge, and feelings about the disease. The participants will be conducted in English, and a translator will be present to translate in their native language. All interviews will be audio-recorded, and the participants' responses will be translated and transcribed. The opinions of all 10 African women will be explored. Prior to the interview, all participants will receive a participant information sheet and sign a consent form after having the opportunity to ask questions.

### Data Collection

Face-to-face, semi-structured interviews in which open-ended questions will be asked about participants' experiences of having stage 3 breast cancer without an early diagnosis will be the first data collecting method. Which will occur at participants' preferred location: either at their home or in private settings. Prior to the interview, each participant will be asked to fill out consent and confidentiality agreement forms, and they will reserve the right to leave the research study at any time. Participants were not disqualified if they did not want to share their personal experiences due to the topic's sensitivity during the interview. The research's goal, advantages, and future usage will be fully disclosed to participants after collecting the data. Each group participant is interviewed separately to explain their personal experience to understand different perspectives to identify themes and patterns.

Translators will be present during the interview. During each interview, the participants will be asked the same first question 'Can you tell me your story about being diagnosed with stage 3





## Barriers of North African Women Seeking Mammography Screenings

breast cancer? What happened?'. Followed by questions about knowledge, experience, barriers, opinions, thoughts, and feelings. The questions will be asked until answers are repeated, or participants indicate they have nothing further to add. The interview will be audio recorded to ensure confidentiality; each interview should last about 30 minutes. Data will be collected and analyzed after interviews are completed, and participants will be followed up to ensure continuity of care and support. Additionally, all breast cancer stage III participants will be given mammography screenings and followed up for a while to ensure they are getting treated for their disease.

### Analysis

The transcribed interviews will be subjected to thematic analysis for this study, and common themes will be identified. All data will be audio-recorded and transcribed correctly into English with the participants' permission. Using theme analysis, line-by-line coding will be used to construct thematic codes that describe each relevant phrase meaningfully. The data were categorized into a findings section based on individual interviews or between many interviews. The research will investigate the participants' knowledge, experience, and opinions about North African women with stage 3 breast cancer barriers to mammography screening.

### Ethical Considerations

During this qualitative study, ethical considerations are taken into account. Each participant must sign informed consent documents before the interview is conducted. The Institutional Review Board must approve this study before beginning the study. The Institutional Review Board must also review and approve this study in north Africa.

Before starting the interview, all participants are reminded that all personal information will

remain confidential to protect the individuals' privacy. Patterns and themes that are identified will be shared. This study may cause emotional distress to the participants during the interview. Due to the sensitive topic, the participants have the right not to continue the study or disclose personal information when they decide to do so. Lastly, the researcher will engage in reflexivity by taking notes during the interview regarding participants' comments and the researcher's ideas.

## Discussion & Future Directions

### Significance

Breast cancer rates have increased in Northern African women with stage 3 breast cancer with a higher death rate than those with lower breast cancer stages. This study's importance and purpose are to gather knowledge about what North African women knew about breast cancer. It was also to hear the participants' personal experience with having stage 3 breast cancer and understand why it was not diagnosed for a long time. This study will address the relationship between these barriers and breast cancer and how to overcome these barriers by developing intervention strategies that the participants need.

Many barriers prohibit North African women from getting a mammogram. It could be mistrust of the healthcare system, difficulty accessing healthcare, affordability, lack of knowledge about the disease, inability to detect its symptoms to receive early care, and lack of experience with mammography screening in Northern Africa. Fear of pain, embarrassment, shame, religious beliefs, and preferences with the same religious background seeing female providers are the main barriers that may discourage women from seeking mammography. Healthcare access: North African women frequently lack access to high-quality healthcare. They may be forced to travel considerable distances for treatment or lack the financial means to pay for it. Affordability:



Even if North African women have access to healthcare, getting screened may be out of reach. Mammograms can be costly, and many women in this area lack health insurance. North African women may be hesitant to get checked for breast cancer due to cultural reasons.

The findings from this study will help benefit adding breast cancer awareness in the North African region with the highest breast cancer rates. Several interventions can help overcome the barriers that prevent North African women from receiving mammography screening. To overcome these barriers, healthcare providers and policymakers need to increase awareness about the importance of mammography and make mammography services more accessible. Healthcare access: Women in North Africa should have access to high-quality healthcare. This could be accomplished by increasing the number of healthcare clinics in the area or offering financial support to women who cannot pay for care. This can be done through fundraising campaigns or partnering with organizations that provide financial assistance for mammography screenings. Governments and healthcare groups should make mammograms more affordable for women in North Africa. This could be accomplished by granting financial aid or lower rates. Governments and healthcare organizations should develop culturally sensitive campaigns to encourage North African women to get screened for breast cancer. These campaigns should emphasize the importance of mammography screenings, that breast cancer is a serious disease, and that early detection is key to survival. This can also be done by creating population-based public health programs or educational campaigns targeting women and healthcare providers.

Finally, the barriers that hinder women in Northern Africa from receiving mammography screenings for breast cancer must be addressed. A method like this could help doctors detect diseases early, educate people about risks and habits, and develop treatment strategies that

improve overall health results. This could help to reduce the number of women diagnosed with breast cancer. Nonetheless, the findings of this study may be useful to other researchers looking for a possible medical intervention for stage 3 breast cancer patients in undeveloped nations to lower breast cancer rates.

As a result, the study's findings will help promote mammography screening for stage III breast cancer screening in the Northern African community. It will serve as a foundation for future research. This study would be able to fill in knowledge gaps around access to care quality and health disparities.

### Limitations

Some limitations for this study could be the loss of follow-up right after the interview to ensure if they have received screening and a treatment plan as needed. The sample selected is limited to North African women with breast cancer stage 3 facing barriers for mammography screening; thus, not applicable to all African women of other stages outside of these designations. The research will not extend to other conditions requiring mammography screening. The study is limited to comparing existing research data on barriers to mammography screening in Northern Africa. The study's findings may not apply to other nations due to differences in barriers, mammography screening, and treatment.

This study will use a small group of women from areas with high breast cancer rates in Northern Africa. The participants will recruit other participants with stage 3 breast cancer for the study using snowball sampling. This study may not adequately reflect the views of all women in the population. The study is conducted with time constraints. The topics discussed were culturally sensitive, and those who chose not to participate in such discussions may have held very different views from those we expressed. Even though our data may not represent the views of all Northern African women who settled



## Barriers of North African Women Seeking Mammography Screenings

in other regions. This study's data can be used to conduct further research using a quantitative approach to see if the themes identified in this study can be applied to a larger population. Mammography screening is also important for other cancers, and more research is needed to discover if it can be applied to other populations with different cancers.

### Future Direction

The research aims to develop medical intervention applicable to North African women for earlier diagnosis of breast cancer and address the barriers identified in this study with the help of the local community and government units. Follow-up research is recommended to examine healthcare practitioners' education and training. If further research is not conducted, breast cancer rates in the North African population will worsen. This study could encourage further research on different regions to compare studies and results; additionally, for the long term, this research hopes to promote future research for reducing stage 3 breast cancer rates to promote health and well-being in the Northern African population. Further research should be conducted on the long-term effects of the health risk of breast cancer and breast cancer stages and survival rates.

### References

- Brady, L. A., Tumiel-Berhalter, L. M., Schad, L. A., Bentham, A., Vitale, K., Norton, A., Noronha, G., Swanger, C., & Morley, C. P. (2021). Increasing Breast, Cervical, and Colorectal Cancer Screenings: A Qualitative Assessment of Barriers and Promoters in Safety-Net Practices. *Journal of patient-centered research and reviews*, 8(4), 323–330. <https://doi.org/10.17294/2330-0698.1857>
- Joffe, M., Ayeni, O., Norris, S. A., McCormack, V. A., Ruff, P., Das, I., Neugut, A. I., Jacobson, J. S., & Cubasch, H. (2018). Barriers to early presentation of breast cancer among women in Soweto, South Africa. *PloS one*, 13(2), e0192071. <https://doi.org/10.1371/journal.pone.0192071>
- Keane, E., Moore, N., Leamy, B., Scally, A., & McEntee, M. F. (2021). Identifying barriers to Irish traveler women attending breast screening. *Radiography* (London, England : 1995), S1078-8174(21)00189-9. Advance online publication. <https://doi.org/10.1016/j.radi.2021.11.010>
- Pinder, L. F., Nzayisenga, J. B., Shibemba, A., Kusweje, V., Chiboola, H., Amuyunzu-Nyamongo, M., Kapambwe, S., Mwaba, C., Lermontov, P., Mumba, C., Henry-Tillman, R., & Parham, G. P. (2018). Demonstration of an algorithm to overcome health system-related barriers to timely diagnosis of breast diseases in rural Zambia. *PloS one*, 13(5), e0196985. <https://doi.org/10.1371/journal.pone.0196985>
- Raymond, N. C., Osman, W., O'Brien, J. M., Ali, N., Kia, F., Mohamed, F., Mohamed, A., Goldade, K. B., Pratt, R., & Okuyemi, K. (2014). Culturally informed views on cancer screening: a qualitative research study of the differences between older and younger Somali immigrant women. *BMC public health*, 14, 1188. <https://doi.org/10.1186/1471-2458-14-1188>
- Romieu, I., Biessy, C., Joffe, M., Cubasch, H., Norris, S., Vorster, H. H., Taljaard-Krugell, C., Gunter, M. J., & Rinaldi, S. (2021). Reproductive factors and risk of breast cancer in black South African women. *Cancer causes & control : CCC*, 32(4), 415–422. <https://doi.org/10.1007/s10552-021-01390-9>



Hussein

- Smit, A., Coetzee, B., Roomaney, R., & Swartz, L. (2021). Understanding the subjective experiences of South African women with recurrent breast cancer: A qualitative study. *Journal of Health Psychology*. <https://doi.org/10.1177/13591053211002236>
- VilaprinYO, E., Forné, C., Carles, M., Sala, M., Pla, R., Castells, X., Domingo, L., Rue, M., & Interval Cancer (INCA) Study Group (2014). Cost-effectiveness and harm-benefit analyses of risk-based screening strategies for breast cancer. *PloS one*, 9(2), e86858. <https://doi.org/10.1371/journal.pone.0086858>



# A COMPREHENSIVE ANALYSIS: THE RELATIONSHIP BETWEEN TEMPERATURE AND PRECIPITATION ON CHOKECHERRIES

Gurkamal Kaur

***ABSTRACT:** This research aimed to figure out and study the relationship and combined impact of temperature and precipitation on the overall fruit yield of Chokecherry trees. The goal was to find the best possible set of conditions that would maximize not only production but the quality of produce as well, as constantly changing climate conditions influenced by global warming immensely impact the marketability of the fruit. The hypothesis was that in order to maximize yield as well as quality, the trees needed spring temperatures ranging from 70°F to 85°F (21°C to 29°C) during growing seasons, and 32°F and 45°F (0°C to 7°C) during dormancy to ensure proper bud breaking when spring arrived. Moderate to high levels of rainfall are needed (15-25 inch annually), and in areas of lower precipitation, supplemental irrigation is required. It needs to be made sure that the stages of growth sync with the weather predictions, as too high or too low of temperature and precipitation levels can seriously impact the fruit yield. In order to collect data for this research, data and tools from the USA National Phenology Network (NPN) will be used. Data was collected between the years of 2014-2023. This time frame will be consistent throughout the research. Then, data analysis will determine the relationships collectively and separately between temperature, precipitation and fruit yield. The results suggest minimal correlation between precipitation and yield, maximum correlation between temperature and yield, and no correlation between temperature and precipitation collectively on yield. To get these results, statistical analysis as well as regression analysis was conducted, and the data was analyzed and sorted in Excel.*

***Keywords:** Climate change, chokecherry, temperature, precipitation, fruit cracking, fruit yield, quality.*

## Introduction

The goal of this research is to understand the phenology and relationship between temperature and precipitation relative to the fruit yield of chokecherries. Getting the most and good quality yield has become increasingly challenging as climate change impacts rainfall and temperature patterns (JT Doyle, 2013). It is crucial for cultivators to understand the ever-changing patterns to get the most yield, so as to maximize marketability, especially in the case of a fruit having such a high and significant economic impact. In this case, farmers often find themselves facing a dilemma

where they must prioritize one condition over the other, either due to lack of knowledge of the best set of conditions required, or due to the lack of planning of growth periods relative to fruit production and weather predictions. Understanding the relationship between temperature and precipitation, individually and together, allows us to firstly address a critical gap and lead to a potential breakthrough in chokecherry production, as well as allow us to assess and create predictive models, and come up with new and reformed practices that will ensure sustainable and high quality yields from every growing season.





Chokecherries, scientifically known as *Prunus virginiana*, are a deciduous shrub, which may also be sometimes seen as a small tree, native to Northern American primarily. The plant itself tends to grow up to heights of 3 to 6 meters (6.5 feet to 20 feet, but they have been seen growing to heights up to 9 meters or 30 feet). As for the main focus, the fruits of this tree, chokecherries, emerge from small clusters of white fragrant flowers that bloom in spring, and these clusters are usually 6 to 15 centimeters long. The fruit itself is small and spherical and is only about 6 to 10 millimeters in diameter. The berries are usually dark red to black in color and carry an astringent acidic taste. These fruits are widely known for their ability to adapt to changing conditions, but frequently fluctuating weather patterns affect the growth and yield immensely (Petruzzello et al., 2024).

Studies such as Proebsting, E. L., & Middleton, J.E. (1980), provides us with information for the optimal temperature ranges for growing chokecherries. This study suggested that to maximize fruit production, growing periods had to be timed so the spring temperatures ranged from 70°F to 85°F (21°C to 29°C) during growing seasons and 32°F and 45°F (0°C to 7°C) during dormancy. This range of temperatures helped ensure that proper bud breaking would occur when spring arrived. As for rainfall, 13 to 65 inches of annual rainfall is considered optimal to promote and boost both quality and yield of the fruit (Crowder, 2003).

My research question aimed to incorporate both the above mentioned phenophases, temperature and precipitation, and study their separate and combined effects on the production of chokecherries which led my research question to be, “What relationship between temperature and rainfall works best in order to maximize fruit yield and quality of chokecherry fruits?”. My hypothesis going forward was that temperature and precipitation worked together to show their collective significant impacts. If one of the two is removed, then fruit yield will

go down by a significant amount. Additionally, too high or too low of temperature and rainfall levels would also affect the fruit yield by a lot, as too high precipitation leads to fruit cracking, and too high of temperatures can lead to lower efficiency in seed germination and will show signs of heat stress. Precautions, such as rain covers, or cooling mechanisms can be set up to counter these adverse climate conditions. As I move forward, data from NPN will be used to test my hypothesis and analysis will be done based on that. Furthermore, statistical and visual analyses will be used to draw conclusions. Models can then be created based on those results, to design preemptive measures that ensure optimal conditions for chokecherry trees and fruit.

### Methods and Materials

The data needed for the analysis of this was retrieved from the USA National Phenology Network (NPN) database. Two tools were used all together to collect a broader set of results and a more specific set of results. Firstly, the NPN visualization tool was used to construct a scatter plot which showed the relationship between total rainfall with respect to onset of days of year showing the relative fruit yield. To generate this scatter plot, I decided to not apply boundaries to maximize the data points I got. I then chose a fairly recent time frame of 2014-2023 as I did mention how global warming did contribute to the weather and climate changes, so in order to get the most accurate results, using a recent data set would be suitable as it accounts for a higher number of observed fluctuations in temperature and precipitation. I then chose to focus on fruits itself by picking “Chokecherry/ Fruit or seed cones” as my observable phenophase, and my intention was to study how much fruit was produced around a certain time of year with respect to my chosen climate factor. On the X-axis, I had accumulated precipitation in millimeters and on the Y-axis I had the onset day ` the year. Additional filters used by me included the data precision for 30



## The Relationship Between Temperature and Precipitation on Chokecherries

days and I also checked the box off for “Used Individual Phenometrics.”

The second graph is also generated with the help of the NPN visualization tool. Instead of a scatter plot, an AGDD diagram was created. AGDD stands for accumulated growing degree day. I used this set of data to answer the individual portion of how temperature affects fruit yield. As for the filters, they were mostly similar to ones from the last graph. I chose no boundaries to maximize the data points that I could get. I chose the same time frame as for my precipitation data in order to maintain consistency throughout my research and exclude any amount of bias that may have come up. I once again chose my observable phenophase to be “Chokecherry/ Fruit or seed cones”. My X-axis this time depicted the AGDD but the Y-axis still showed the onset day of the year. Data precision was once again turned on for 30 days and individual phenometrics were used.

My third graph was a little more complex. For this graph I used the NPN observational tool. For this, I started off by matching the date to my data for the last two graphs, January 1st, 2014, to December 31st, 2023. I then set my species as *Prunus virginiana*, and chose fruits for the limiting phenophase, as I am researching exactly at what times in the year or certain climate conditions fruit yield is at its maximum. I then skipped picking specific partner groups and source datasets and went to include all the data from all sources and specified phenophase name, phenophase category, species name and species category in the optional output fields. For the climate data field, I selected accumulated precipitation. The purpose of this graph was to provide additional evidence to support the results of my first graph, which showed no significant or only a minimal relationship with rainfall.

The above three graphs include and touch upon all the necessary aspects that are required to answer my research question. With one graph

examining the relationship of temperature and fruit yield and the other examining that of precipitation, we will eventually be able to compare those two graphs and pinpoint a connection if there was one. From my presentation, I found out that precipitation had a minimal impact on the fruit yield, so I planned to do another analysis to ensure the credibility and accuracy of my data, claims and observations. To create my third graph, I had to create a pivot table which helped me graph my data set. I made sure to remove any missing information (-9999's). I also averaged out the onset days which were relative to the Y-axis on the graph.

All of the data used for my research was obtained from the NPN database where appropriate researchers and organizations input it into the database. In order to create my third graph, I selected the column for accumulated precipitation and onset of days. I also chose phenophase name and observation date as guides to organize my data. As mentioned above, all the missing information was filtered out, as was any additional irrelevant data which could not be graphed. The analytical approach that I went for was data visualization where I was able to see the trends and relationships with respect to the climate conditions for each day of the year and I was also able to look at the linear regression line for a clear idea of what the trends were. My scatter plot showed points signifying each individual observed phenophase. This model can also help predict fruit yield and quality under the same or different temperature and rainfall conditions, becoming an extremely useful resource for chokecherry cultivators.

To analyze Graph 1 and 2, regression analysis was conducted. I was able to tell the relationship by looking at the  $R^2$  value. In graph 1, the X-axis represents the total rainfall accumulated in millimeters over a period and the Y-axis indicates said period or the day of year on which the fruits or seed cones of chokecherries began to appear. The trendline showed the relationship in the form of the slope. The  $R^2$  value came out



Kaur

to be 0.27 which indicated a weak yet positive correlation between the phenophase and the climate condition. As for my second graph, the X-axis represents the accumulated growing degree days, which is basically a measure of heat accumulation which can be used to predict plant development rates, over a period and the Y-axis indicates said period or the day of year on which the fruits or seed cones of chokecherries began to appear. The trendline showed the relationship in the form of the slope. The  $R^2$  value for graph 2 came out to be 0.73 which showed that statistically, temperature played a huge role in the timing and yield of fruit and seed cones in chokecherry trees.

Using a scatter plot and an AGDD diagram as a means of graphical visualization between the two variables turned out to be a reliable way to figure out relationships and test if our data matches our claims and hypothesis. Each point in the scatter plot represented an individual observation in the dataset with the x-axis representing the independent variable (temperature or precipitation) and the y-axis

representing the dependent variable (onset day of year). Using linear regression, relationships could be observed. The  $R^2$  value is a statistical measure that indicates the proportion of variance that can be predicted from the independent variable and projected on the dependent variable. The primary goal was to understand the relationship between the climate factors and linear regression analysis through this value helps figure out how much variation there is.

