Investigating the Nexus of Historical Displacement and Contemporary Indigenous Suicide Rates in the USA (1999-2004)

A Fixed Effects Panel Data Analysis

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Abstract:

This paper investigates the potential link between historical displacement and contemporary Indigenous suicide rates among in America. This paper employs Ordinary Least Squares (OLS) regression to explore the statistical relationship between historical displacement distances and suicide rates among Indigenous Americans, while controlling for population, labor market characteristics and poverty rates. Findings reveal no statistically significant relationship between median displacement distance and contemporary suicide rates. The study recognizes constraints, including incomplete data and the suppression of county identifiers, potentially impacting the outcomes. Nonetheless, despite these limitations, the research underscores the interplay of suicide risk among Indigenous communities and highlights the imperative for comprehensive data.

Introduction:

In the 15th century, Indigenous Americans enjoyed a high standard of living and well-defined infrastructure and institutions (Dunbar-Ortiz, 2014). However, the arrival of European settlers marked a significant turning point, leading to forced migration, land dispossession, and the disruption of cultural continuity for Indigenous communities in the present-day United States. Today's Indigenous population is characterized by low life expectancy and one of the lowest incomes per capita rates in the country (Carlos et al., 2022).

In this paper, I examine the role of historic displacement in explaining modern day trauma among Indigenous Americans. I focus on suicide rates among Indigenous Americans, as suicide rates are a useful indicator for mental health outcomes as, about 90% of those who commit suicide have a mental health condition (Smith & Kawachi, 2014). The current rate of suicide among American Indian or Alaska Native (AI/AN) peoples is higher than all other racial and ethnic groups, 28.1 per 100,000 in 2021. Suicide ranks as the 9th leading cause of death among AI/AN persons, and the situation is even more alarming for AI/AN males aged 15-34, with a suicide rate at 82.1 per 100,000 (CDC, 2023). Using Ordinary Least Squares (OLS) regression, I evaluate the statistical relationship between the distances that Indigenous Americans were displaced historically and contemporary Indigenous suicide rates while controlling for other important factors (labor market characteristics, poverty rates and population counts).

My work is informed by scholarly evidence of the inter-generational transmission of trauma. The offspring of trauma survivors are more likely to develop post-traumatic stress disorder, as well as mood and anxiety disorders, indicating that trauma can be biologically embedded and passed down through generations (Fortuna et al., 2022). The dispossession of land assets had profound and long-lasting effects on economic development for Indigenous

Americans, hindering their opportunities for industrialization. Historical displacement disrupted the continuity of cultural practices, traditional knowledge, and sense of community, resulting in a disintegration of support structures and leaving Indigenous communities at a higher risk for mental health challenges (Hill, 2009). There is compelling evidence of the long-term impacts of the stress stemming from displacement globally, alongside exposure to disaster and violence associated with displacement. Further consequences of forced displacement are often explained by inadequate integration into host societies (Cuadrado et al., 2023).

Moreover, evidence suggests that Indigenous Americans who stewarded the most valuable lands in the United States were displaced further distances relative to communities displaced from less valuable lands (Carlos et al., 2022). Those displaced the furthest distances may have seen the most acute reversal of their fortunes, amplifying their trauma. Moreover, communities displaced very long distances likely found themselves in areas where their place-based ecological knowledge was no longer salient, resulting in greater hardship. Additionally, the act of displacement from one's home involves intense trauma; and the experience may be especially traumatic when displacement forces communities to relocate very far distances.

My analysis uses CDC mortality data, specifically focusing on suicide among Indigenous Americans, to construct annual county-level Indigenous suicide rates (1999-2004). Using displacement data from Farrel et al. (2021), I identify the tribes displaced to different contemporary US counties (some of which overlap with reservations) and determine the median displacement distance. I also control for annual county labor force counts and unemployment rates using the US Local Area Unemployment Statistics (LAUS) and poverty rates based on the Small Area Income and Poverty Estimates (SAIPE) survey. My OLS approach seeks to gain

deeper insights into the long-term consequences of forced migration and land dispossession on mental health and intergenerational trauma within Indigenous communities.