## Results

The graph shown above illustrates the relationship between total accumulated precipitation in millimeters and the onset day of year for chokecherry fruit and seed cone's first appearance. The graph has data from January 1st 2014 to December 31st 2023. Here The x-axis is showing the total accumulated rainfall, and the y-axis shows the onset day of the year when fruits or seed cones begin to appear. Each one of the red circles represents an individual data point for a year between the given dates of 2014-2023. The  $R^2$  value of 0.27 points

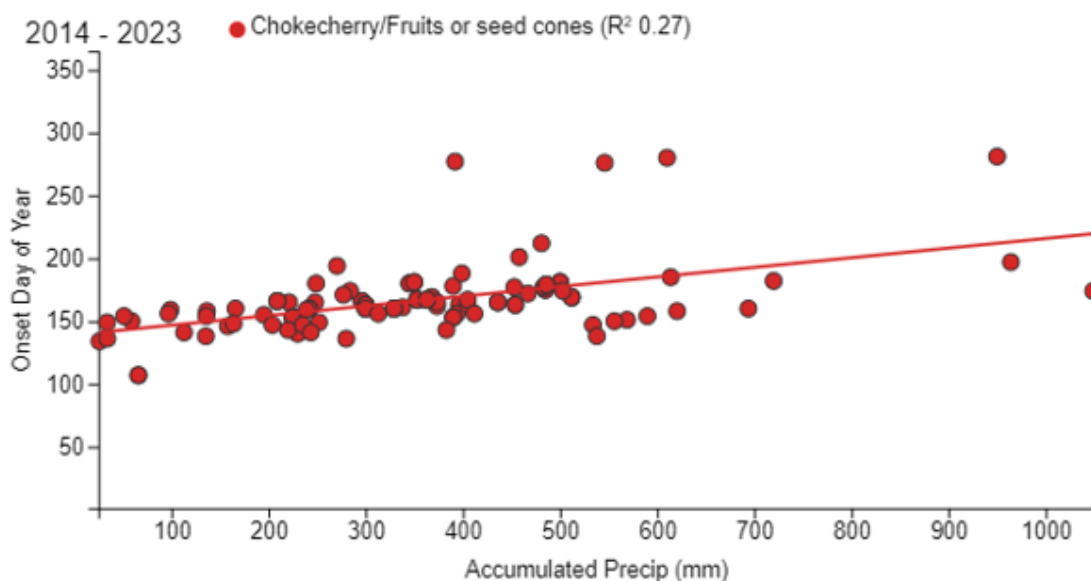


Figure 1: Relative fruit yield with respect to accumulated rainfall and onset day of year.



## The Relationship Between Temperature and Precipitation on Chokecherries

toward the idea of there being a relatively weak correlation between precipitation levels and fruiting. Basically, what it meant was that only 27% of the variability in the onset of the day of reproduction could be explained by precipitation

levels. From this we were able to conclude that even though it can be observed that wetter conditions may possibly delay fruiting but other climatic factors, such as temperature, tend to play a more significant role in fruiting.

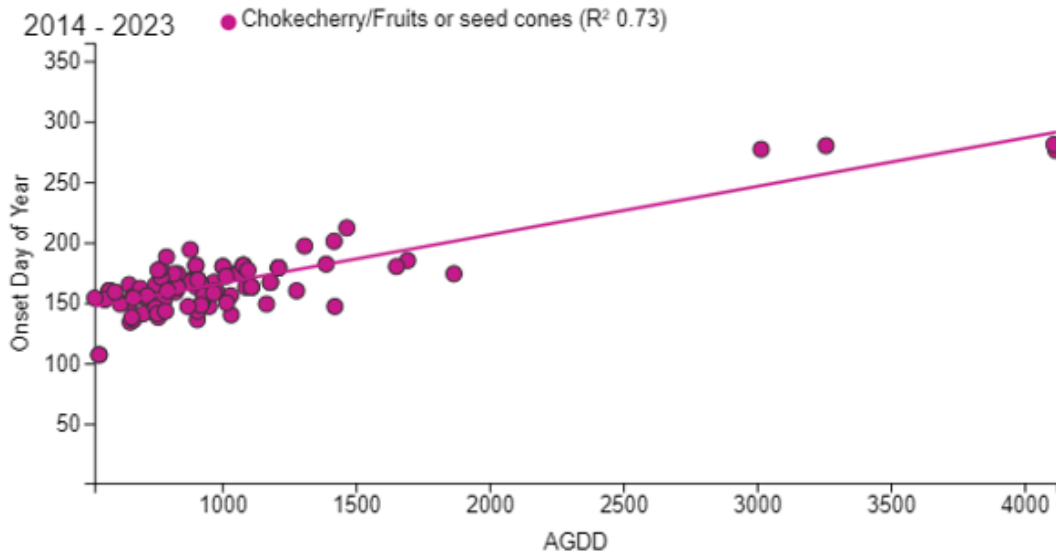


Figure 2: Relative fruit yield with respect to AGDD and onset day of year.

Additionally, the scattered data points visible around the trendline end up further supporting my claim of a weak correlation. This graph shown above illustrates the relationship between AGDD (Accumulated Growing Degree Days) and the onset day of the year for chokecherry fruit and seed cone's first appearance. The graph has data from January 1st 2014 to December 31st 2023. Here The x-axis depicts the AGDD and the y-axis depicts the onset day of the year when fruits or seed cones begin to appear. Each one of the red circles represents an individual data point for a year between the given dates of 2014-2023. The  $R^2$  value of 0.73 points toward the idea of there being a significant and strong correlation between temperature and fruiting. In other words, we can say that 73% of the variability in the onset of the day of reproduction could be explained due to the

temperature conditions. From this observation, we can conclude that temperature is one of the more significant climatic conditions which affects fruiting and eventually, the overall fruit yield of chokecherry trees as the yield obtained will be controlled by how much fruit is produced relative to the temperature conditions. We can also see that the data points on the graph are close and follow the trendline which further supports our claim towards there being a strong correlation between the independent variable and the dependent variable.



Kaur

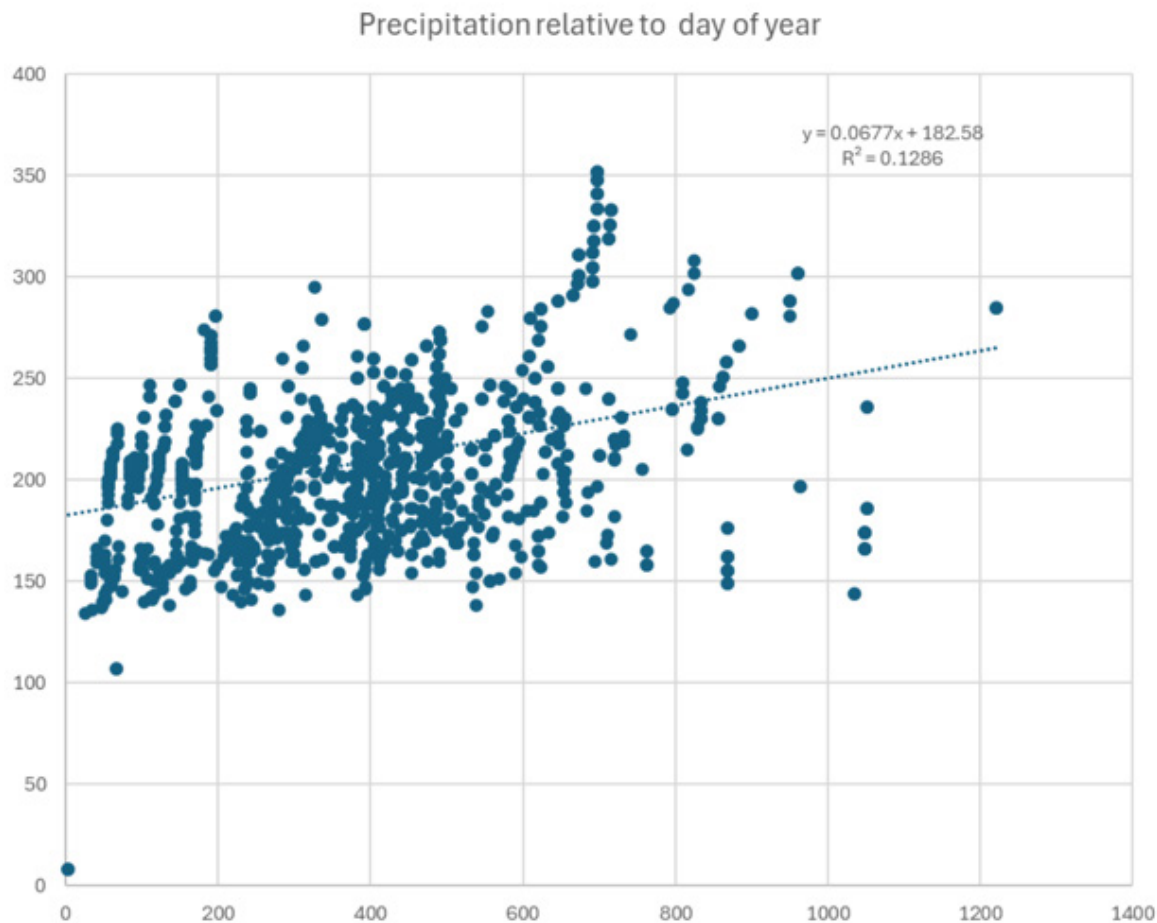


Figure 3: Observed fruiting patterns with respect to accumulated precipitation and onset day of year.

I decided to construct a third graph with the same parameters and variables as graph 1 to further back up as well as confirm the claim of there being a weak and not very significant correlation between accumulated precipitation and fruiting and in turn, the fruit yield. I initially took data from the NPN observational tool as I have described in methods and materials. I further filtered out missing data and selected just the accumulated precipitation over the same date range as my other two graphs. I then averaged out the day of onset as well as accumulated precipitation data, and created a scatter plot that showed data and observed fruiting relative to the selected climatic conditions and day of year when the phenological event occurred. I was able

to form an equation of the regression line which was  $y = 0.0677x + 182.58$  and had an  $R^2$  value of approximately 0.13. This value showed us an even weaker relationship between accumulated precipitation and fruit yield showing that only 13% of the variability in the onset of the day of reproduction could be explained by precipitation level. This helped us back up our initial slightly uncertain claim about precipitation not having a significant impact on fruiting. This graph also had data points scattered more widely and further apart from the trendline as did Graph 1, which shows the weak influence of accumulated precipitation and a greater influence of other climatic factors.





## The Relationship Between Temperature and Precipitation on Chokecherries

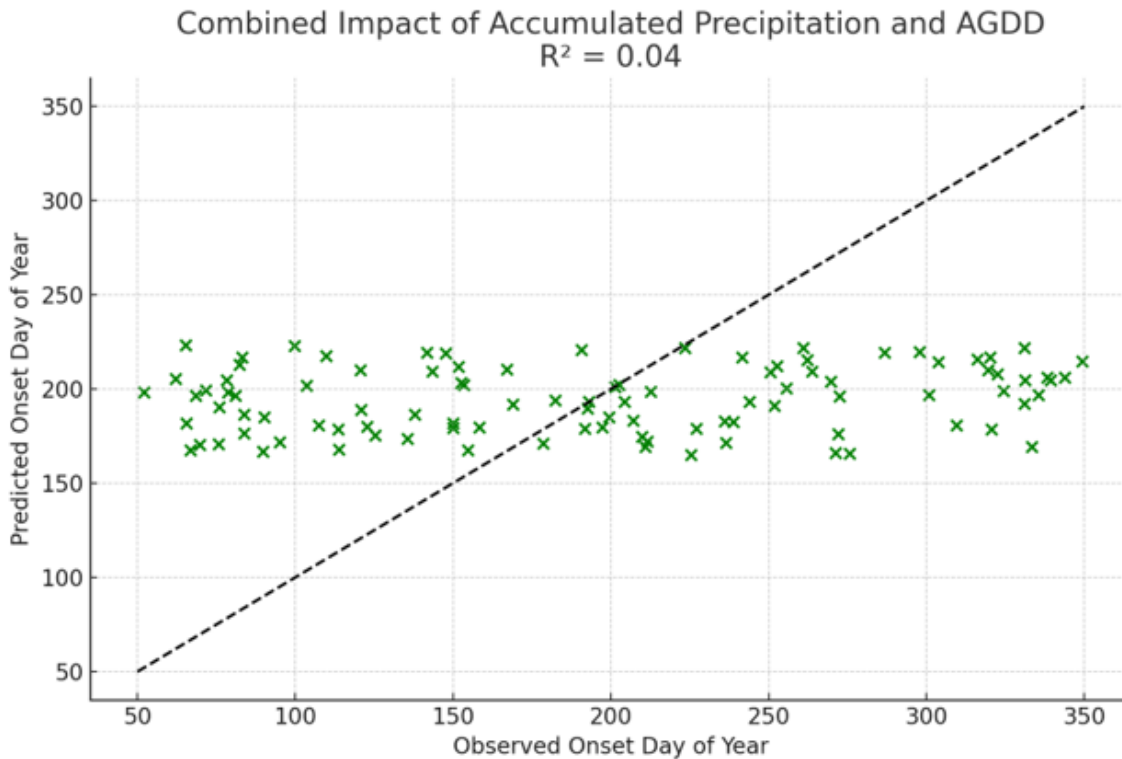


Figure 4: Scatter plot showing predicted vs observed onset day of year based on the combined impact of precipitation and AGDD.

In order to answer my main research question which was “What relationship between temperature and rainfall works best in order to maximize fruit yield and quality of chokecherry fruits?”, I needed to analyze the collective impact. For this purpose, I constructed the three graphs but then I proceeded to combine the data to see if there was a relationship between the two climatic conditions on the selected phenophase collectively. From that graph, I was able to get the  $R^2$  value, which came out to be 0.04, which showed an extremely weak relationship between the two combined variables (accumulated precipitation and AGDD), relative to the onset day of the year. This showed that there was only a 4% variance. The linear regression line in this graph was depicted by the black dashed line. Overall, we can say that while temperature (AGDD) significantly predicted the onset day of year for fruit and seed cone appearance,

accumulated precipitation did not add onto the accuracy of the predictions. The weak  $R^2$  value showed that there was a greater chance of other biological or environmental factors affecting the fruit yield rather than the precipitation levels.

### Discussion

In the introduction of this research paper, I briefly highlighted the reason for conducting this experiment and explained that my goal was to bridge a critical gap in the production of chokecherries. This gap, if addressed, could lead to a potential breakthrough and allow us to further assess conditions, develop predictive models, and design improved practices that ensure sustainable, high-quality yields each growing season. As we all are aware, global warming has caused weather patterns to become unpredictable, and inconsistent. With rapidly increasing temperatures, increase in the UV



## Kaur

index, rising Carbon dioxide levels, and many more environmental changes, it has become more challenging for farmers to follow and continue with old crop growing techniques. But the lack of research and data made it challenging to come up with possible solutions to this issue. With foundational research, predictive models could be designed that not only predict the conditions needed for the best fruit yield of a specific plant at the given moment, but they also allow us to predict how the climate and environmental conditions will change, and what steps they need to and can take to ensure the best and most productivity from their crops. (City of Chicago, n.d)

I selected chokecherries due to their high economic value in the Seattle region and their growing significance in global markets. Given the increasing demand and market potential, I viewed this study as a foundational research with the potential to inform best practices, guide other cherry cultivators through agronomic challenges, and mitigate factors that threaten the marketability of this important crop. My contribution to addressing this gap was to pinpoint the perfect set of conditions that were required for chokecherry trees to produce the maximum yield while also ensuring the best quality. From my research I found out that the temperature was the more significant climatic factor that controlled the production of chokecherries. Ideally, temperatures of 70°F to 85°F (21°C to 29°C) during growing seasons and 32°F and 45°F (0°C to 7°C) during dormancy are needed and strictly recommended for the best possible yield. Precipitation levels on the other hand do not significantly impact the fruit yield although the aim is for the chokecherry trees to get around moderate to high levels of rainfall, which would be around 15-25 inch annually, and in areas of lower precipitation, supplemental irrigation is required. During my research I found that participation contributes more towards fruit cracking, where excess rainfall leads to the decrease in quality of the fruits produced.

As for discussing the implications of stakeholders, I will start off by stating that the primary stakeholders of this research would be the cultivators or farmers who focus on this crop, agricultural planners, and other researchers and scientists who plan on helping create foundational or more complex predictive models. It is crucial for farmers and cultivators to understand the requirements and relationship between temperature and precipitation collectively and separately on the productivity of their crop. Understanding this and studying the models provided will aid them as they develop strategies against too high or too low levels of temperature and precipitation. These predictions give them enough time to set up preventive measures such as cooling mechanisms during higher temperatures or random heat waves or rain covers in case the precipitation levels rise unexpectedly. Additionally, irrigation mechanisms can also be set up in case the precipitation levels fall below the requirements.

In the case of agricultural planners, it is their duty to highlight and promote the trends and needs as the climate conditions change and help the farmers come up with plans relating to timings of the growing seasons as well as particular growth periods. By promoting new innovations and technologies as well as climate-resilient practices, they can help lower the adverse impacts of the varying and unpredictable climate and maximize good quality yield. They also are the ones who need to focus more towards weather forecasts and climate conditions and it is their responsibility to provide the farmers with this data, and a plan in order to get the best results and produce.

As for researchers and scientists, this research acts as a push in the direction of more in depth and specific research on varying climate and the effects of varying climate conditions on crops and in turn the economy of the world. This research is also applicable to many other crops and provides a great foundation to build upon. Overall, this research enhanced our knowledge



## The Relationship Between Temperature and Precipitation on Chokecherries

of what we already knew and provided researchers with more information that could be referenced back to when needed.

Although this research was very specific as it focused on two of the biggest factors that affected the fruit yield of chokecherry trees, there were certain limitations as well that cannot be ignored. One of the biggest ones being that this paper only focused on temperature (AGDD) and accumulated precipitation. While these two factors had the strongest impact on the quantity and quality of the yield, many other climatic factors such as humidity, wind, soil type, altitude, UV rays, etc. could have impacts on the fruit yield. Even if a certain condition had a relatively small impact, adding the rest of the conditions would amplify said impact and could potentially immensely change our results. Another limitation was the time frame that I was able to study as I was limited to 2014-2023. If I were to have studied a larger period, such as 2003-2023, I would have a larger data set and in turn a smaller uncertainty about my results. I would have also been able to study the climate and temperature changes as well as how the fruit yield seemed to have changed according to said temperature and precipitation level changes. Not only that, but the NPN database was also limited to just the United States, and it is entirely possible that other regions have different sets of conditions and research results compared to what I have.

Even though I filtered out the missing data, using NPN left me with inaccuracies and gaps within my research topic and additionally averaging the onset day of the year may have ruled out crucial peaks and variations in the data. All of the combined factors could have easily impacted the precision of my findings in significant ways. Additionally, a known fact is that using linear regression to analyze complex environmental and biological occurrences, is a way to oversimplify the relationships. If I were to further research this, I would opt for non-linear regression so as to hopefully get the idea

and understand the complexity of connections between my independent and dependent variables.

### Acknowledgement

I would like to thank Professor Trujillo for helping me by providing crucial and extremely useful data sources as well as teaching us how to analyze the data properly. I would also like to thank the USA National Phenology Network (NPN) for providing me with the data needed for this research.

(Data were provided by the USA National Phenology Network)



Kaur

### Works Cited

- Britannica. (n.d.). Chokecherry. In *Encyclopedia Britannica*. Retrieved July 17, 2024, from <https://www.britannica.com/plant/chokecherry/additional-info#history>
- City of Chicago. (n.d.). Climate impacts on agriculture and food supply. Retrieved July 17, 2024, from <https://climatechange.chicago.gov/climate-impacts/climate-impacts-agriculture-and-food-supply>
- Ibáñez, I., & Zakharova, L. (2016). The effect of environmental temperature on sweet cherry phenology. *ResearchGate*. Retrieved July 17, 2024, from [https://www.researchgate.net/publication/296607158\\_The\\_Effect\\_of\\_Environmental\\_Temperature\\_on\\_Sweet\\_Cherry\\_Phenology](https://www.researchgate.net/publication/296607158_The_Effect_of_Environmental_Temperature_on_Sweet_Cherry_Phenology)
- Natural Resources Conservation Service.(n.d.). Chokecherry: *Plant guide*. Retrieved July 17, 2024, from <https://www.nrcs.usda.gov/plantmaterials/kspmcpg5596.pdf>
- PictureThis AI. (n.d.). *Prunus virginiana* - temperature. Retrieved July 17, 2024, from [https://www.picturethisai.com/question/Prunus\\_virginiana-temperature1.html](https://www.picturethisai.com/question/Prunus_virginiana-temperature1.html)
- Upper Snake River Tribes Foundation. (2017). *Chokecherry climate summary sheet*. Retrieved July 17, 2024, from <https://uppersnakerivertribes.org/wp-content/uploads/2017/03/USRT-Chokecherry-Climate-Summary-Sheet-Final.pdf>



# RODENTIA SPECIES DID NOT FOLLOW THE LATITUDINAL DIVERSITY GRADIENT DURING THE MIOCENE

Yordanos Berhane

**ABSTRACT:** *The latitudinal diversity gradient (LDG) suggests that species richness increases as they get closer to the equator, but it is unclear whether this trend applies to rodents. Rodents are widespread across various ecosystems which makes them an ideal species to study biodiversity patterns and conservation. Understanding whether they follow the LDG during the Miocene can provide insight into how environmental factors such as tectonic activity influenced species distribution. I chose the Miocene epoch due to its close resemblance to present Earth geography while still experiencing environmental shifts to analyze how these shifts shaped rodent diversity and how similar changes affect this group today. This paper evaluated the hypothesis that there was a statistically significant correlation between latitudinal ranges and Rodentia species richness during the Miocene. Using data from the Paleobiology Database, a linear regression analysis conducted yielded a p-value of 0.619. The results indicate that there was no statistically significant relationship between latitudinal range and species richness which suggests that the latitudinal diversity gradient does not apply to rodents. Plate tectonic activity in the Miocene that led rodents to adapt and survive to various environments rather than temperature changes explain these results.*

**Keywords:** Rodentia, Latitudinal Diversity Gradient, Miocene, Mammalia, Tectonic Activity, Species Richness, Linear Regression

## Introduction

Latitudinal diversity gradient (LDG) describes the increase in species richness of most animals and plants as one moves toward the equator—a pattern seen across geographic regions (Mittelbach et al., 2007). Although extensive research supports this trend, the underlying causes are not well known (Mittelbach et al., 2007). Proposed hypotheses include the Evolutionary Time Hypothesis, which suggests that new species originated in the tropics due to factors such as stable environments and larger areas (Hillebrand, 2004) and the Out of the Tropics Hypothesis, which states that species tend to disperse away from the equator over time (Jablonski et al., 2006).

Rodents inhabit most parts of the world, with approximately twenty-five percent of all rodent species residing in the Neotropical region (Amori et al., 2013). Zoologist Giovanni Amori, Professor of Zoology Carlo Rondinini and Wildlife Ecologist Jan Schipper performed a study with the goal of identifying regions with high rodent diversity and emphasized the importance of studying these species for both conservation efforts and the species' role within ecosystems (Amori et al., 2013). While the pattern of increasing species richness toward the tropics is evident in both terrestrial and marine mammals, rodents are an exception (Mannion, 2020). Contemporary data demonstrates that rodents do not follow the latitudinal diversity gradient (Buckley et al., 2010). This discovery challenges long-standing assumptions in paleontology and brings about new possibilities





for exploring rodent biogeography.

In this paper, I will assess the hypothesis that there is a statistically significant correlation between *Rodentia* species richness and latitudinal ranges. I predict that there is a positive correlation, with the number of rodent species increasing as they get closer to the equator, due to the latitudinal diversity gradient theory.

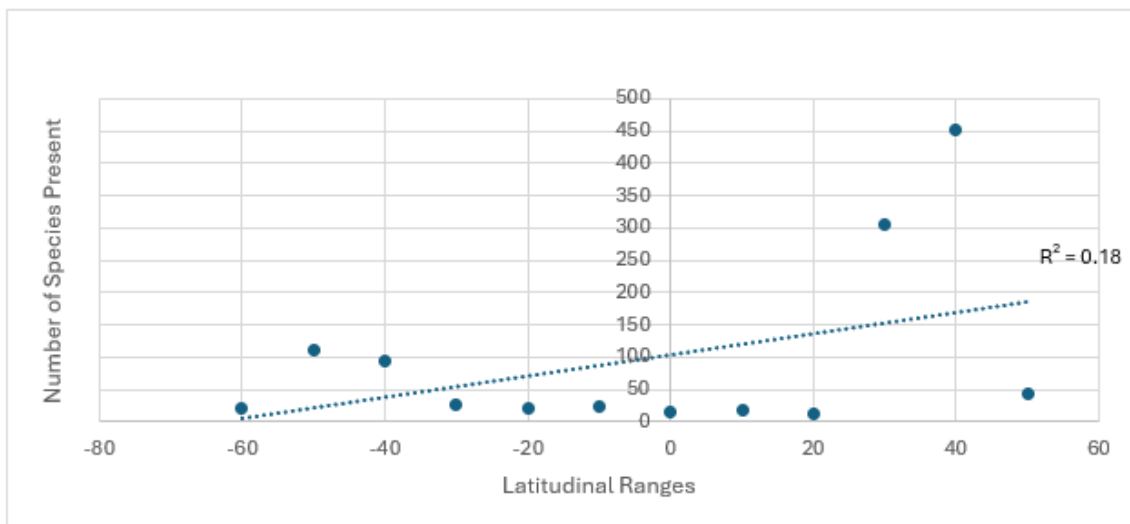
### Materials and Methods

The data of all mammals alive in the Paleocene and Eocene was downloaded from the Paleobiology Database on September 23, 2023 (<https://paleobiodb.org>) into an Excel file. From this spreadsheet, I extracted *Rodentia* data from this file. The mammals' dataset was filtered by excluding all names aside from *Rodentia* from the Order column. According to the Geological Time Scale, the Miocene ranged from 5.33 million years to 23.03 million years ago, so any genera younger than 5.33 million years ago and older than 23.03 million years ago were removed. Species that might fall outside the Miocene were also excluded to ensure that

only those within the intended time period were analyzed. The data was studied at the species level to reduce the number of specimens while allowing more precise analysis, as opposed to analyzing the data at the genus level, which would result in more specimens but less precision. A pivot table was created after concatenating all the genera and species names then the data transferred under a new "genus. species" column. The pivot table was then modified to show the maximum and minimum paleolatitude for the species. A linear regression test was conducted to evaluate the prediction that there is a correlation between latitudinal range and the number of species present. A significance level of 0.05 was chosen, as this is not a high-risk test. A p-value of less than 0.05 would indicate a statistically significant relationship between the two variables. All analyses were conducted in Excel.

### Results

A linear regression test was conducted to compare the number of species present and latitudinal ranges. This test resulted in a p-value



*Figure 1.* There is no statistically significant relationship between latitudinal range and species richness of *Rodentia* during the Miocene, Linear regression, p-value=0.169,  $R^2=0.18$  which means that 18% of the variation in dependent variable (latitudinal range) can be explained by the variation in independent variable (number of species present), accept  $H_0$ : there is no statistically significant relationship between latitudinal range and species richness of Miocene *Rodentia*.



within the latitudinal range of 40°-49.9°, while only 15 species found in the 0°-9.9° latitudinal range. The number of species ranging from 40° South to 20° North is the lowest, resulting in a distribution that is skewed to the left (Figure 1).

### Discussion

Based on the results of the linear regression test, the research hypothesis is rejected: there is no statistically significant relationship between latitudinal range and species richness of *Rodentia* during the Miocene. The resulting p-value exceeded the acceptable significance threshold of 0.05, indicating that the latitudinal diversity gradient (LDG) does not apply to the *Rodentia* species analyzed in this study.

As previously mentioned, the LDG has been widely documented in earlier studies which showed that species tended to live closer to the equator and away from the poles (Mittelbach et al., 2007). However, this pattern was not observed in this study. Out of the 916 fossils in my dataset, 452 were found within the latitudinal range of 40°-49.9° and only 15 species were found in 0°-9.9° latitudinal range. Notably, the number of species recorded between 40° South and 20° North was the lowest, resulting in a left-skewed distribution (Figure 1). Additionally, my graph lacked the expected peak in species richness near 0°, contrasting with typical diagrams that depict highest species richness and density near the equator (Gaston, 2000). In discussions of latitudinal diversity gradients, a controversial issue is whether species richness varies with latitude. While some argue that species tend to be most abundant in the tropics (Mittelbach et al., 2007), others contend that making broad assumptions can be misleading and overlook important outliers (Jablonski et al., 2006).

### Plate Tectonics in the Miocene

Much of the flora and fauna that seen today resemble those found in the Miocene

(Steinhorsdottir, 2020). The Earth's geography was also similar to that of the Miocene Era. Changes in temperature were evident, with periods of global warming followed by a period of cooling. Although mammalian dispersal typically went from Europe to Africa, the early Miocene saw the Proboscidea Datum Event, which marked the migration of African and North American mammals to Eurasia (Van der Made et al., 2003). This event was caused by tectonic shifts that brought Africa and India closer, along with consistently low sea level that formed land connections between Africa and the rest of Eurasia, where it had a warmer climate (Van der Made et al., 2003). As the years progressed to the Middle and Late Miocene, these mammals started to go extinct due to Europe's drier conditions that made it hard to survive with smaller mammals being able to adapt (Steinhorsdottir, 2020).

A study conducted by paleobiologist John Alroy and researchers specialized in geosciences analyzed why the species richness of mammals that resided in the United States did not follow the latitudinal diversity gradient trend. Their findings state that the increase in mammalian species was driven by tectonic activity that reshaped the landscape, rather than by significant changes in global temperature (Alroy et al., 2000). United States is a key area of focus, as it lies around 40° North—where my results show the highest rodent species richness. One of the major tectonic events occurred during the Mid-Miocene Climatic Optimum, when the western United States fragmented, leading to a peak in species richness in the mountain regions. This increase was caused by the arrival of species unique to those areas (Barnosky, 2002). In brief, the rise in American rodent species was not due to the LDG but rather by geological changes, explaining the low species richness near the equator and the peak around 40° North observed in my results.



## Rodentia and Climate During the Miocene

During the early to middle Miocene, rodents migrated southward as the availability of livable areas expanded from higher to lower latitudes. The peak of this biodiversity occurred in the early Vallesian (Late Miocene) period in the Iberian Peninsula, where a wide variety of species cohabited. Later, around 9.7 million years ago, there was a period called the Vallesian Crisis, where there was a decline in rodents adapted to forests and humid environments and the latitudinal gradient in species richness began to even out (Madern et al., 2018). Another study, conducted by researchers at the University of Michigan, examined 418 fossil rodent species found in North America dating back to 20 million years ago. This study aimed to understand the relationship between species richness and topographic complexity. It concluded that species diversity increased during the Miocene Climate Optimum—when the Earth was warming up and shifting— but declined during the subsequent cooling period, as rodents migrated to areas with little to no tectonic activity (Finarelli et al., 2010). As more habitats became available, rodents were no longer confined to specific latitudes. They adapted to changing environmental conditions and migrated toward regions with minimal tectonic activity, highlighting how those geological processes—rather than latitude— influenced rodent distribution.

## Limitations and Future Work

Although the data used came from the Paleobiology database and included all recorded fossils under the genus *Rodentia*, bias may be introduced during the filtering process. Numerous species were removed from the database during the statistical analysis due to incomplete data. Although there were around 1,000 samples available, the exclusion of outliers could have skewed the results or led to false conclusions. Possible outliers included

fossils that were not identified to the species and/or genus level but may still have belonged to the designated period. These results could start a discussion about species that do not follow the latitudinal diversity gradient, in which diversity peaks at the equator. Future studies could examine rodent extinction rates during the Miocene and how these events affected neighboring ecosystems, comparing them to how it is currently.

## Acknowledgments

I would like to thank Professor for aiding me through this process and the University of Washington Bothell Library databases and librarians for providing the resources for my research. I would like to also acknowledge my peer reviewers for giving constructive feedback and comments.

## References

- Alroy, J., Koch, P. L., Zachos, J. C. (2000). Global climate change and North American mammalian evolution. *Paleobiology*, 26(S4), 259-288.
- Amori, G., Chiozza, F., Patterson, B. D., Rondinini, C., Schipper, J., & Luiselli, L. (2013). Species richness and distribution of Neotropical rodents, with conservation implications. *Mammalia*, 77(1), 1-19.
- Barnosky, A. D., & Carrasco, M. A. (2002). Effects of Oligo-Miocene global climate changes on mammalian species richness in the northwestern quarter of the USA. *Evolutionary Ecology Research*, 4(6), 811-841.
- Finarelli, J. A., & Badgley, C. (2010). Diversity dynamics of Miocene mammals in relation to the history of tectonism and climate. *Proceedings of the Royal Society B: Biological Sciences*, 277(1694), 2721-2726.
- Gaston, K. J. (2000). *Global patterns in biodiversity*. *Nature*, 405(6783), 220-227.



## Rodentia and the Latitudinal Diversity Gradient During the Miocene

- Jablonski D, Roy K, Valentine JW. (2006). Out of the Tropics: Evolutionary Dynamics of the Latitudinal Diversity Gradient. *Science*. 314(5796):102–106.
- Madern, P. A., van de Put, J. M., Casanovas-Vilar, I., & van den Hoek Ostende, L. W. (2018). Iberian micromammals show local extent of Vallesian Crisis. *Paleogeography, Palaeoclimatology, Paleoecology*, 496, 18-31.
- Mannion, P. D. (2020). A deep-time perspective on the latitudinal diversity gradient. *Proceedings of the National Academy of Sciences*, 117(30), 17479-17481.
- Mittelbach, G. G., Schemske, D. W., Cornell, H. V., Allen, A. P., Brown, J. M., Bush, M. B., . . . Turelli, M. (2007). Evolution and the latitudinal diversity gradient: speciation, extinction and biogeography. *Ecology Letters*, 10(4), 315-331. doi:10.1111/j.1461-0248.2007.01020.x
- Steinhorsdottir M, Coxall HK, de Boer AM, Huber M, Barbolini N, Bradshaw CD, Burls NJ,
- Feakins SJ, Gasson E, Henderiks J. (2020). The Miocene: the Future of the Past. *Paleoceanography and Paleoclimatology*. 36(4).
- Van der Made, J., Agustí, J., & Morales, J. (2003). The Vallesian Crisis in the Iberian and European mammal records. *EEDEN*. 59.







# EFFECTS OF THE PALEOCENE-EOCENE THERMAL MAXIMUM ON FRESHWATER PLANT DISTRIBUTION AND ITS RELATION TO MODERN CLIMATE CHANGE

Victoria Jeffords

*ABSTRACT: Amidst the current trajectory of global warming, researching past warming events in our planet's history offers a benchmark for contextualizing present-day conditions, enabling us to anticipate consequences that are currently unknown. The following research embraces this notion by testing the hypothesis that the distribution of plants in freshwater aquatic environments changed because of a rapidly warming climate during the Paleocene-Eocene thermal maximum. This was done by comparing the number of aquatic and terrestrial plant species present between the Paleocene and Eocene epochs via a  $\chi^2$  test. The analysis revealed a notable increase in distribution of aquatic plants from the Paleocene to the Eocene. This potentially resulted in impaired water quality, eutrophication, and a decline in aquatic biodiversity. Given our dependence on freshwater resources, if similar trends were to manifest as a response to present day climate change, it could pose significant risks to life on Earth.*

**Keywords:** biodiversity, climate change, dispersal, epochs, eutrophication, freshwater, global warming, Paleocene-Eocene thermal maximum.

## Introduction

A rapid increase in global carbon emissions over recent centuries has initiated a climate crisis unprecedented for humanity, though not for Earth. Similar warming periods, albeit naturally occurring, have occurred throughout Earth's geological history (Röhl et al. 2007). Understanding the environmental transformations that occurred during these past warming events is crucial for adapting to the current climate crisis. The fossil record serves as an invaluable tool, enabling us to investigate historical climate changes and better prepare for future challenges (Mann et al. 2008).

One of the best-known instances of a temporary climate disruption is the Paleocene-Eocene thermal maximum (PETM), which was an intense period of global warming and a significant disturbance of the global carbon cycle caused by a massive injection of carbon

into the ocean and atmosphere (Röhl et al. 2007). Under these conditions, the Earth faced an average global temperature increase of 5–8 °C which persisted for about 200,000 years (Haynes and Hönisch 2020). Estimates of the amount of average global temperature rise at the start of the PETM ranged from approximately 3 to 6 °C to between 5 and 8 °C, which worryingly coincides with the 3.3 to 7.6 °C of warming expected by 2100 (McInerney and Wing 2011; Calvin et al. 2023). With parallels being drawn between the PETM and current warming predictions, understanding the changes that might have occurred in the past may prove to be crucial for the persistence of human life on earth.

Freshwater resources are indispensable for sustaining life on Earth; understanding the implications of a warming climate on freshwater ecosystems enables more effective conservation efforts. Examining the impacts



## Jeffords

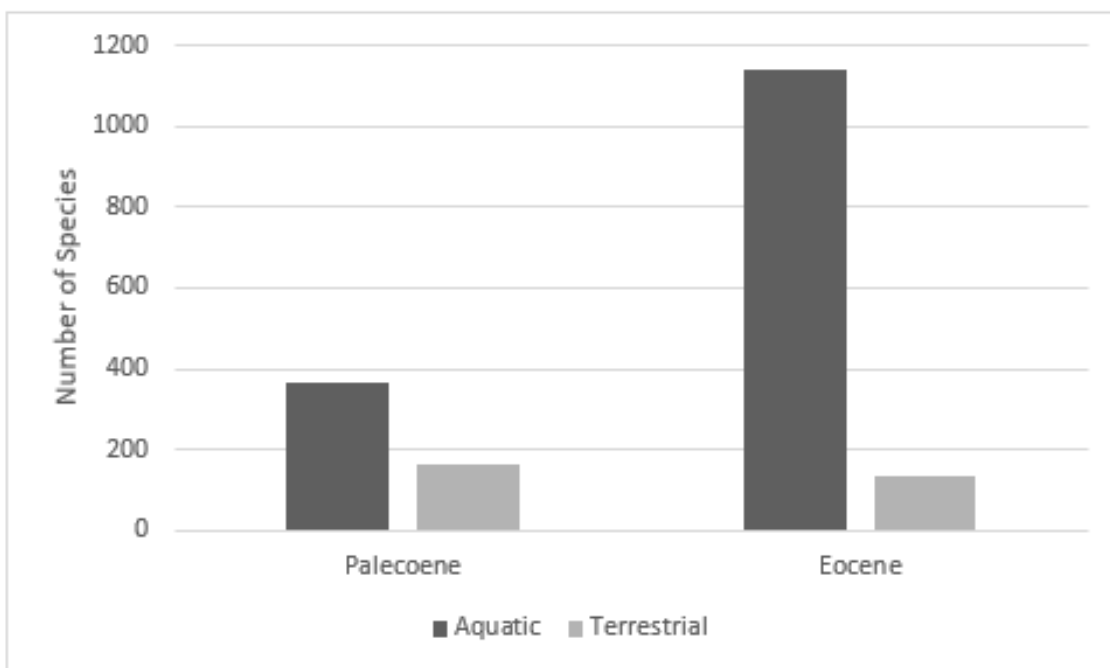
of global warming on plants, the fundamental building blocks of ecosystems, offers valuable insights into the state of freshwater ecosystems during the PETM. In response to current climate change, evidence has suggested that freshwater plant species have experienced range shifts in the past century (Heino et al. 2009). While there exists a scarcity of historical data on the distribution of species in certain locations or regions which restricts predicting or observing shifts in distribution, identifying trends in species distribution between the Paleocene and Eocene epochs can lay a foundational understanding of where we might anticipate finding plants in the future and how their distribution could change with warming (Heino et al. 2009).

Paleobiologic data was used in this study to test the hypothesis that the distribution of plants in freshwater aquatic environments changed due to a rapidly warming climate during the PETM. The result that freshwater plant species increased between the Paleocene and

Eocene epochs indicates that warming aquatic temperatures induced by climate change had positive effects on plant species.