My study is constrained by some important data limitations. Although suicides are rare events, I was limited to a relatively narrow study period (1999-2004). Data privacy rules in the CDC mortality data results in the suppression of some county identifiers, meaning that I cannot identify the full sample of relevant counties. Moreover, I cannot identify the suicide rate by tribe, meaning I must use an aggregated measure of displacement based on the distances of displacement for all tribes now residing in each county. This aggregation may miss within-county differences across communities displaced further and shorter distances. I include a secondary analysis using the maximum distance of displacement in each county to capture those who were more acutely impacted.

My findings suggest that that there is no statistically significant relationship between the median displacement distance for a contemporary county's (and its reservation's) tribes and the suicide rate from 1999 to 2004. As expected, I find that poverty rates and suicide rates are positively correlated in these counties. Surprisingly, unemployment rates are negatively correlated with Indigenous suicide rates, which may speak to the exclusion of Indigenous communities from economic opportunities enjoyed by non-Indigenous Americans. The secondary analysis reveals intriguing findings regarding the maximum distance variable. The results challenge the initial hypothesis, indicating that tribes more acutely affected by historical displacement may be less exposed to suicide risk.

Literature Review:

This literature review aims to provide an overview of the existing research surrounding the long-lasting impacts of forced migration and subsequent loss of land experienced by Indigenous people in the present-day United States of America.

Quality of life of Indigenous Americans prior to colonial contact and history of Indigenous displacement in the U.S.

According to Dunbar-Ortiz (2014), the Indigenous people in the US flourished in the 15th century, enjoying one of the highest standards of living in the world at that time. Their prosperity was evident through "surpluses from Indigenous production" that were traded extensively across the continent via a vast system of trading networks (Dunbar-Ortiz, 2014).

However, in stark contrast to their thriving past, Indigenous Americans today face a significant decline in their quality of life, as reflected in their low life expectancy and one of the lowest income per capita rates in the US. Contrary to what has been depicted in the media, Indigenous life was far from ‘primitive’. Indigenous people had shaped the North American landscape to meet economic needs and formed governing bodies well before the arrival of Europeans. (Carlos et al., 2022)

For Indigenous peoples, historic land value and historic displacement are interlinked. Carlos et al. (2022) points out that the states that were highly populated prior to colonization remain some of the wealthiest and most heavily populated areas today, demonstrating the value of the land that tribes inhabited and the importance of geography (Carlos et al., 2022). For example, consider the Cherokee lands in the southeastern United States. The Cherokee people had access to lawyers for negotiations, which, when compared to other tribes (who relied on missionaries and translators) is a testament of the wealth of the Cherokee at the time (Dippel, 2014). However, Cherokee lands were highly valuable, especially after the discovery of gold

resources, and as such their land was sought after. To appropriate this desirable land, the federal government ordered the army to march approximately sixty thousand Indigenous people from five distinct tribes, including the Cherokee, from Georgia to Oklahoma, along what is now referred to as the Trail of Tears. Historians estimate thousands of Indigenous deaths along this trek. In areas where the land quality was lower (for example, Michigan), Indigenous communities had more success resisting displacement efforts (Carlos et al., 2022). It should also be noted that tribes that occupied more valuable land were more likely to be forced to co-inhabit reservations with many other tribal groups. Hence, the value of a tribe's land was a key determinant of where they were displaced and how they were treated (Dippel, 2014).

It is widely accepted that a fundamental attribute of effective institutions is the establishment and protection of robust property rights. European settlers developed strong property rights on American soil by directly undermining Indigenous relations to property. Following the Civil War, the federal government ceased using force and violence as a mechanism for gaining access to land. Instead, they transitioned Indigenous rights to property from ownership to occupancy, that could be revoked at any time, under the pretense of homesteading and the expansion of railroads. The government used subsidies for homesteading and railroad grants to incentivize migration to unceded territories and effectively establish property rights through occupation (Allen, 2019). The dispossession of land assets had long-lasting effects on the economic development of the Indigenous population. For example, it is widely agreed upon in the literature that societies with strong property rights are better positioned to take the opportunity to industrialize (Carlos et al., 2022).