### Materials and Methods

The dataset of all plant species alive in the Paleocene and Eocene was downloaded from the Paleobiology Database on September 23, 2023 (<https://paleobiodb.org>). From this spreadsheet, the data was distinguished by whether the plant species was terrestrial or aquatic. This resulted in two variables: an environmental variable and a temporal variable indicating whether the species existed during the Paleocene or the Eocene. A  $\chi^2$  test was then applied to test the prediction that there was a change in the frequency of aquatic freshwater plant species when compared to terrestrial plant species between the Paleocene and the Eocene epochs because of atmospheric warming attributed to the Paleocene-Eocene thermal maximum.



*Figure 1. Analysis of Aquatic and Terrestrial Plant Populations Across the Paleocene and Eocene Epochs. The results indicate an increase in the frequency of aquatic plant species between the Paleocene and Eocene epochs. A  $\chi^2$  test was employed, resulting in a p-value of  $0.044 \times 10^{-56}$ .*



A standard significance level of 0.05 was used since the analysis did not involve critical outcomes. All analysis was conducted in Microsoft Excel.

## Results

To test the hypothesis that warming atmospheric temperatures resulted in a change in aquatic plant populations from the Paleocene to the Eocene, it was predicted that there would be an increase in aquatic plant species between the two periods. A  $\chi^2$  test was applied to compare the number of species during the Paleocene and during the Eocene. This test resulted in a p-value of 4.41341E-54. This p-value is considered statistically significant and indicates that the chance that the relationships tested are due to chance is low, essentially approaching zero. Therefore, the relationships observed are highly unlikely to be the result of random processes. As a result, the statistical null hypothesis is rejected, and the research prediction is accepted (Figure 1).

## Discussion

Based on the results of the  $\chi^2$  test, the research hypothesis is accepted, indicating that the relative distribution of freshwater plants increased between the Paleocene and Eocene. This change can likely be attributed to the drastically warming climate.

### Growth Rates

A positive correlation exists between temperature increase and photosynthetic activity (Wang et al. 2023). Warmer temperatures and higher levels of carbon dioxide in the air—both key factors during the PETM—can enhance the rate of photosynthesis, which is the process by which plants convert sunlight, carbon dioxide, and water into energy. This, in turn, promotes faster growth and wider spread of plant species. (De Graaff et al. 2006). For instance, an experiment conducted by Zhang et al. to confirm

the relationship between increased aquatic temperatures and plant growth found that heightened temperatures increased the growth of all plants tested, suggesting that warming generally stimulates aquatic plant proliferation (Zhang et al. 2019). If similar conditions occurred between the Paleocene and Eocene epochs, it would be evident in the fossil record as an increase in species distribution. While this aligns with the analysis conducted between the Paleocene and Eocene, the findings from Zhang et al. are broadly generalizable and cannot independently confirm PETM-specific trends; however, they support the hypothesis that a rapidly warming climate could have contributed to a shift in the distribution of freshwater aquatic plants during that period. Therefore, the recorded increase in aquatic plant biota during these epochs may plausibly be linked to global climate changes, aligning with the proposed hypothesis.

### Reduced Predation

A decrease in predation of aquatic plants may have also contributed to the rise in the dispersal of aquatic species between the Paleocene and Eocene epochs. As previously discussed, increased temperatures promote higher rates of photosynthesis and plant growth. This can result in algal blooms—rapid increases in phytoplankton populations—which, upon decomposition by aerobic bacteria, consume large amounts of dissolved oxygen (Diaz and Rosenberg 2008; Schleyer and Vardi 2020). The resulting conditions reduce water quality and threaten the survival of many aquatic organisms, particularly predators and herbivores that rely on sufficient oxygen levels (Diaz and Rosenberg 2008). Under such stress, these organisms likely struggled with the rapidly changing climatic conditions of their environment due to insufficient time for adaptation. As their populations declined or their feeding activity was reduced, plant-eating pressures would have decreased, allowing for aquatic vegetation to grow unchecked. Accelerated growth and



reduced predation are interconnected and together form an explanation for the observed shift in aquatic plant distribution during the PETM. Rapid growth increases the plants' ability to expand or colonize new areas, with the absence or decline in grazing species removes natural inhibitors from that expansion. This ties in with the hypothesis that plant distributions in freshwater environments changed in response to rapid warming during the PETM.

However, some research suggests that warming could increase herbivore consumption rates. For instance, warming amplifies the consumption rate of plants by ectothermic, or cold-blooded, omnivores and herbivores (Zhang et al. 2018). As water temperatures rise, the metabolic rate of these animals accelerate, increasing their overall energy requirements. As such, warming is expected to strengthen interactions between plant-eating animals and aquatic plants, leading to increased grazing pressure that helps keep plant growth in check, known as top-down control. In this case, warming would enhance top-down control rather than weaken it (Zhang et al. 2019). Yet, these findings may not fully apply to the PETM, as they disregard the potential adaptive responses of ectothermic omnivores and herbivores to rapid and extreme climate change. Therefore, while modern data present a nuanced picture, the unique pace and intensity of the warming during the PETM likely created conditions in which aquatic plant species could expand their distribution due to diminished predation.

### Relevance

With escalating rates of global warming, utilizing historical instances of similar warming periods such as the PETM as a tool to gain insight into the potential consequences of climate change is imperative for securing a future for life on Earth (Mann et al. 2008). However, complex interactions within the climate system—such as feedback loops involving cloud cover, ocean circulation changes, and permafrost thawing—

make it difficult to predict future outcomes with certainty, thereby impeding accurate climate projections (Pachauri et al. 2015). These interactions can either amplify or dampen climate change effects, complicating our ability to forecast specific regional or global impacts. This is significant as freshwater sources, which are crucial for sustaining biota, remain vulnerable (Bates et al. 2008). The results suggest that rising global temperatures will lead to an increase in aquatic plant abundance. Consequently, this could result in reduced biodiversity via eutrophication and a higher dissolved oxygen content in our freshwater sources, necessitating additional energy and resources to ensure the water remains usable. Human populations rely on freshwater resources to grow crops, raise livestock, produce energy, manufacture and distribute goods, and support the economy (US EPA 2022 Oct 18 ). Therefore, placing emphasis on preserving these resources in the wake of climate change is imperative for securing our collective future – by anticipating what lies ahead, we can better prepare.

### Limitations and Future Work

An additional  $\chi^2$  test comparing the distribution of freshwater plant predators from the Paleocene to the Eocene epochs is needed to provide a clear conclusion regarding whether the increase in freshwater plant distribution can be attributed to decreased predation. This statistical analysis will provide further insight into whether aquatic fauna succeeded in adapting to the warming conditions. Furthermore, analyzing the past consequences of the Paleocene-Eocene Thermal Maximum on aquatic flora presents challenges in determining whether similar events are unfolding in response to current global warming trends. While evidence suggests that freshwater species have undergone range shifts in the past century, the scarcity of historical data on species distribution in certain locations or regions restricts the basis for predicting or observing shifts in species distribution when comparing historical data (Heino et al. 2009). So, despite



observing definite range shifts backed by data in specific regions, there is a lack of definitive evidence to conclude that this is a global occurrence. Future efforts should prioritize the collection and global availability of such data, facilitating a point for future comparisons as climate change progresses.

### Acknowledgments

I express my sincere gratitude to Dr. Becca Price for her invaluable support in both data collection and analysis, as well as for her mentorship throughout the production of this paper. Special thanks also go to Erin Holtz for her role in peer reviewing the Method and Results sections. Lastly, I extend my appreciation to Ms. Chelsea Nesvig for her guidance in navigating the resources of the University of Washington's Library and her mentorship in locating relevant research articles.

### Literature Cited

- Bates B, Kundzewicz ZW, IPCC, editors. 2008. Climate change and water. (IPCC Technical Paper; 6).
- Calvin K, Dasgupta D, Krinner G, Mukherji A, Thorne PW, Trisos C, Romero J, Aldunce P, Barrett K, Blanco G, et al. 2023. IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. *First. Intergovernmental Panel on Climate Change* (IPCC). [accessed 2024 May 23]. <https://www.ipcc.ch/report/ar6/syr/>.
- De GRAAFF M-A, Van GROENIGEN K-J, Six J, Hungate B, Van KESSEL C. 2006. Interactions between plant growth and soil nutrient cycling under elevated CO<sub>2</sub>: a meta-analysis. *Global Change Biology*. 12(11):2077–2091. doi:10.1111/j.1365-2486.2006.01240.x.
- Diaz RJ, Rosenberg R. 2008. Spreading Dead Zones and Consequences for Marine Ecosystems. *Science*. 321(5891):926–929. doi:10.1126/science.1156401.
- Haynes LL, Hönisch B. 2020. The seawater carbon inventory at the Paleocene–Eocene Thermal Maximum. *Proc Natl Acad Sci U S A*. 117(39):24088–24095. doi:10.1073/pnas.2003197117.
- Heino J, Virkkala R, Toivonen H. 2009. Climate change and freshwater biodiversity: detected patterns, future trends and adaptations in northern regions. *Biological Reviews*. 84(1):39–54. doi:10.1111/j.1469-185X.2008.00060.x.
- Mann ME, Zhang Z, Hughes MK, Bradley RS, Miller SK, Rutherford S, Ni F. 2008. Proxy-based reconstructions of hemispheric and global surface temperature variations over the past two millennia. *Proceedings of the National Academy of Sciences*. 105(36):13252–13257. doi:10.1073/pnas.0805721105.
- McInerney FA, Wing SL. 2011. The Paleocene-Eocene Thermal Maximum: A Perturbation of Carbon Cycle, Climate, and Biosphere with Implications for the Future. *Annu Rev Earth Planet Sci*. 39(1):489–516. doi:10.1146/annurev-earth-040610-133431.
- Pachauri RK, Mayer L, Intergovernmental Panel on Climate Change, editors. 2015. Climate change 2014: synthesis report. Geneva, Switzerland: *Intergovernmental Panel on Climate Change*.
- Röhl U, Westerhold T, Bralower TJ, Zachos JC. 2007. On the duration of the Paleocene-Eocene thermal maximum (PETM). *Geochemistry, Geophysics, Geosystems*. 8(12). doi:10.1029/2007GC001784. [accessed 2024 May 23]. <https://onlinelibrary.wiley.com/doi/abs/10.1029/2007GC001784>.
- Schleyer G, Vardi A. 2020. Algal blooms. *Current Biology*. 30(19):R1116–R1118. doi:10.1016/j.cub.2020.07.011.
- US EPA O. 2022 Oct 18. Climate Change Impacts on Freshwater Resources. [accessed 2024 Apr 30]. <https://www.epa.gov/climateimpacts/climate-change-impacts-freshwater-resources>.
- Wang L, Zheng J, Wang G, Dang Q-L. 2023. Combined effects of elevated CO<sub>2</sub> and warmer temperature on limitations to photosynthesis and carbon sequestration in yellow birch. *Tree Physiology*. 43(3):379–389. doi:10.1093/treephys/tpac128.





## Jeffords

Zhang P, Blonk BA, van den Berg RF, Bakker ES. 2018. The effect of temperature on herbivory by the omnivorous ectotherm snail *Lymnaea stagnalis*. *Hydrobiologia*. 812(1):147–155. doi:10.1007/s10750-016-2891-7.

Zhang P, Grutters BMC, van Leeuwen CHA, Xu J, Petruzzella A, van den Berg RF, Bakker ES. 2019. Effects of Rising Temperature on the Growth, Stoichiometry, and Palatability of Aquatic Plants. *Front Plant Sci*. 9. doi:10.3389/fpls.2018.01947. [accessed 2024 May 9]. <https://www.frontiersin.org/journals/plant-science/articles/10.3389/fpls.2018.01947/full>.



# BENTHIC FORAMINIFERA FOUND TO HAVE SURVIVED BETTER DURING THE PALEOCENE-EOCENE THERMAL MAXIMUM WITH IMPLICATIONS TO A FUTURE MASS EXTINCTION EVENT

Liz Macias

*ABSTRACT: This research aims to test whether, during the Paleocene-Eocene Thermal Maximum (PETM), planktonic foraminifera were greater victims of the global extinction event than benthic foraminifera because they were more exposed to global warming events due to living in the open water column. Data for all taxa alive during the PETM was pulled from the Paleobiology Database (PBDB). Then planktonic and benthic foraminifera-specific data were extracted from the datasheet. To test the hypothesis a  $\chi^2$  (chi-squared statistic) test was applied using the variables planktonic, benthic, Paleocene, Eocene, and frequency of species. The results from the test showed that the frequency of benthic foraminifera increased from the Paleocene to the Eocene while the frequency of planktonic foraminifera decreased. Based on these results we may infer that benthic forams survived better during the PETM than planktonic forams because they are present on the seafloor and therefore less exposed to the dangers of global warming events. Upon further investigation of the strength of the findings reported in the literature these results appear to be spurious. This may be attributed to the datasheet used from the Paleobiology Database (PBDB), there were many gaps in the data, leaving opposite results of what other literature has discovered.*

**Keywords:** Benthic foraminifera, planktonic foraminifera, PETM, implications for the future, global warming

## Introduction

The Paleocene-Eocene Thermal Maximum (PETM) is known to be the largest and fastest onset global warming event (Moretti et al., 2024). The PETM occurred 56 million years ago and caused a major global mass extinction, one of the first species to face extinction was foraminifera. The decline in the carbon-13- to carbon-12 ratio preserved materials in marine sedimentary archives, called the carbon isotope excursion (Moretti et al., 2024). This created a geological record of foraminifera, which we use to help us predict future climate projections (Moretti et al., 2024). During the PETM global average temperatures rose to at least 5 degrees

celsius and created a wide spread of ocean acidification (Moretti et al., 2024).

Previous data we have from the way that foraminifera lived through a mass global extinction can be used to show us future trends with current foraminifera, making this comparison relevant to current anthropogenic warmings. Foraminifera are single celled calcareous marine zooplankton with well constrained phylogenies and a very long fossil record, which makes them great candidates for studies in evolution and relationships between diversity and climate change (Wade and Olsson, 2009). They can be found in the deep parts of the oceans or more shallow regions; benthic forams can have microhabitats of infaunal



(living within sediment) or epifaunal (living in the uppermost part of the seafloor) (Alegret et al. 2021), while planktonic foraminifera are mainly distributed in the open water columns.

In discussion of the PETM, planktonic and benthic foraminifera, and implications for the future. A controversial issue is created with benthic foraminifera and if they were greater victims of the PETM compared to planktonic forams. While some argue that there was a major extinction of benthic foraminifera, most of the planktonic forams did not experience any mass extinction (McInerney & Wing, 2011). Others contend that modern ecology suggests a positive correlation between abundance and survivorship. However, in research on bivalves which are a similar species to forams, it was found that there is no link between the two forams (Lockwood, 2003). Research on PETM or other similar rapid global change intervals can offer us geological parallels for future anthropogenic warmings, but there is still much research to be done (McInerney & Wing, 2011). Therefore, this study is necessary to help us gain more knowledge for a possible future mass extinction event.

This study tests the hypothesis that during the PETM, planktonic foraminifera were greater victims of the global extinction event than benthic foraminifera because they were more exposed to global warming events due to living in the open water column. However, contrary to my prediction, benthic foraminifera were more exposed to global warming events, and planktonic foraminifera were better able to survive the PETM due to being able to migrate to the poles to escape warmer waters.

### Materials and Methods

The data for all taxa alive in the Paleocene and Eocene epochs were downloaded from the Paleobiology Database on September 23, 2023 (<https://paleobiodb.org>). From this spreadsheet, planktonic forams and benthic forams were

extracted to include semi-infaunal, epifaunal, and infaunal all from the Paleocene and Eocene.

To clean this data, all non-foraminifera were filtered out from the database and a pivot table was created with all planktonic and benthic foraminifera from the Paleocene, and all planktonic and benthic foraminifera from the Eocene.

A  $\chi^2$  test was applied to analyze the data, a  $\chi^2$  test is a statistical hypothesis-testing method in which observed frequencies are compared with expected frequencies for experimental outcomes. The test seeks to identify whether a disparity between actual and predicted data is due to chance or due to a link between the variables under consideration.

This statistical hypothesis-testing method was used to test the prediction that the relative diversity of the planktonic foraminifera in the Paleocene will drop during the Eocene. While benthic foraminifera's relative diversity will increase during the Eocene versus the Paleocene. A significance level ( $\alpha$ ) of 0.05 was used because that is the convention for studies such as this one. The  $\alpha$ -value (or level of significance) is the threshold used to decide whether to reject the null hypothesis in a  $\chi^2$  test. Meaning if the p-value is less than or equal to 0.05, there is enough evidence to reject the null hypothesis. A p-value is the strength of evidence against the null hypothesis. A p-value less than or equal to 0.05 indicates that the observed values differ from the expected values.

The first variable used in this test was time, further defined as Paleocene and Eocene to deal with the PETM. The other variable was the number of species of Foraminifera, further defined as planktonic and benthic, allowing the use of the  $\chi^2$  test.

All analysis was conducted in Microsoft Excel.



## Results

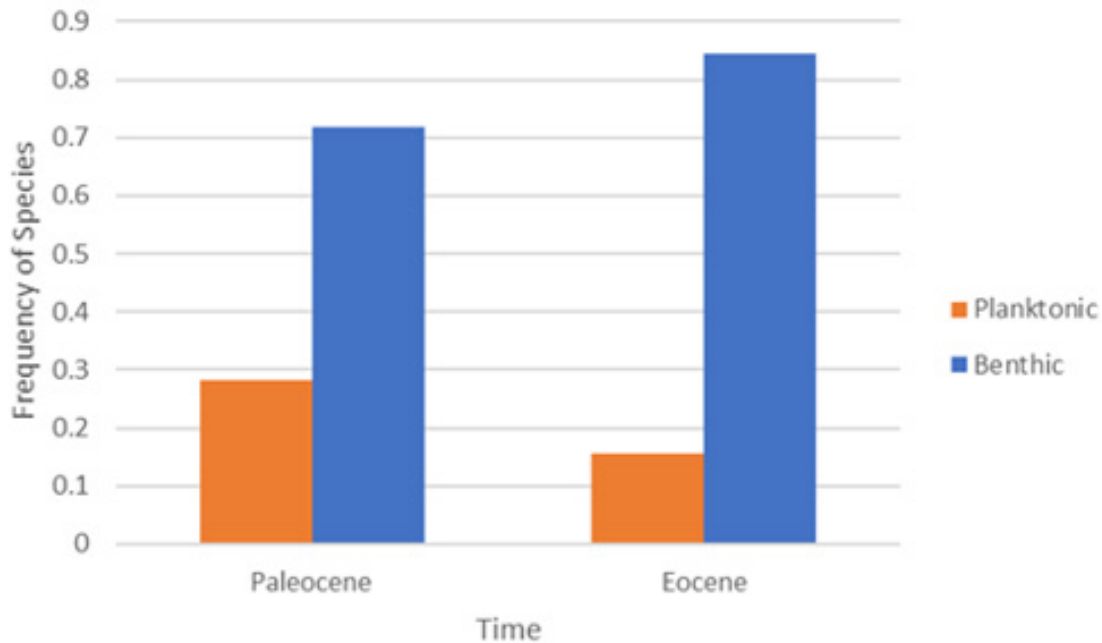


Figure 1. Frequency of benthic and planktonic Foraminifera species from the Paleocene and Eocene. A  $\chi^2$  test was used and a p-value of 0.0076 was found from the number of benthic and planktonic foraminifera.

To test the hypothesis that during the PETM planktonic foraminifera were greater victims of the global extinction event than benthic foraminifera. It was predicted that the relative diversity of the planktonic foraminifera in the Paleocene would drop during the Eocene, while benthic foraminifera's relative diversity will increase during the Eocene versus the Paleocene. A  $\chi^2$  test was applied to compare time and frequency of species see figure 1. The test resulted in a p-value of 0.0076. This p-value means there is a 0.76% chance that the relationships tested are a result of random processes. Therefore, the statistical null hypothesis can be rejected (Figure 1). However, the research prediction will also be rejected due to stronger data from the primary literature.

## Discussion

The  $\chi^2$  test results show that the null hypothesis can be rejected due to the statistical

significance between the frequency of planktonic foraminifera decreasing from the Paleocene to the Eocene, and the benthic foraminifera increasing. However, even though the results point to an acceptance of the research hypothesis that planktonic forams are less common in the Eocene, findings from articles in the primary scientific body of knowledge uniformly report that planktonic forams survived the PETM better than benthic ones.

## Other, More Complete Databases

The rejection of the research hypothesis in this study is due to its limitations. The data used in this study was gathered from the Paleobiology Database. In this database, the most logical explanation is that there were many gaps within the foraminifera data, which led to false acceptance of the research prediction. This gap in the data is relevant because there are other more complete databases such as The World



Foraminifera Database, which has all species of foraminifera ever described with recent fossil data. Also, in the larger scientific body of knowledge, it is discussed that the Paleocene-Eocene transition was one of the biggest benthic foraminifera extinction intervals (McInerney & Wing, 2011). Their extinction was attributed to lower oxygen levels, food supply changes, and exposure to higher temperatures due to the PETM (McInerney & Wing, 2011) these are opposite results found from the  $\chi^2$  test.

### **Planktonic Foraminifera Survival During the PETM**

It is also widely known in the scientific body of knowledge that planktonic foraminifera numbers didn't seem to significantly decrease during the PETM. Planktonic foraminifera were found to have increased in size due to increased growth and or grazing rates (Barrett et al., 2023). This increase in size can reflect their success in avoiding extinction (McInerney & Wing, 2011). Planktonic foraminifera also shifted geographic ranges and moved to higher latitudinal sites before and during the PETM to avoid major temperature increases that would be above their optimal range (McInerney & Wing, 2011).

In other articles it was also discovered that in the middle Eocene, certain subspecies of planktonic foraminifera were described as having the "Lilliput Effect." This effect is a post-event syndrome that leaves dwarfed descendants able to continue for thousands or even millions of years (Wade & Olsson, 2009). This means that for a successful evolutionary strategy the foraminifera dwarfed to survive environmental perturbations that caused larger predecessors to die off (Wade & Olsson, 2009). This allowed the planktonic foraminifera to extend their lineage and survive the PETM (Wade & Olsson, 2009).

### **Extinction of Benthic Foraminifera During the PETM**

As previously discussed during the PETM benthic foraminifera went through what is known as the Benthic Foraminifera Extinction Event (BFE). During this event, it was found that the increase in temperature from the PETM could have affected the metabolic rates of the benthic forams yet it is unclear of the exact reason for the extinctions (Alegret et al., 2009). In other articles, it was discovered that the most probable cause for the extinction of benthic foraminifera was due to low dissolved oxygen conditions (Takeda & Kaiho, 2007).

Ocean acidification is a significant factor in the extinction of benthic foraminifera. The acidification of the large regions of the deep-sea caused emissions of carbon-compounds on millennial time scales (Alegret et al. 2021). Lastly, another explanation for their extinction can be attributed to a change in deep-water circulation. The more oxygenated deep waters at the lower bathyal depths got replaced with warmer, less oxygenated water which led to hypoxia in the benthic foraminifera (Thomas, 1990).

### **How Survival of Foraminifera Can Offer Us Implications for the Future**

In discussions of implications for the future, based on the data discussed in this study the PETM could be used as a possible analog for future anthropogenic climate change (Si & Aubry, 2018). This is because foraminifera significantly decline in their fitness when environmental temperatures increase above their optimal range (Si & Aubry, 2018). Recent data has come out finding that the biomass of forams is predicted to decrease in the future and the biomass of forams has already decreased by 3.4% since the 1900-1950 average (Ying et al., 2024). A controversial issue is whether we have enough information to use the patterns from foraminifera that came from PETM data





## Benthic Foraminifera and the Paleocene- Eocene Thermal Maximum

to help predict anthropogenic warming. As one article contends, in their research they found no significant extinction in most groups other than benthic forams which sheds an interesting light on future global warming as we have been told we will see major extinctions in many species (McInerney & Wing, 2011).

### Limitations and Future Work

Gaps in the data, make space for future work. There is much to be studied about the PETM and its implications for a 6th mass extinction event in the future. In addition, there is still a lot of data to be studied within the benthic and planktonic foraminifera survival and

diversification strategies. The exact cause of the benthic foraminifera extinction event also remains unidentified, and good scientific evidence remains available for further study.

### Acknowledgments

Thank you to Professor Rebecca Price for helping with the assistance of this research topic, along with cleaning the data, finding relevant resources to support my claim, and providing revisions. I also want to thank Nic Warn, Hadi Chohan, and Dr. Susan Brooks for providing peer reviews and any additional edits.

### Glossary

Terms	Definitions
<b>Anthropogenic</b>	Environmental change is caused or influenced by people, either directly or indirectly.
<b>Bathyal Depths</b>	A part of the ocean extends from 800 to 3,500 meters deep.
<b>Benthic Foraminifera</b>	Single-celled eukaryotic microorganisms abundant in marine sediments.
<b>Bivalve</b>	An aquatic mollusk with a hinge shell that compresses its body closed.
<b>Carbon Isotope Excursion (CIE)</b>	Refers to distinct period in Earth's geologic history where there is a significant and rapid change in the ratio of carbon isotopes (carbon-12 and carbon-13) within the sedimentary record.
<b>Carbon-compounds</b>	Chemical substances containing carbon.
<b>Dissolved Oxygen</b>	The amount of oxygen that is present in water.
<b>Diversification Strategies</b>	Types of strategies that can help increase the genetic diversity of a population or species.
<b>Environmental Perturbation</b>	A change in environmental conditions that disrupts the normal state of an ecosystem.
<b>Epifaunal</b>	Small mobile organisms living on the surface of marine structures.
<b>Hypoxia</b>	A condition where there is an inadequate supply of oxygen to the body's tissue.
<b>Infaunal</b>	Aquatic animals that live in the substrate of a body of water.



<b>Ocean Acidification</b>	The process by which the ocean becomes more acidic due to an increase in carbon dioxide (CO <sub>2</sub> ) from the atmosphere.
<b>Paleocene-Eocene Thermal Maximum (PETM)</b>	A period of global warming that occurred about 56 million years ago. Characterized by a large increase in carbon dioxide and rise in global temperatures.
<b>Phylogenies</b>	Patterns from species ancestry that can be traced between their lineages.
<b>Planktonic Foraminifera</b>	Single-celled marine eukaryotes characterized by having calcareous shells, they are abundant in the open water columns
<b>Semi-infaunal</b>	Organisms that live partially below the sediment but protrude above.

### Literature Cited

- Alegret, L., Ortiz, S., & Molina, E. (2009). Extinction and recovery of benthic foraminifera across the Paleocene–Eocene Thermal Maximum at the Alamedilla section (Southern Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology.*, 279(3–4), 186–200. <https://doi.org/10.1016/j.palaeo.2009.05.009>
- Alegret, L., Arreguín-Rodríguez, G. J., Trasviña-Moreno, C. A., & Thomas, E. (2021). Turnover and stability in the deep sea: Benthic foraminifera as tracers of Paleogene global change. *Global and Planetary Change.*, 196. <https://doi.org/10.1016/j.gloplacha.2020.103372>
- Barrett, R., Adebowale, M., Birch, H., Wilson, J. D., & Schmidt, D. N. (2023). Planktic Foraminiferal Resilience to Environmental Change Associated With the PETM. *Paleoceanography and Paleoclimatology : An AGU Journal Exploring Earth's Paleoclimate.*, 38(8). <https://doi.org/10.1029/2022PA004534>
- Keller, G., Mateo, P., Punekar, J., Khozyem, H., Gertsch, B., Spangenberg, J., Bitchong, A. M., & Adatte, T. (2018). Environmental changes during the Cretaceous-Paleogene mass extinction and Paleocene-Eocene Thermal Maximum: Implications for the Anthropocene. *Gondwana Research*, 56, 69–89. <https://doi.org/10.1016/j.gr.2017.12.002>
- Lockwood, R. (2003). Abundance not linked to survival across the end-Cretaceous mass extinction: Patterns in North American bivalves. *Proceedings of the National Academy of Sciences*, 100(5), 2478–2482. <https://doi.org/10.1073/pnas.0535132100>
- McInerney, F. A., & Wing, S. L. (2011). The Paleocene-Eocene Thermal Maximum: A Perturbation of Carbon Cycle, Climate, and Biosphere with Implications for the Future. *Annual Review of Earth and Planetary Sciences*, 39(1), 489–516. <https://doi.org/10.1146/annurev-earth-040610-133431>
- Moretti, S., Auderset, A., Deutsch, C., Schmitz, R., Gerber, L., Thomas, E., Luciani, V., Petrizzo, M. R., Schiebel, R., Tripathi, A., Sexton, P., Norris, R., D’Onofrio, R., Zachos, J., Sigman, D. M., Haug, G. H., & Martínez-García, A. (2024). Oxygen rise in the tropical upper ocean during the Paleocene-Eocene Thermal Maximum. *Science.*, 383(6684), 727–731. <https://doi.org/10.1126/science.adh4893>
- Si, W., & Aubry, M. (2018). Vital Effects and Ecologic Adaptation of Photosymbiont-Bearing Planktonic Foraminifera During the Paleocene-Eocene Thermal Maximum, Implications for Paleoclimate. *Paleoceanography and Paleoclimatology : An AGU Journal Exploring Earth's Paleoclimate.*, 33(1), 112–125. <https://doi.org/10.1002/2017PA003219>



## Benthic Foraminifera and the Paleocene- Eocene Thermal Maximum

- Takeda, K., & Kaiho, K. (2007). Faunal turnovers in central Pacific benthic foraminifera during the Paleocene–Eocene thermal maximum. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 251(2), 175–197. <https://doi.org/10.1016/j.palaeo.2007.02.026>
- Thomas, E. (1990). Late Cretaceous–early Eocene mass extinctions in the deep sea. *Geological Society of America Special Papers*, 481–496. <https://doi.org/10.1130/spe247-p481>
- Wade, B. S., & Olsson, R. K. (2009). Investigation of pre-extinction dwarfing in Cenozoic planktonic foraminifera. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 284(1–2), 39–46. <https://doi.org/10.1016/j.palaeo.2009.08.026>
- Ying, R., Monteiro, F. M., Wilson, J. D., Ödalen, M., & Schmidt, D. N. (2024). Past foraminiferal acclimatization capacity is limited during future warming. *Nature*, 636(8042), 385–389. <https://doi.org/10.1038/s41586-024-08029-0>





# STUDENTS EVENTUALLY VALUE ACTIVE LEARNING

Parbeen Sekhon and Eric Onnen

*ABSTRACT: This research investigates STEM (Science, Technology, Engineering, and Math) students' feelings towards active learning methodologies in foundational physics and mathematics courses through an analysis of Student Evaluations of Teaching (SET) open-ended questions. Our findings demonstrate a consistent increase in student appreciation for active learning environments over the course of three quarters. Additionally, our study explored potential gender biases and variations in teacher effectiveness over time; however, data did not support clear findings. The research highlights that educators who engage with more advanced students/classes of the introductory physics and math series tend to achieve higher student satisfaction compared to those teaching newer students, emphasizing that prolonged exposure to active learning positively correlates with increased student satisfaction. These insights suggest that educational leaders should consider a broader range of metrics beyond SETs, such as actual test scores and longitudinal teaching outcomes, when evaluating teacher performance and the impact of teaching methodologies.*

## Background and Motivation

Research on SETs began in the early 1900s with studies of the different elements of the evaluations [1]. Concerns over the validity of these evaluations arose in the 1980s [1]. To this day, studies are being conducted to determine what information from SETs is valuable, if any, and what can be changed about the evaluations themselves to make them more effective or valid in the eyes of those who administer them [2]. Prior research suggests that test scores are an effective way to determine teacher effectiveness, whereas using SETs to determine teacher effectiveness is a poor use of the information, and doesn't reflect anything of the sort [3].

Studies have found that there are specific teaching practices that yield higher test scores; specifically, active learning instruction yields higher grades and test scores than traditional lecture instruction [4], [5]. Active learning instruction refers to any type of instruction that enlists student participation, for example, through student-to-student interaction in small

groups, or through student interaction with the instructor for the benefit of the entire class. Some other examples of active learning are: "group problem-solving, worksheets or tutorials completed during class, use of personal response systems with or without peer instruction, and studio or workshop course designs" [5]. Unfortunately, despite these teaching methods yielding higher test scores, students themselves are sometimes apprehensive about the techniques and may prefer traditional lectures [4]. Traditional lecturing refers to any collegiate instruction that uses little to no student involvement; the entire class period consists of the teacher talking to the students as a group. This is unfortunately the more common approach to teaching at the undergraduate level, despite it being proven less effective than active engagement instruction [4]. Because we are studying the satisfaction of students in active engagement classroom environments, we collected data from specifically teachers that use the engagement techniques listed above. Therefore, when a student was satisfied with the teaching style in a class we were studying, we interpreted them to be satisfied with active





learning; when they were unsatisfied with the class, we interpreted them to be unsatisfied with active learning.

Our motivation for doing this research stemmed from our own experiences in college. Starting the research as 3rd year students, we already had significant exposure to both teaching styles over our previous two years of college, and all our years of schooling prior. We both had negative experiences with traditional lecture environments, and positive experiences with active learning environments by the time we started this study. We personally connect to the findings of Deslauriers et al— that students are less likely to enjoy active learning compared to lecturing because we remember being nervous to interact with our peers at first [4]. Our findings show that students don't enjoy participating in active learning at first; our personal experience suggests that students may be nervous about being in a big school, not knowing anybody in their class, being far away from home, or any number of other factors. We feel that as students' collegiate career progresses, they become more comfortable with the classroom environment and active learning, and are more likely to want to participate and reap the benefits of the instruction style. Some of the benefits we have experienced include working through problems ourselves or with our peers, creating a memory of how the problem needed to be solved, or how the way we tried hadn't worked. On the other hand, because lecturing is the predominant teaching method (and is historically so), many students are disappointed when they have to participate in group activities or raise their hand in class; they wanted the "college experience," and having to do active learning activities felt demeaning to them.

### Study Overview

The role of teaching methodology in shaping student outcomes is pivotal, particularly in the context of foundational courses that are both high-stakes and high-risk. Introductory

courses in algebra-based physics (BPHYS 114 mechanics, BPHYS 115 electromagnetism, BPHYS 116 optics/waves), calculus-based physics (BPHYS 121 mechanics, BPHYS 122 electromagnetism, BPHYS 123 optics/waves), precalculus (BMATH 121, BMATH 122, BMATH 123) and calculus (STMATH 124, STMATH 125, STMATH 126), are mandatory for a broad spectrum of science and engineering majors. These courses are often seen as "gatekeepers," with a significant impact on students' academic trajectories: students who don't pass them may lose access to their intended major. In this evolving landscape of educational methodologies the shift from traditional lecture-based teaching to active-engagement instruction has sparked significant interest among educators and researchers. This pedagogical shift, emphasizing interactive, student-centered learning, enhances student engagement and academic achievement.

Recognizing the potential of active-engagement teaching styles to improve student engagement and understanding, our study seeks to assess changes in student perceptions of these methods over three academic quarters. The extent to which students' attitudes towards these teaching styles change during their studies remains an area ripe for exploration.

The primary research questions guiding this study are:

1. Do student attitudes about active engagement instruction improve throughout the BPHYS 1XX series, and if so, how long does it take?
2. Do student attitudes about active engagement instruction improve throughout the B/STMATH 12X series, and if so, how long does it take?

To gain a comprehensive understanding of the dynamics at play, this study also explores several secondary research questions that arose



## Students Eventually Value Active Learning

during data collection and analysis:

1. Are there differences in student attitudes across different quarters for the same professor teaching the same class?
2. Are students more satisfied with certain professors?
3. Does a single professor become more “satisfying” to students over the years?
4. Is there a difference in student satisfaction between male and female professors?
5. Are students more satisfied with younger professors?
6. Are there notable patterns of student satisfaction associated with student attitudes?
7. Are there differences in student attitudes between BPHYS 11X (intro physics for life sciences) and BPHYS 12X (intro physics for engineers)?
8. Are there differences in student attitudes between BMATH 12X (pre-calculus) and STMATH 12X (calculus)?

We claim that students eventually come to value active learning methods by the end of their three-quarter course sequence in introductory physics and mathematics. Below we substantiate this claim and elucidate the factors that could potentially modulate this shift in student attitudes. By exploring both primary and secondary research questions, we seek to provide a comprehensive analysis of how active-engagement teaching styles influence student perceptions and identify the variables that might affect this transformation. This systematic examination is designed to offer insights that can refine pedagogical strategies,

enhancing student retention and success in courses that serve as critical gateways for a broad spectrum of scientific and engineering disciplines. The results are intended to inform educational practices and policies, ultimately supporting improved engagement and outcomes in foundational science and mathematics education, pivotal areas in high-stakes, high-risk academic settings.

### Methods

The general method of analysis for this study was to code student responses to the open-ended questions on SETs for student satisfaction. These open-ended questions are:

1. Was the class intellectually stimulating? Did it stretch your thinking? Why or why not?
2. What aspect of this class contributed most to your learning?
3. What aspect of this class detracted from your learning?
4. What suggestions do you have for improving the class?

SETs also include Likert-scale questions inviting students to agree or disagree with statements such as “clarity of instructor’s voice was” or “instructor’s enthusiasm was.” We chose not to use the Likert scale data in our analysis based on research indicating that these Likert scale questions don’t accurately reflect the teaching environment [1]. Instead, they primarily capture students’ subjective opinions about their liking or disliking of a particular professor [1]. Since our focus was on examining the impact of teaching methodologies, particularly active learning, on student perceptions, we opted to prioritize the qualitative data obtained from the open-ended questions in the surveys.

The quality of student responses also improves over time, with fewer neutral responses by the end of the series. As students advance, their



feedback becomes more detailed and in-depth regarding the course content, characterized by more words and sophisticated language. This evolution in response quality suggests that students are becoming more engaged and thoughtful in their evaluations. As they progress through their academic journey, their feedback becomes more targeted and reflective of their educational experience. This maturation allows students to provide more constructive and nuanced insights, which can be invaluable for educators seeking to refine and enhance their teaching methods.

### **Data Collection**

The following criteria guided our study recruitment. First, we focused on high-risk foundational STEM courses. These courses are considered pivotal for students pursuing STEM majors, as they often have a significant impact on students' academic trajectories. These introductory courses in particular present a higher likelihood of failure, which can prevent students from progressing into their desired majors.

Second, we limited our selection to professors who were recognized for their engagement in active learning methodologies. This focus was informed by relevant literature [6], which highlights the effectiveness of active learning in enhancing student outcomes and engagement. Professors known for incorporating these approaches were prioritized for our study.

Finally, our research was restricted to programs in physics and mathematics. This decision was based on the familiarity our research advisor had with faculty members in these departments, allowing for more effective collaboration and insight into the pedagogical practices of the instructors involved.

Professors who met these criteria were recruited by our research advisor by individual email (see Appendix). Those who elected to participate voluntarily provided electronic

copies of their SETs, which were redacted by the research advisor (professor names removed) before being made available for the study. Table X gives an overview of the data that was collected and analyzed.

The research utilized over 5100 responses in 164 classes from a dataset provided by faculty from the University of Washington Bothell (UWB) and Seattle (UWS), Cascadia College (CC) and Western Washington University (WWU) Physics programs and the University of Washington Bothell Math programs. Data was collected from the last ten years, 2014 through 2024. Specifically, the dataset included 100 physics classes taught by 9 different professors with over 3600 student responses, and 64 math classes taught by 2 professors with over 1500 responses.

### **Codebook Development**

Responses to open-ended SET questions were coded based on a carefully constructed codebook, which converts qualitative data from student responses into quantifiable categories for statistical analysis. The coding process classified responses into three primary categories: satisfied/happy, neutral, or dissatisfied/unhappy. Each response was analyzed for sentiments and content related to the students' experiences and perceptions of the teaching methods, classroom environment, and course content. The codebook was collaboratively developed and continuously refined over the quarters of our research. It outlined specific criteria for categorizing responses, helping to standardize the coding process across various raters.

### **Criteria Included**

Additional categories are defined for responses that do not pertain to the perception of teaching methods.