Numerous factors, in connection with their relocation, have contributed to the disruption of cultural continuity and the loss of a sense of identity among Indigenous people. The Dawes

Act of 1887 was implemented to help Indigenous communities start farming practices that mirrored those of homesteaders. However, this 'help' was just another way to force Indigenous people to assimilate into the European way of life and to disregard their traditional knowledge, passed through generations tied to the land (Akee, 2020). In addition, the lack of respect for the heterogeneity of sub-tribal groups correlates directly with negative long-run growth outcomes and tumultuous local political environments (Dippel, 2014). Tribes with differing traditions and social organization were forced together and treated as one. In the end, Indigenous communities were left with no option other than to try to amalgamate into the US political structure, despite being excluded from most opportunities to accumulate wealth.

Present outcomes for Indigenous Americans

Over centuries, Indigenous populations have faced a history of colonization, forced assimilation, land dispossession, and cultural genocide. These traumatic experiences have reverberated through generations, leading to a multitude of challenges, including disproportionately high rates of mental health issues. Such problems are only amplified by systematic disparities in access to quality healthcare, education, and economic opportunities. Indigenous people globally, even when compared to other marginalized groups, are disproportionately affected by suicide. In 2021, the CDC found that suicide rate for American Indians was 99% higher than that of the public (Stone et al., 2022).

The transition from traditional to modern lifestyles has led to an increase in diseases such as obesity, cardiovascular disease, Type 2 diabetes, and substance-abuse related disorders (Gracey & King, 2009). Several studies have investigated mental health outcomes for Indigenous Americans and have revealed concerning disparities. Christian et al. (1989) examine alcohol-related mortality among Oklahoma tribes from 1968 to 1978, finding heightened rates of alcohol

related deaths among Indigenous peoples as compared to other ethnic groups (Christian et al., 1989). Furthermore, Blanchflower & Feir (2023) investigate chronic distress between 1993 and 2020 find significantly poorer mental health among Indigenous Americans, especially those over the age of 30. This trend also is on the rise, widening the race gap in mental health outcomes. However, the study also finds that, in states with a higher population of Indigenous people, Indigenous respondents experience lower levels of chronic stress (Blanchflower & Feir, 2023).

The health gap between Indigenous and non-Indigenous populations is substantial; and the lack of acknowledgement and availability of comprehensive data for Indigenous groups further marginalizes them and exacerbates the challenges in addressing health disparities such as lack of access to culturally sensitive healthcare practitioners. Indigenous people are disproportionately facing higher rates of physical and mental illness, injuries, disabilities, premature mortality, and tobacco use when compared to other sub-populations. Without accurate information on these trends, it becomes challenging to develop intervention and prevention strategies to improve health outcomes. (Gracey & King, 2009)

Akee et al. (2022) investigates persistent disparities in Indigenous mortality rates in America, including the impacts of geographic location, cause of death and age of death. The study reveals that Indigenous people are more likely to die younger and because of homicide. The authors also point to lack of access to quality healthcare, economic vulnerabilities, and a lack of data to assist with addressing these trends as critical for reducing differences in life expectancies. (Akee et al., 2022)

There exists a phenomenon, commonly denoted as the “Western Suicide Belt”, which pertains to the notably higher suicide rates in the American western states (Smith & Kawachi, 2014). This area affected by this runs north-south and happens to also run directly through the

Navajo Nation, the largest Indian reservation in the US (Indian Health Services, n.d.). Suggested explanations for these heightened rates vary from social isolation to childhood adversity (Smith & Kawachi, 2014).