Before beginning the coding process, all researchers involved in the study underwent training sessions to familiarize themselves with



## Students Eventually Value Active Learning

Institution	Course	# courses	# professors	# student responses
UWB	BPHYS 121	10	3	430
UWB	BPHYS 122	11	3	338
UWB	BPHYS 123	9	3	179
UWB	BPHYS 114	6	2	192
UWB	BPHYS 115	7	2	124
UWB	BPHYS 116	2	1	24
UWS	BPHYS 121	10	1	422
UWS	BPHYS 122	12	1	581
UWS	BPHYS 123	9	1	328
UWS	BPHYS 114	6	1	502
UWS	BPHYS 115	5	1	327
UWS	BPHYS 116	4	1	270
CC	BPHYS 121	2	1	24
CC	BPHYS 122	3	1	23
CC	BPHYS 123	3	1	18
WWU	BPHYS 121	1	1	62
UWB	BMATH 121	8	1	168
UWB	BMATH 122	3	1	36
UWB	BMATH 123	35	2	629
UWB	STMATH 124	12	2	302
UWB	STMATH 125	2	1	34
UWB	STMATH 126	6	2	112
<b>TOTAL</b>	<b>-</b>	<b>164</b>	<b>-</b>	<b>5125</b>

Table 1. Study Data



the codebook. These sessions included practice coding exercises using a set of sample responses. After coding independently, we discussed the results to identify and resolve any discrepancies in interpretation. This calibration process was crucial for aligning our understanding and ensuring consistency across all coders.

We first examined the data from one class, aligning our efforts with our definition of active learning. We derived a set of rules organized into a hierarchy that categorized responses into satisfied, unsatisfied, and neutral sentiments. For instance, responses expressing enjoyment of group work were classified as satisfied, while those indicating a preference for traditional lectures were classified as unsatisfied. We iteratively refined these criteria, adding detailed guidelines to address different nuances in student responses. Initially, we coded the same classes individually and found that our inter-rater reliability (IRR) rating was less than 40%, indicating significant discrepancies in our coding interpretations. In response, we revisited the codebook, enhancing the criteria and examples to provide clearer guidance for coding. After these adjustments, we re-coded the same classes individually, leading to an increase in our IRR rating to 50%. We continued this iterative process of refining the codebook and re-coded the classes until we achieved a high IRR rating of 95%. To further validate the reliability of our coding process, we engaged Dr. Scherr, who was not familiar with our codebook. After explaining the codebook and our coding criteria hierarchy, Dr. Scherr coded a few classes independently. Our joint IRR between our team and Dr. Scherr was 93%, indicating a high level of agreement and reinforcing our confidence in the coding process. As we acquired more data and introduced a new student researcher, we encountered a decrease in our IRR rating to around 80%. In response, we revisited the codebook, adding more detailed criteria to differentiate between satisfied, unsatisfied, and neutral responses. Following these adjustments, we re-coded the same classes individually,

leading to an increase in our IRR rating to 85%. We continued this process of refinement until our IRR rating reached 92%, ensuring the consistency and reliability of our coding across different datasets and coders.

In instances where a response could potentially fit into more than one category, we used the hierarchy established in the codebook, where specific codes would supersede others based on the context of the response. If we were unsure of how to categorize a response, the case was brought to a team meeting for discussion and consensus. As coding progressed, we regularly revisited and refined the codebook. This iterative process allowed for adjustments based on real coding experiences, enhancing the accuracy and relevance of the coding categories. Changes to the codebook were documented into the codebook, and previously coded data were reviewed to ensure consistency with the updated standards. Once all responses were coded, the data were compiled and prepared for quantitative analysis. This analysis aimed to identify trends and patterns in student attitudes toward active learning, correlating these findings with different variables such as the course, professor, and time.





## Students Eventually Value Active Learning

Examples of Coding Responses		
Responses	Reasons	Code
<p>R1: "This class was intellectually stimulating; it offered new concepts and perspectives on previous content given in different classes."</p> <p>R2: "Textbook, in-class assignments, and problem sets."</p> <p>R3: "There was no specific aspect that detracted from my learning."</p> <p>R4: "I really enjoyed the class as a whole. I liked the flexibility and accessibility of the class giving people time to understand the concepts without feeling overly pressured."</p>	<p>[code #4] Expressing support for in-class time, whether online or in-person = satisfied</p> <p>[code #5] Expressing the importance of group work, (with PF's, TAs, or classmates) = satisfied</p> <p>[code #9] Expressing general enjoyment of the entire class, <u>no negatives</u> = satisfied</p>	Satisfied
<p>R1: "I don't like physics as a topic; however the content was good, and I did not feel like I was suffering through it."</p> <p>R2: "I liked the group interactions where we got to interact with each other and build off each other's knowledge."</p> <p>R3: "I wish the quizzes were able to give us immediate feedback for each problem."</p> <p>R4: "Honestly, it was a good class, and I wouldn't change anything about it."</p>	<p>[code #4] Expressing support for in-class time, whether online or in-person = satisfied</p> <p>[code #5] Expressing the importance of group work, (with PF's, TAs, or classmates) = satisfied</p> <p>[code #9] Expressing general enjoyment of the entire class, <u>no negatives</u> = satisfied</p>	Satisfied
<p>R1: "Nope"</p> <p>R2: "N/A"</p> <p>R3: "N/A"</p> <p>R4: "N/A"</p>	<p>[code #12] Poor answers or not enough information (see example) = neutral</p>	Neutral

Table 2. Examples of coding student responses in SETs



Responses	Reasons	Code
R1: "It is simulating because of the thought process that goes into solving one question." R2: "Might be the homework because it had explanations afterwards." R3: "In-class activities" R4: "Instead of in-class assignments, it would be great if you would teach some important concepts at least for one hour and then do in-class activities."	[code #1] 50/50 (see example) = neutral	Neutral
R1: "Not at all. Wish we had a real lecture" R2: "In-class was the only time we had facilitated learning" R3: "NOT HAVING LECTURE !!!!!" R4: "Make some time for lecture so this class doesn't feel like a waste of time."	[code #2] Any requests for more traditional lectures = unsatisfied	Unsatisfied
R1: "Yes! A lot of aspects to it require the knowledge of actually understanding what needs to be calculated." R2: "Expert TA" R3: "Weekly worksheets/ group work" R4: "No group work"	[code #6] Expressing distaste for group work, (with PF's, TAs, or classmates) = unsatisfied	Unsatisfied

Table 2 continued. Examples of coding student responses in SETs

### Inter-rater Reliability

Inter-rater reliability (IRR) is a measure used to assess the extent to which different raters (or observers, coders, etc.) agree in their assessment decisions when using the same method to assess the same phenomenon [7]. IRR is crucial in research settings where data points are subject to interpretation, such as coding open-ended survey responses, assessing qualitative interviews, or any situation where judgments can vary between different individuals. High IRR indicates that the method of assessment

produces consistent results across different raters, leading to more accurate and reliable conclusions. It is essential to ensure that the findings of our study are based on the data and not on subjective interpretations of individual raters. Research validity is strengthened by high IRR, as it suggests that the tools or criteria used in the research are clear and apply consistently across different raters. The research validity makes the research findings more credible and generalizable. High IRR supports the replicability of a study. If other researchers use the same methods and tools, they should be



able to obtain similar offshoots, reinforcing the reliability of the original findings. By ensuring that all raters in our team understand and apply the assessment criteria similarly, IRR reduces the potential for bias that can occur when different raters interpret data differently.

The interpretation of IRR values typically depends on the percentage agreement among the raters. Low IRR values, defined as below 50%, indicate poor agreement among raters. This suggests that the criteria or method of assessment may be unclear, overly subjective, or inconsistently applied. Such low levels of agreement can compromise the reliability and validity of the study results, as raters may be using different, and potentially conflicting, standards.

Moderate IRR values, ranging from 50% to 80%, suggest a reasonable level of agreement that might be acceptable in certain research contexts. This is especially true for preliminary studies or those exploring new domains where established standards are not yet fully developed. While not ideal, moderate IRR can still provide meaningful insights if the context justifies some variability among raters.

High IRR values, such as those above 80%, reflect strong agreement among raters. This level of consistency indicates that the assessment method is clear, well-defined, and consistently applied. An IRR of 90% or higher is considered excellent, ensuring reliable data interpretation and robust study findings that are less affected by individual rater variability. In our study, we achieved an IRR of 92%, which is a testament to the high level of agreement among us as a research team.

### **Limitations**

This study, while providing significant insights into the impact of active-engagement teaching on student attitudes over several academic quarters, is subject to several limitations

## **Students Eventually Value Active Learning**

that could influence the interpretation and generalizability of the findings:

### **Voluntary Data Contribution**

The data utilized in this research were provided voluntarily by professors. Not all instructors who taught relevant courses were invited into the study, and not all who were invited chose to contribute their data. Consequently, the study may not encompass a full representation of teaching styles or student experiences across the different programs. Additionally, the willingness of professors to share their data might be influenced by their perception of their teaching success, potentially introducing a bias toward more positive student evaluations.

### **Student Response Rate**

The average student response rate is about 60% across our dataset. Student participation in course evaluations can be influenced by factors such as the perceived relevance of the feedback process or students' engagement with the course [8]. Low response rates can skew results, typically in favor of more extreme opinions, either positive or negative

### **Potential of Bias**

Although the SETs we coded did not include any identification related to the professors, we were aware of which class they belonged to within the STMATH 12X, BMATH 12X, or BPHYS 1XX series. This knowledge could have introduced potential bias into our coding process. Specifically, being aware of the course series might have subconsciously influenced our interpretations and evaluations, potentially skewing the results based on preconceived notions about the difficulty or reputation of certain course series. To mitigate this potential bias, we could have employed a one-way blinded procedure. In this approach, we would code all the SETs without any information regarding the class descriptions. Once the coding was



complete, we could then return our coded data to the faculty, who would assign the coding results to the respective courses. This separation of duties would help ensure that our coding was impartial and not influenced by any knowledge of the course series. Implementing such a blinded procedure could enhance the objectivity of our analysis, providing more reliable and unbiased insights into the effectiveness of the courses and teaching methods.

### Dominance of UW Seattle Data

Significant amounts of the data we gathered was from 2 UW Seattle professors, equating to 63% of the total data for both intro physics series, (36% was from UW Bothell professors, and 1% from WWU and Cascadia). Despite this weighting, our first iteration of the research when we first began the project was simply 5 UW Bothell professors and we found very similar trends. Both of the UWS professors we got data from had very strong satisfaction

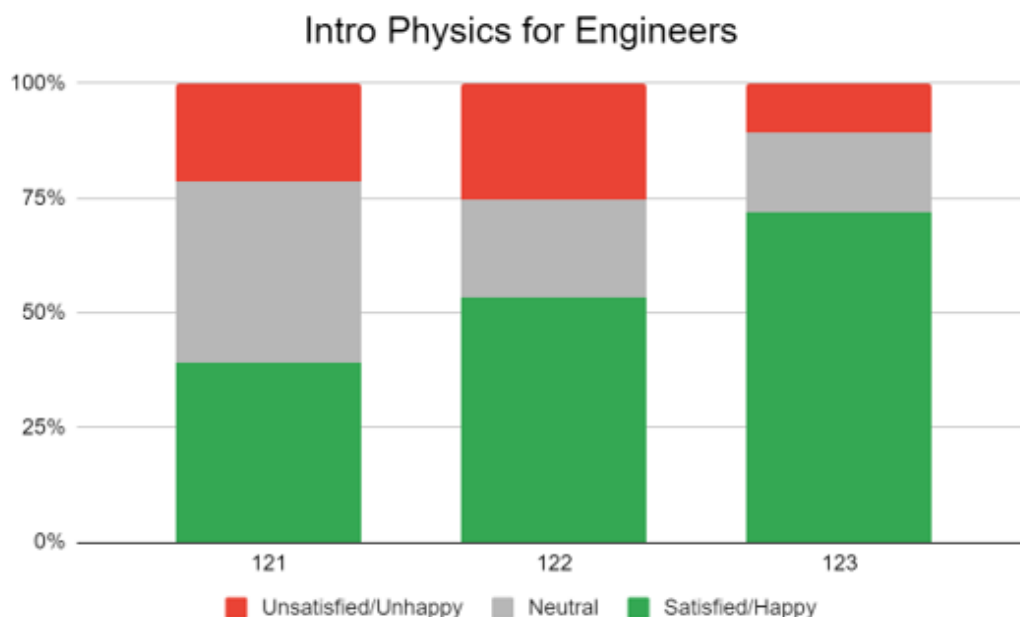


Figure 2. Satisfied, Neutral, and Unsatisfied percentages for calculus-based physics intro series

scores compared to their Bothell counterparts, and weighted the satisfaction numbers in each class's total heavily. However, when we compare the numbers from Seattle and Bothell professors, we see the same increasing trends of satisfaction over the course of both series.

### Results: Physics

#### Major trends

Results from our research are shown in Figures 2 and 3. Figure 2 shows increasing

satisfaction as the students progress through the intro calculus-based physics series. Figure 2 shows the same trends for the intro algebra-based physics series. Specific classes are shown on the horizontal-axis: BPHYS 121, 122, 123 for Figure 2, and BPHYS 114, 115, 116 for Figure 3. The vertical-axis in both figures represents the percentage of student responses that were determined to be either satisfied (green), neutral (gray), or unsatisfied (red). We found an approximately 33% increase in satisfaction over the course of the intro calculus-based series, and an approximately 18% increase in satisfaction



over the course of the algebra-based series. Increased satisfaction values in these figures represents a larger value of students that prefer to engage in class, and a lower value of students who desire lecturing or other teaching methods besides active learning.

In addition to the increase in satisfaction through the course of both series, we also found an increase in response quality from students in the later courses of the series compared to those submitted from students in the beginning classes. We postulate that this is because

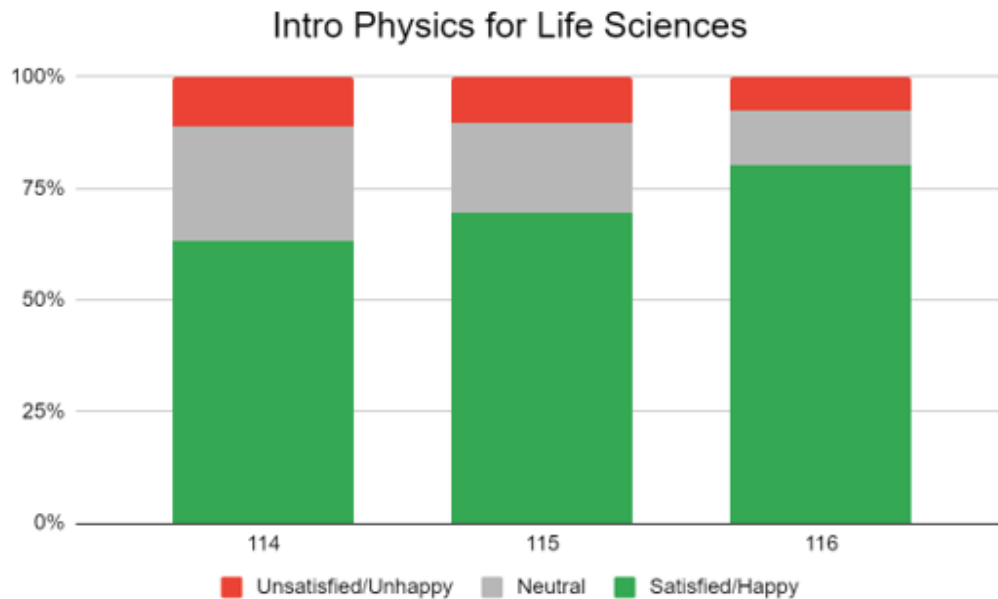


Figure 3. Satisfied, Neutral, and Unsatisfied percentages for algebra-based physics intro series

students' understanding of the importance of SETs increases over time, as well as their familiarity with the SET format. For example, when submitting responses to the open-ended questions for SETs in the 121 class, students perhaps would be submitting SETs for the first time, whereas with the 123 class submissions, they would've already submitted responses for up to three quarters of part time or full time class loads. Some professors choose to allow students to dedicate class time to completing these evaluations, as well as informing their class as to the purpose and value of their responses, leading to perhaps higher quality in responses. With these higher quality responses, we see a reduction in the percentage of responses that we determine to be neutral based on our code-book, for some of our rules required us to make inferior responses, (all responses simply "NA", or heavily opinionated and distasteful comments

about group-mates with no comments on the professor or class structure whatsoever).

Significant amounts of the data we gathered was from 2 UW Seattle professors, equating to 67% of the total data for both intro physics series, (30% was from UW Bothell professors, and 2% from WWU and Cascadia). Despite this weighting, our first iteration of the research when we first began the project was simply 5 UW Bothell professors and we found very similar trends. Both of the UWS professors we got data from had very strong satisfaction scores compared to their Bothell counterparts, and weighted the satisfaction numbers in each class's total heavily. However, when we compare the numbers from Seattle and Bothell professors, we see the same increasing trends of satisfaction over the course of the series.





### Detailed observations

**Algebra-based classes have overall higher satisfaction ratings than their calculus-based counterparts.** We speculate that this is because of the lower level of math being done in class/homework, leading to what can be perceived as easier classes for the students. In addition, a large majority of the algebra-based data we collected was from the professor at UWS (over 80% of the total data) and this professor had high satisfaction ratings.

**BPHYS 122 has a relatively large number of negative responses.** We speculate that because new undergraduate students are apprehensive to active learning compared to their 2nd, 3rd, or 4th year counterparts, we can presume that 122 would have additional new students, leading to increased dissatisfaction numbers. Another possible explanation is that our data for BPHYS 121 and 123 includes SETs from

WWU and Cascadia professors, whose SETs do not include the question, “What detracted from your learning?” and therefore might elicit more “satisfied” responses., **BPHYS 121 has more neutral responses.** We speculate that this is caused by the different SET format used by Cascadia College, which is 4% of the BPHYS 121 data. They use hand-written responses to the questions that yielded very simple answers, such as smiley-faces or cartoons in place of meaningful comments about the class structure or other valuable information. These had to be labeled as neutral when following our code-book.

### Results: Math

#### Major trends

Figures 4 and 5 represent the Calculus (STMATH 124-5-6) and Pre-Calculus (BMATH 121-2-3) series at the University of Washington

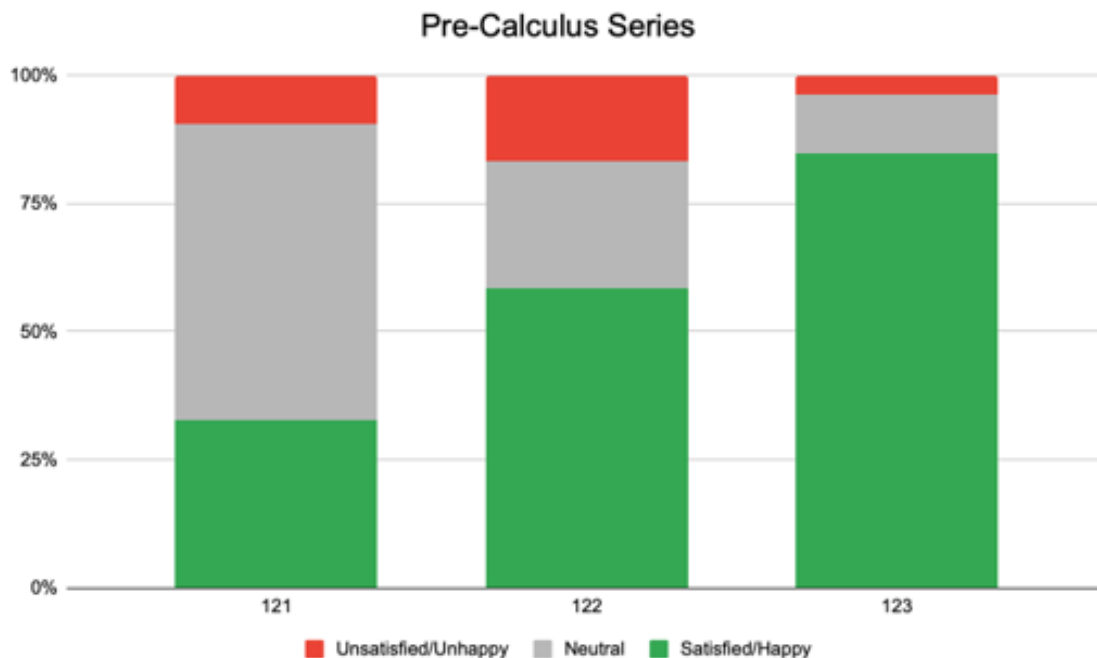


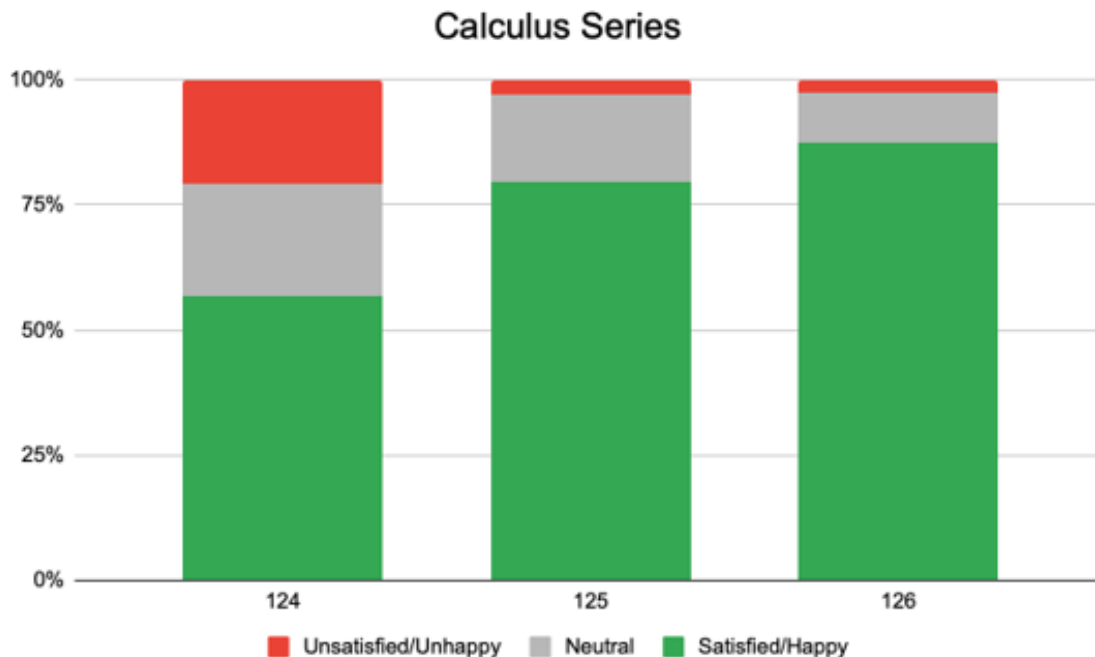
Figure 4 Satisfied, Neutral, and Unsatisfied percentages for precalculus math series



## Students Eventually Value Active Learning

Bothell, showing how students feel about active learning across the three-quarter sequence. The horizontal axis shows the classes and the vertical axis the percent satisfaction. Across each series, there is a noticeable increase in satisfaction among students. Simultaneously, there is a reduction in unsatisfied and neutral

responses throughout both series. This suggests that students are developing stronger opinions about the teaching methods as they progress, possibly due to increased familiarity and comfort with the active learning environment. The quality of student responses also improves over time, with fewer neutral responses by the



*Figure 5* Satisfied, Neutral, and Unsatisfied percentages for calculus math series

end of the series as responses get more in depth regarding the course information with more words and more sophisticated language. This could be attributed to students' maturation and enhanced understanding of Student Evaluations of Teaching (SETs) and their role in shaping educational practices. As students' progress through their academic journey, their feedback becomes more targeted and reflective of their educational experience.

Additionally, there is an increase of dissatisfaction in the second course of the BMATH 12X series. This is likely due to students' initial placement in the BMATH series. UWB has a directed self-placement

(DSP) process where students may place themselves into BMATH 121, 122, 123 or STMATH 124, 125, 126. Students can choose to skip the first class of the series and be directly placed in the second course. This process may lead to some students being less prepared or less familiar with the active learning methods used in BMATH 122, thus initially resulting in higher dissatisfaction.

In summary, both figures indicate a positive trend in student satisfaction with active learning across the Precalculus and Calculus series. As students advance through the courses, they become more engaged, appreciative, and decisive in their opinions about the



teaching methods employed. This highlights the importance of sustained exposure and engagement with active learning methodologies in foundational mathematics courses.

### Detailed observations

Although the overall pattern is that satisfaction increases, there is a rise in dissatisfaction between the first (121) and second (122) classes. This could be attributed to the unique dynamics of placement within the series. The University of Washington employs a Directed Self-Placement (DSP) process, allowing students some autonomy in selecting their entry point in the math sequence based on self-reflection and an understanding of their capabilities. Students can place themselves into either 121 or 122 based on their initial math placement tests, but all must complete 123 to proceed to Calculus 1. This requirement might lead to increased challenges or initial dissatisfaction as students adjust to the rigor and expectations of the course sequence midway. The sudden introduction to mid-level pre-calculus in 122, potentially without gradual exposure from the beginning of the series, could contribute to the observed increase in dissatisfaction.

Initially, many students provided neutral feedback, which significantly decreased by the end of the series. This shift we speculate reflects a maturation in students' ability to articulate their educational experiences and a more profound understanding of the active learning methods being employed. Thus, despite potential initial challenges associated with DSP and placement dynamics, the overall trajectory toward increased satisfaction and decreased dissatisfaction by the end of the Pre-Calculus series suggests a successful adaptation and growing appreciation for active learning among students.

These patterns underscore several key points about student engagement with active learning in foundational mathematics courses.

First, initial exposure to active learning might not immediately yield high satisfaction, but continued experience through successive courses can lead to increased appreciation and reduced dissatisfaction. Second, the course entry point, as influenced by placement tests, can affect initial student satisfaction levels, particularly in series where course complexity and expectations escalate quickly. Lastly, the maturation of students' understanding of their role in feedback mechanisms like SETs and their ability to evaluate their educational experiences more critically may also contribute to the observed trends in student satisfaction over time. These findings highlight the potential benefits of active learning methodologies and suggest that sustained exposure and engagement with such pedagogical approaches are crucial in foundational mathematics courses.

### Other Investigations

#### Gender bias

Past studies have shown that gender biases exist in SETs; primarily that students prefer male instructors, and leave more positive feedback on their SETs compared to their female counterparts [9]. Our study includes data from 11 total professors: 5 male, 5 female, and 1 non-binary. To investigate this bias in our own data, we compared the average satisfaction percentages amongst all the male professors to those of the female professors. However, data from male professors makes up over 90% of our total data, raising concerns that this data set does not provide for appropriate comparison.

Additionally, professors who only teach BPHYS 122 and BPHYS 123 classes experience higher student satisfaction than those who only teach BPHYS 121 and BPHYS 122 classes, which likely confounds any gender effects. To effectively investigate SET gender biases, one would have to gather data from an equal number of classes taught by all genders of professors, and of all levels of class (BPHYS 121, BPHYS



122, etc.).

### Chronological improvement of teachers

We also attempted to investigate chronological improvement of teacher effectiveness over time by graphing all the classes of data for each professor and determining if there was an increase or decrease in student satisfaction over time. However, this would require comparison of the same course (since different courses tend to have different satisfaction levels), and no professors we studied taught any single class for many terms in a row. For example, Figure 6 shows all the classes that Prof. G taught

from 2014 through 2023, and the respective satisfaction/neutral/dissatisfaction values. It might appear at first glance that there was significant improvement as time went on, larger green bars on the right, and small green bars on the left. However, this change is likely due to Prof. G having switched from teaching primarily BPHYS 121 and BPHYS 122, to only teaching BPHYS 122 and BPHYS 123, which tend to elicit higher satisfaction.

### Covid-19 “dip”

All levels of classes showed decreased satisfaction from Winter 2020 to Spring 2021,

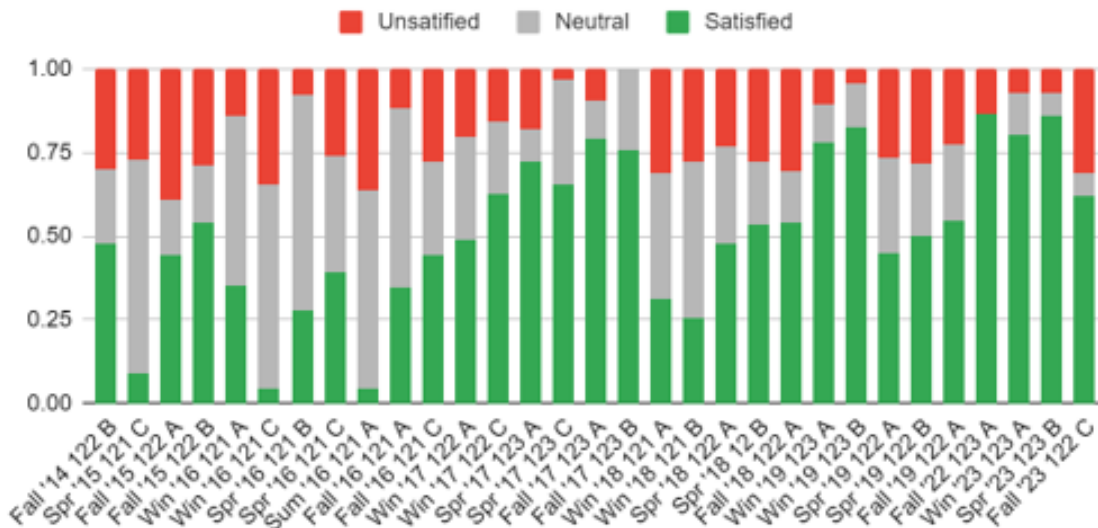


Figure 6 Satisfied, Neutral, and Unsatisfied percentages for Prof. G, classes organized chronologically

likely caused by the COVID-19 pandemic. All classes of all levels had decreased satisfaction during this time. It was quite heartbreaking to read through all the SETs from classes during that period; students complained about being online and expressed concern about their relatives being sick. We at first considered dropping the data from the 3 quarters of 2020, because the satisfaction values were so low. But after gathering everything together and getting our total, the trends were still very clear, so we decided to keep the data. It's interesting

to note the slow recovery back to baseline we see in the data of Prof. B, where they taught the same level of class, there was still a steady increase in satisfaction amongst the SETs. This is most likely because of the familiarity of everybody with the way things were during the lockdown and later recovery period, as well as the professors familiarity with Zoom, online instruction, and the remote environment as a whole.

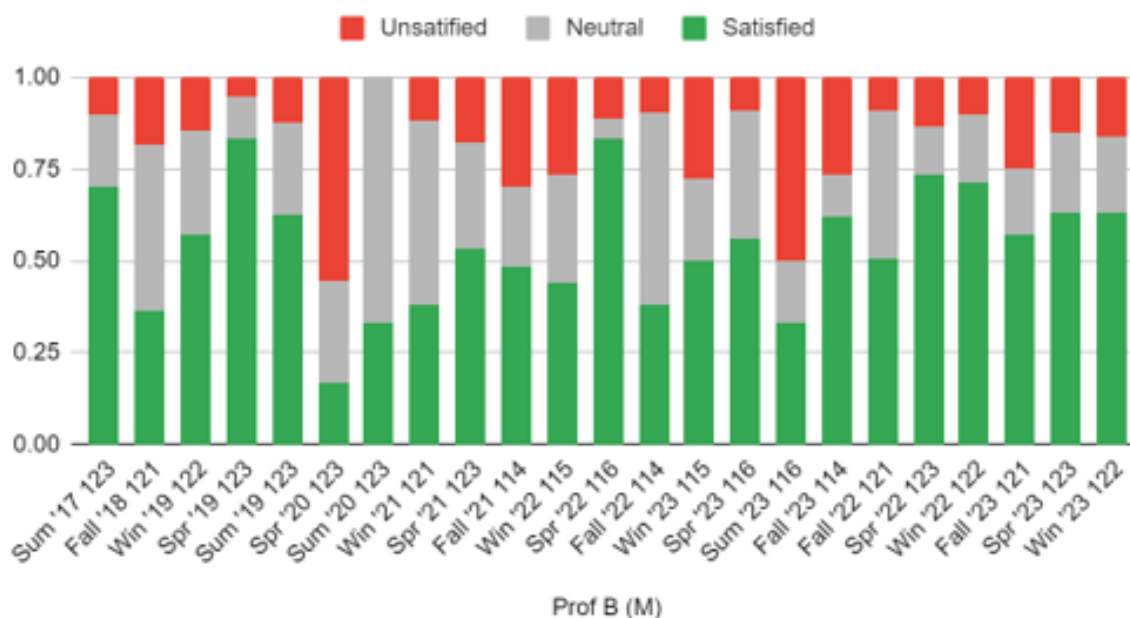


Figure 7 Satisfied, Neutral, and Unsatisfied percentages for Prof. C, classes organized chronologically

## Discussion

Our research aimed to determine if student attitudes about active engagement instruction improve throughout a series of BPHYS 1XX and B/STMATH 12X classes and if so, how long it takes. We analyzed student responses from the Student Evaluations of Teaching (SETs) across both physics and mathematics courses. Our findings indicated that satisfaction with an active learning environment indeed increases over the duration of these class series. Moreover, our data showed that active learning, which has been corroborated by multiple studies as more effective than traditional lecturing in yielding higher test scores, is also positively received by students over time.

During our analysis, we observed a consistent increase in the appreciation for active learning. While we attempted to study potential gender biases and teacher improvement over time, no significant findings emerged in these areas. This suggests that while SETs are useful for gauging student satisfaction of teaching methodologies,

they should not solely influence how professors are evaluated by educational leaders or policymakers. Students need to be in an active learning environment for a sustained period in order to appreciate its benefits.

## Implications

These findings have critical implications for several key stakeholders in the educational process:

- **For Students:** Students should know that although they might not like active learning environments at first, they will come to appreciate it more eventually. The increase in student satisfaction with active learning strategies, as revealed by our research, underscores the importance of adopting teaching methods that actively involve students in the learning process. Active learning environments provide more than just an understanding of course material; they equip students with essential life skills such as critical thinking, problem-solving,





and teamwork. These environments also foster the ability to articulate thoughts clearly and effectively, preparing students for real-world challenges where these skills are indispensable. Such strategies can enhance their understanding of complex subjects, improve retention rates, and ultimately lead to more fulfilling educational experiences.

- **For Professors:** Understanding the dynamics of student satisfaction and the effectiveness of active learning is vital for course and curriculum planning. Teachers who effectively implement active engagement strategies may not only see improved student outcomes but could also eventually benefit from enhanced evaluations from students, which can influence their professional development and advancement opportunities. Furthermore, our findings suggest that teachers who engage with both new and more advanced students can see varied impacts on satisfaction levels; hence, adapting teaching strategies to the level of student experience in the classroom might be necessary.

- **For Administrators:** These insights are essential for administrators, such as division chairs and deans at the School of STEM, who value both student satisfaction and learning outcomes. The finding that student satisfaction increases over time with sustained exposure to active learning environments suggests that administrators should support long-term engagements rather than short-term interventions. Additionally, administrators who use SETs as part of faculty evaluation should proceed with caution. Our findings suggest that teachers who only teach new students tend to have lower student satisfaction compared to those who teach more advanced students. The longer students remain in active learning environments, the higher their satisfaction tends to be, indicating that administrators should encourage active learning environments in more courses and across more departments.

### Recommendations

Incorporating these insights into policy decisions can help create a more responsive and effective educational system that not only values but actively enhances student experiences and outcomes. By acknowledging the nuances in teaching evaluations and the progressive benefits of active learning, education leaders can better support educational institutions in cultivating environments that are both intellectually stimulating and beneficial to all stakeholders involved.

For education professionals looking to apply these findings, we recommend:

- Encouraging the adoption of active learning techniques early, especially in foundational courses that have traditionally relied on lecture-based teaching.
- Providing ongoing training and support for teachers to develop and refine active engagement strategies.
- Evaluating faculty in consideration of the pattern that student satisfaction with active learning tends to be lower at first and increase over 3-6 months of student experience.
- Implementing longitudinal studies within their institutions to further understand the impact of teaching methodologies over time.

### Future Research Suggestions

To build on our work, future research could focus on:

- Recruiting more professors from more institutions into the study, to increase its national significance.
- Hiding course information while coding, to remove potential coding bias.



- Investigating the variation in active learning formats among different professors, courses and disciplines.
- Our analysis of student evaluations in introductory physics courses, spanning both calculus-based and algebra-based series, as well as introductory math precalculus and calculus series, illuminates the dynamic evolution of student appreciation for active learning environments. Initially, students may exhibit skepticism or neutrality, but as they progress through the series, they tend to develop more appreciation for active learning strategies. These findings emphasize the necessity of early preparation and ongoing support for students to maximize the benefits of these innovative educational approaches.

### Glossary

#### 1. SETs: Student Evaluation of Teaching.

- A university form/survey administered to students at the end of each course to elicit feedback on their experiences,

#### 2. DSP: Directed self-placement

- UWB has a directed self-placement (DSP) process where students may place themselves (with some reflection) into BMATH 121, 122, 123 or STMATH 124, 125, 126. More information here: <https://www.uwb.edu/premajor/first-year/placement-tests/math>

#### 3. IRR: Inter-rater reliability.

- Measures the degree of consistency or agreement between two or more raters or observers when evaluating the same set of data, ensuring the reliability of the assessment process.

#### 4. Active learning

- Active learning is an instructional approach that actively engages students in the learning process
- Student Engagement (at least 50% of class time) via working in pairs or small groups, encouraging interaction among students and between students and instructors. Students receive immediate feedback on their activities and are encouraged to reflect on their learning process and outcomes. Students apply what they have learned to new and different contexts, facilitating a deeper understanding of the material.

#### 5. Likert Scale

- A Likert scale is a psychometric scale commonly used in questionnaires to measure people's attitudes, opinions, or perceptions. The scale presents a statement or question to the respondent. For example, "I am satisfied with the customer service provided."
- Responses: Strongly disagree, disagree, neutral, agree, strongly agree

#### 6. High-risk courses

- High-risk courses refer to academic courses that have a higher-than-average rate of students withdrawing or failing. These courses often serve as prerequisite courses for advanced study in a particular major, making their successful completion critical for academic progression.



## Appendix 1: Codebook

### Coding rules to follow: (92% IRR)

(The following is a hierarchy; lower numbers supercede higher numbers)

1. 50/50 (see example) = neutral
2. Any requests for more traditional lectures = unsatisfied
3. Any complaint regarding traditional lectures = satisfied
4. Expressing support for in-class time, whether online or in-person = satisfied
5. Expressing the importance of group work, (with PF's, TA's, or classmates) = satisfied
6. Expressing distaste for group work, (with PF's, TA's, or classmates) = unsatisfied
7. ~~Expressing distaste in specific peers but enjoyed class time = satisfied~~
8. Expressing distaste of live zoom calls (online-only) = satisfied
9. Expressing general enjoyment of the entire class, no negatives = satisfied
  - a. No recommended changes
10. Expressing general distaste for the entire class, no positives = unsatisfied
11. Expressing support for live class traditional lecture = unsatisfied
12. Poor answers or not enough information (see example) = neutral
13. Expressing distaste towards ExpertTA, WebAssign or textbook is irrelevant
14. Expressing distaste towards TAs, professor, or classmates is irrelevant
15. Expressing distaste towards lab and lecture not matching is irrelevant
16. Expressing distaste towards classroom/online environment is irrelevant
17. Expressing distaste towards timing of class is irrelevant
18. Expressing distaste towards desk in classroom is irrelevant
19. Anything regarding labs is irrelevant



## Appendix 2: University of Washington Student Evaluation of Teaching Form



Form Preview  
Y - Remote Course Evaluation

### SUMMATIVE ITEMS

RATING SCALE	Excellent (5)	Very Good (4)	Good (3)	Fair (2)	Poor (1)	Very Poor (0)
1. The remote learning course as a whole was:						
2. The course content was:						
3. The instructor's contribution to the course was:						
4. The instructor's effectiveness in teaching the subject matter was:						

### FORMATIVE ITEMS

RATING SCALE	Excellent (5)	Very Good (4)	Good (3)	Fair (2)	Poor (1)	Very Poor (0)
1. The effectiveness of this remote course in facilitating my learning was:						
2. Timeliness of instructor response to assignments was:						
3. Quality/helpfulness of instructor feedback was:						
4. Clarity of course objectives was:						
5. Clarity of student responsibilities and requirements was:						
6. Usefulness of reading assignments in understanding course content was:						
7. Usefulness of written assignments in understanding course content was:						
8. Usefulness of online resources in understanding course content was:						
9. Evaluative and grading techniques (tests, papers, projects, etc.) were:						
10. Reasonableness of assigned work was:						
11. Organization of materials online was:						

### STUDENT ENGAGEMENT ITEMS

RATING SCALE	Much Higher (7)	(6)	(5)	Average (4)	(3)	(2)	Much Lower (1)
<b>Relative to other college courses you have taken:</b>							
1. Do you expect your grade in this course to be:							
2. The intellectual challenge presented was:							
3. The amount of effort you put into this course was:							
4. The amount of effort to succeed in this course was:							
5. Relative to similar courses taught in person, your participation in this course was:							
6. Relative to similar courses taught in person, your success in this course was:							



## Students Eventually Value Active Learning

RATING SCALE	Under 2	2-3	4-5	6-7	8-9	10-11	12-13	14-15	16-17	18-19	20-21	22 or more
1. On average, how many hours per week have you spent on this course, including attending classes, doing readings, reviewing notes, writing papers and any other course related work?												
2. From the total average hours above, how many do you consider were valuable in advancing your education?												

RATING SCALE										
A (3.9-4.0)	A- (3.5-3.8)	B+ (3.2-3.4)	B (2.9-3.1)	B- (2.5-2.8)	C+ (2.2-2.4)	C (1.9-2.1)	C- (1.5-1.8)	D+ (1.2-1.4)	D (0.9-1.1)	
D- (0.7-0.8)	F (0.0)	Pass	Credit	No Credit						
What grade do you expect in this course?										

RATING SCALE	In your major	A core/distribution requirement	An elective	In your minor	A program requirement	Other
In regard to your academic program, is this course best described as:						

### OPEN ENDED ITEMS

OPEN ENDED ITEMS
1. Was this class intellectually stimulating? Did it stretch your thinking? Why or why not?
2. What aspects of this class contributed most to your learning?
3. What aspects of this class detracted from your learning?
4. What suggestions do you have for improving this class generally?
5. If this course were offered remotely again, what suggestions do you have to improve the student experience?





## Appendix 3: Example of data analysis spreadsheet

## Prof C's Fall '21 BPHYS 121 course

Prof C (F)				
Fall '21 121	Satisfied/happy	unsat/unhappy	neutral	Reason
student 1	x			4
student 2		x		2
student 3			x	1
student 4	x			4
student 5		x		2
student 6		x		10
student 7	x			5
student 8	x			5
student 9	x			4
student 10	x			5
student 11			x	1
student 12			x	12
student 13		x		11
student 14		x		2
student 15		x		2
student 16		x		11
student 17		x		11
student 18		x		10
student 19	x			4
student 20	x			5
student 21	x			5
student 22	x			9
student 23	x			4
student 24		x		5
student 25			x	12
student 26		x		2
student 27		x		10
quant. data (Likert 5p):				
totals:	11	12	4	



#### Appendix 4: Study recruitment email

Dear [Name],

I'm writing with a research request/invitation/ask, related to you sometimes teaching PHYS 1XX lecture courses. I have three students doing research this quarter to answer the question: "Do student attitudes about active engagement instruction improve over the course of a year of introductory physics, and if so, how long does it take?" This is a continuation of a study they did last year, which was limited to physics courses at UWB. We are studying the lecture course only. What we have learned so far is that it seems to take students about 6 months (two quarters) of experience with active engagement instruction to buy in to it (enjoy it, appreciate it, believe they are learning). I'm attaching the students' poster that was presented at the UWB Spring STEM Symposium.

To investigate this question, the student researchers identify themes in free-response student evaluations of teaching (SETs), such as "The teacher doesn't teach me, I have to teach myself," and code for the frequency of these themes over multiple quarters. Five UWB physics professors have volunteered their own SETs for this purpose, but their research will be greatly enriched if they can include at least some of the (comparatively huge) UW-Seattle courses. Are you willing to share your SETs with us for this purpose?

I understand SETs are normally confidential. I would remove your name from the data before sharing it with the student researchers; however, they could still guess who it is. The student researchers will maintain confidentiality and any presentation they make will not identify specific faculty. That said, if you prefer not to share your SETs, I completely understand.

Please let me know what questions you have. Thanks for considering it,

Rachel



**Work cited**

- [1] P. Spooren, B. Brockx, and D. Mortelmans, "On the Validity of Student Evaluation of Teaching: The State of the Art," *Rev. Educ. Res.*, vol. 83, no. 4, pp. 598–642, Dec. 2013, doi: 10.3102/0034654313496870.
- [2] H. W. Marsh and L. A. Roche, "Making students' evaluations of teaching effectiveness effective: The critical issues of validity, bias, and utility," *Am. Psychol.*, vol. 52, no. 11, pp. 1187–1197, 1997, doi: 10.1037/0003-066X.52.11.1187.
- [3] "Student Evaluations of Teaching: Are They Related to What Students Learn?: A Meta-Analysis and Review of the Literature - Dennis E. Clayson, 2009." Accessed: May 16, 2024. [Online]. Available: <https://journals.sagepub.com/doi/10.1177/0273475308324086>
- [4] L. Deslauriers, L. S. McCarty, K. Miller, K. Callaghan, and G. Kestin, "Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom," *Proc. Natl. Acad. Sci.*, vol. 116, no. 39, pp. 19251–19257, Sep. 2019, doi: 10.1073/pnas.1821936116.
- [5] S. Freeman et al., "Active learning increases student performance in science, engineering, and mathematics," *Proc. Natl. Acad. Sci.*, vol. 111, no. 23, pp. 8410–8415, Jun. 2014, doi: 10.1073/pnas.1319030111.
- [6] D. E. Meltzer and R. K. Thornton, "Resource Letter ALIP-1: Active-Learning Instruction in Physics," *Am. J. Phys.*, vol. 80, no. 6, pp. 478–496, Jun. 2012, doi: 10.1119/1.3678299.
- [7] "Interrater Reliability - an overview | ScienceDirect Topics." Accessed: Jun. 03, 2024. [Online]. Available: <https://www.sciencedirect.com/topics/nursing-and-health-professions/interrater-reliability>
- [8] J. Anderson, G. Brown, and S. Spaeth, "Online Student Evaluations and Response Rates Reconsidered," Jan. 2006.
- [9] H. Vera, D. Gijs, and D. Eliane, "Gender Bias in Student Evaluations of Teaching: Students' Self-Affirmation Reduces the Bias by Lowering Evaluations of Male Professors," *Sex Roles*, vol. 84, no. 1–2, pp. 34–48, Jan. 2021, doi: 10.1007/s11199-020-01148-8.



## ABOUT THE STUDENT AUTHORS

**Hoda El Anany (she/her/hers)** is a senior pursuing a degree in Law, Economics, and Public Policy with a minor in Human Rights and Business Administration. She has a passion for music and loves attending concerts. In her professional career, she has been working as an Administrative Assistant for UW Medicine. Academically, she has focused her research on Middle Eastern politics, with a particular emphasis on human rights issues in Palestine. Following her anticipated graduation in Spring 2025, she intends to go to law school with a passion for criminal justice or public interest.

**Yordanos Berhane (she/her/hers)** is a first generation Eritrean-American undergraduate student at the University of Washington Bothell. She will graduate in Spring 2025 with a Bachelor's in Psychology and a minor in Health Studies. After graduating, she plans to further her education with the goal of practicing behavioral medicine, especially in underrepresented communities.

**Amado Chacon** is a first-generation college graduate and second-generation Latino, graduating in 2024 with a BA in Culture, Literature, and the Arts. He plans to continue his education and will join the Master's in Teaching program in the Spring of 2025. Amado has long been interested in history and culture, hoping to be an ethnic studies teacher. In his free time, he enjoys reading, writing, and drawing. The researcher and writer of this article, Amado, has expressed interest in continuing and expanding on this research.

**Brianna Fero** is dedicated to advancing human rights, global justice and ethical development. Originally from Arizona, she made her way to the Pacific Northwest, where she obtained an Associate of Arts in Global Studies from Seattle Central College and a Bachelor of Arts in Global Studies with a minor in Gender, Women, and Sexuality Studies from the University of Washington Bothell in 2024. Brianna is currently earning her Master of Arts in Policy Studies in the 2024-2025 program at the University of Washington Bothell. Her research explores international development and governance, with an emphasis on women, children, Indigenous rights, and the intersection of these issues with international affairs. Driven by a belief that true freedom comes when everyone is free, Brianna views her work not just as a career, but as her calling. With a PhD on the horizon, she is committed to dismantling unjust systems and ensuring that everyone has a seat at the table.

**Niki Hakimi (she/her)** is a 2024 UW Bothell graduate with a B.S. in Biology. She plans to continue her education through optometry school, and is passionate about health and science research, with plans to contribute to both clinical practice and vision science research. She is especially interested in exploring how visual health impacts overall well-being and vice versa. She hopes to engage in research that advances treatments for visual impairments and expands access to quality eye care. Outside of academics, she enjoys planting and reading.

**Mahy Hussein** is a Health Science graduate from the University of Washington Bothell with a passion for global health equity and women's health. Her academic interests focus on health disparities in underserved populations, with a particular emphasis on cancer awareness, prevention, and early detection. Mahy aims to contribute to public health research that leads to culturally sensitive interventions and improved access to care. This research reflects her commitment to amplifying the voices of marginalized communities and advancing health outcomes through education, advocacy, and innovation.



## Author Biographies

**Victoria Jeffords (she/her)** is a fourth-year Earth Systems Science major at the University of Washington, Bothell. She is deeply passionate about environmental science, particularly the ways in which human activity shapes local ecosystems. Victoria is currently conducting research focused on cultivating and identifying microbes capable of bioremediating 6PPD-Quinone, a toxic chemical impacting aquatic life. Beyond the lab, she balances her time bartending part-time and playing as #69 on the University of Washington's Women's Ice Hockey Team. She hopes to continue combining research, fieldwork, and advocacy to address pressing environmental challenges.

**phoenix kai (they/them)** is a queer poet, writer, and multimedia artist located on the unceded Indigenous lands of the Coast Salish peoples in Seattle, WA. their work has appeared in the Henry Art Gallery Interpretive Guide, Silly Goose Press, Beyond Queer Words, and elsewhere. phoenix was a 2024 Husky 100, got their BA in Ethnic Studies from the University of Colorado Boulder, and received their MFA in Creative Writing and Poetics from UW Bothell. they are currently fascinated with open access digital archives, speculative futures, and techno-feminisms. In their spare time they enjoy reading, playing games, and watching cartoons.

**Gurkamal Kaur** is a third-year undergraduate student majoring in Biology at the University of Washington Bothell, with intentions of attending medical school. Deeply aligned with the values that promote health equity and service towards underserved communities, she is passionate about addressing disparities in access to health care, particularly those driven by climate change and resource availability in rural areas. In addition to volunteering in the Post Anesthesia Care Unit at EvergreenHealth, as an undergraduate, she has worked towards research on genetic approaches to investigating protein function, utilizing CRISPRi-dCas9 and morpholino oligo knockdowns. These experiences have continued to shape her interest in translational medicine and community health. Outside of academics, she enjoys swimming, tennis, hiking, reading, and, most importantly, spending time with loved ones. She hopes to make an impact and is actively working towards mental health advocacy for underserved communities alongside other projects such as mentorships and tutoring to first-generation or immigrant students as they navigate through high school, college applications, and university.

**Faith Lambert (she/her)** is a recent UWB alumna as of Winter 2025. She is a biology major with a career interest in cancer research. As a lifelong learner, she plans to attend graduate school and earn a Ph.D. in cellular and molecular biology, immunology, or pathobiology. She aspires to someday lead her own research team to tackle the most prominent issues in healthcare today. Outside of classes, she engaged in activism and educational advocacy as the club president of the Alliance 4 Sustainability at UWB. In her downtime, she enjoys writing free-verse poetry and working on her fantasy-turned-sci-fi book series.

**Stephen Lovas** is currently a freshman undergraduate at the University of Washington Bothell pursuing a Business degree in Marketing Concentration. He has had a passion for writing since he was a kid, writing countless stories and articles across a wide array of subjects. In his free time, he enjoys drawing, playing games, and going on walks.





**Liz Macias (she/her/hers)** Is a senior undergraduate student at University of Washington Bothell in her final quarter. She is getting her bachelor's degree in Conservation and Restoration Science. Liz recently received a Spring internship for Whale Scouts and is planning on continuing her internship this Summer. She is also doing an independent study with Professor Martha Groom, studying how forest density can affect air quality at Saint Edwards State Park using environmental sensors developed during her capstone. In her free time, she likes to put puzzles together, hang out with friends and family, be outdoors as much as possible, and discover new music

**Eric Onnen (he/him)** recently graduated with a Bachelor of Science in Physics and is currently pursuing a Professional Master of Science in Physics at the University of Washington, Seattle. He works as an Engineering Technician at Helion Energy, where he applies his technical expertise to advance sustainable energy solutions. In his free time, Eric enjoys exploring new technologies, hiking, experimenting with new recipes, and photographing scenic landscapes. This is his first year on the CROW editorial board, and he is eager to collaborate with the team and contribute to showcasing innovative research.

**Robin Stone (He/Them)** was a senior undergraduate student at University of Washington Bothell, having graduated in June 2024 with a Bachelor of Art in Health Studies. Robin has a huge passion for public health and public policy, with an emphasis on memory care and geriatric medicine. They hope to one day work in the WA State Department of Health or for Olympia more broadly. A lifelong Mormon and Christian, Robin advocates for an authentically faith filled life while still being authentically queer.

**Parbeen Sekhon (she/her)** recently graduated with a Bachelor of Science in Physics and minor in Math. Her passion for physics education research grew through her work as a peer facilitator for introductory physics courses, where she fostered collaborative learning and supported student success. Now preparing for medical school, Parbeen is driven by a commitment to addressing health disparities and advocating for equitable healthcare. She is excited about combining her analytical background with compassionate care to make a difference in the lives of underserved communities. In her free time, she enjoys hiking, experimenting with new recipes, and photographing scenic landscapes. This is her first year on the CROW editorial board, and she is excited to collaborate with a dynamic team and contribute to showcasing innovative research.

**Kelsey Sugita** is a senior at the University of Washington Bothell, majoring in Health Studies with minors in Global Health and Health Education and Promotion. She is set to graduate in June 2026 and plans to pursue a Master's in Public Health. Kelsey volunteers with the University of Washington's Department of Environmental and Occupational Health Sciences, contributing to research focused on air quality and its impact on community health. A strong advocate for mental health, Kelsey is passionate about promoting well-being and equity in public health. She is grateful for the opportunity to share her work through The CROW.

**Sidra Yousaf** graduated from UW Bothell in 2024 with a BS in Biology, a BA in Community Psychology, and a minor in Neuroscience. She intends on taking her MCAT in the next few months and applying to medical school soon, eventually specializing in neurology. Growing up in a rural part of Washington, she's hyper aware of healthcare disparities faced by marginalized groups. In the future, she wants to start a non-profit organization that provides affordable/free specialized healthcare to lower income communities in urban and rural areas. In her free time, she enjoys painting, hanging out with friends, and perfecting her matcha recipe.





## ABOUT THE EDITORIAL BOARD

**Cecilia Negash** (she/her) is a second-year undergraduate majoring in Education and is studying to become an elementary school teacher. Having worked with kids for the past 3 years, she is particularly interested in child development and developing pedagogical strategies to ensure a more equitable education. Outside of her classes, she is a Lead Tutor at the Writing and Communication Center and a substitute teacher at an after-school program. This is her first year working with the CROW editorial board. During her downtime, she likes to spend money she doesn't have by thrifting clothes and books, as well as hanging out with friends and family.

**Chuck Frickin-Bats** is a queer, non-binary, disabled sex worker and published author. They are in the Masters in Community Health and Social Justice program. After starting sex work in 2010, they quickly got involved in advocacy for their newfound community, and that is what drives their education. Through school, Chuck found a passion for research and plans to continue writing about the stigmatization of the sex trade and health. A common adage in the movement is, "Nothing about us without us." This is their first year on the Crow Editorial board and they can't wait to see what this adventure will bring. They recently dubbed themselves the 'Donation Coordinatrix' for Red Cedar Community Network who assist the unhoused. In Chuck's downtime, they stress about their plants and clean their house while obsessively listening to Sleep Token and devouring audiobooks. Chuck's other obsession is bats, and to them, Halloween is more than just a holiday, it's a lifestyle.

**Kaya Schubiger-Lewis** (she/her) is a 2nd year transfer student at UWB and will be graduating this spring from the Health Studies program with a Bachelor of Arts. She plans to continue her studies after graduation with the goal of becoming an Optometrist. As a woman of color, she has the intention to create space in the medical field for all people to feel safe and cared for. In her spare time, she enjoys laughing with friends and trying new foods – plus spending quality time with her two kitties. This is her first year on the CROW editorial board and she is **\*very much\*** excited to collaborate, learn, and grow with an awesome group of people.

**Layla Youssef** (she/her) is a 2nd year graduate student studying Museology. She is interested in curation and exhibit design with a specific focus in history and cultural museums. With a background in postcolonial studies, ethnic studies and human rights, her goal is to develop exhibits on overlooked histories that encourage stronger understandings of the stories being told and more positive connections between visitors and the communities and cultures represented. In her free time, she enjoys watching movies, exploring vintage shops, and visiting local cafes and bakeries with friends. This is her second year in the CROW, now working as a managing editor, and she is excited to work with both students and the Editorial Board to present all the amazing research being conducted on campus!

**Morgan Fu-Mueller** (he/they) is a third-year Psychology major preparing for law school. He loves to think about K-pop, play D&D, and make art, drawing on all of that to advance his writing. As a WaCC tutor, they're passionate about enabling people to use their own voices to convey themselves; and making academic writing more accessible. Their experience with topics in the medical field stems from growing up around doctors and in hospitals, with lots of gory anecdotes over the dinner table. They're excited to be working with the CROW editorial board this year, to gain experience with a wide variety of writing in a new environment and help produce the best and silliest issue yet.



## Editorial Board Biographies

**Newton (Newt) Austria-Ball** (they/them) is in their third year as an undergraduate at UWB. They are following a path towards majoring in Biology while also minoring in Creative Writing. They love all kinds of writing and being able to help others with their writing, which is what led them to becoming a writing tutor. This is their second year on the CROW Editorial Board. Having lived in an underprivileged area for most of their life, they want to help shed light on those who do not have ready access to healthcare by advocating for more affordable and accessible healthcare. In their free time, they like taking walks in the wetlands, learning about plants, and hanging out with their cat. As well as writing, playing and learning how to play new instruments, and painting.

**Rehema Hassani** (She/her) is a fourth year undergraduate student at UWB. She is a Health Studies major, and double minoring in Health Education and Promotion and Global Health. She loves going on walks and catching the sunset. She also enjoys reading and spending time with her family and friends. She is passionate about public health and would like to do more research on maternal and child health especially for women and children of color. Outside of school she works as a Certified Nursing Assistant at a rehabilitation and care center. This is her first year working with the CROW editorial board. This is a great opportunity to gain more writing experience and work alongside talented individuals.

**Sabine Drake** (she/her/hers) is a fourth-year undergraduate student. She is a Health Studies major, intending to minor in Chemistry in the hopes of pursuing her Doctor of Veterinary Medicine career. She is passionate about public health research and community disparities, as well as her work as a Veterinary assistant. She enjoys writing and reading, especially surrounding health-related topics. This is her second year working with the CROW editorial board, and she is looking forward to continuing to expand her abilities and knowledge in working with others and their writing. In her free time, she enjoys spending time with her family, being outside, and of course, spending time with her two adorable dogs.