Inter-generational trauma

Intergenerational trauma is a form of trauma that is passed across generations without direct exposure to the event. The term trauma refers to experiences that have lasting effects of individuals; and trauma is known to be linked to the development and severity of mental illness. Intergenerational trauma is thought to be transmitted through family and community relationships, often unintentionally. This type of trauma has been identified in descendants of Holocaust survivors and enslaved individuals, among others. (Isobel et al., 2021)

Intergenerational trauma of Indigenous Americans is related to the long-standing impacts of their historical experience of colonization, forced displacement, cultural suppression, and systematic oppression. Numerous studies have explored the transmission of trauma from one generation to another, highlighting the relationship between historical events, cultural identity, and mental health outcomes. Historical events have led to long-lasting biological, psychological, and socioeconomic impacts on Indigenous Americans transmitted across generations, which are exacerbated by racism and structural inequalities (Fortuna et al., 2022). The trauma faced by Indigenous Americans is rooted in a painful history of oppression and systematic injustices. Forced eviction from ancestorial lands, loss of territory, and the large-scale migration such as the Trail of Tears imposed immense suffering on Indigenous communities. Additionally, there is a long history of abusive practices – such as radioactive dumping in proximity to Indigenous communities, flooding of Indigenous lands, and the removal of children from families to

boarding schools for forced assimilation – which have also inflicted trauma (Fortuna et al., 2022).

Cultural disconnection, and the disruption of tribal unity through forced cultural assimilation, led to a loss of cultural and ethnic identity. Disruption of traditional practices, which often foster a sense of belonging and cultural connection, has affected the willingness of Indigenous Americans to seek mental health services. Lack of cultural connection and identity have been linked to increased suicide risk. According to Hill (2009), the highest rates of Indigenous suicides occur among those living on reservations in states where Indigenous populations represent a small proportion of the total population. Additionally, these rates are higher compared to other Indigenous communities residing in areas with better access to healthcare. (Hill, 2009)

The healthcare challenges are also deep-seated. Before European colonization, Indigenous Americans populations faced various health challenges such as tuberculosis and pneumonia. The arrival of Europeans worsened the situation, leading to devastating epidemics of smallpox, measles and influenza that caused rapid decline of the Indigenous American population (Jones, 2006). The disease burden compounds the historical trauma experienced by Indigenous communities. The disparity in physical health outcomes can be attributed to both genetic and socioeconomic factors. The legacy is also compounded as limited access to quality healthcare, educational opportunities, nutritious dietary options, and economic resources can exacerbate existing health issues (Gracey & King, 2009).

The legacy of intergenerational trauma extends beyond emotional and psychological impacts, with profound implications for physical health as well. Biological embedding is the mechanism by which adverse trauma can impact an individual's biology and physiology, and

these embedded experiences can then be passed down to future generations. Through biological embedding, to influence brain structure, immune function, hormone regulation and metabolism. (Fortuna et al., 2022) Fortuna et al. (2022) demonstrates that intergenerational trauma, particularly experiences related to attending boarding schools, can have significant negative impacts on mental health, leading to higher rates of substance abuse, alcohol use disorder, suicidal thoughts, and suicide attempts among former attendees compared to non-attendees (Fortuna et al., 2022).

The historical trauma experienced by these communities, coupled with genetic predispositions to mental and physical health challenges, interact to worsen overall wellbeing of Indigenous Americans. The disruption of cultural continuity and loss of identity further exaggerate mental health disparities. Socioeconomic factors such as limited access to healthcare, education and economic opportunities compound the issue. The intersection of these multifaceted factors creates a complex web of challenges that disproportionately affect the mental outcomes of Indigenous Americans.

Historical impacts of forced displacement

Several studies have examined the long-run effects of forced displacement. These studies illustrate how outcomes can differ based on a variety of factors.

A working paper by Palsson (2023) looks at the case of Haiti's refugee camps following the massacre of Haitian people living in the Dominican Republic in 1937. This is a particularly interesting instance to study in this context, as the refugees were Haitian returnees and therefore had access to the full rights of citizens. More than seventy years after the camps were set up, and long after government funding ceased, these communities are wealthier when compared to other Haitians. Palsson discusses the importance of strong social networks and incomplete property

rights as reasons for why these camps persisted far past the anticipated time frame, despite not being on particularly viable land (Palsson, 2023). In the case of Indigenous Americans, the lack of negotiated property rights (with some transactions going as far as being theft) led to a similar path dependence as in the case of Haiti (Carlos et al., 2022).

A study on the partition of India and Pakistan examines Muslims who were displaced to Pakistan during a massive, violent episode of forced migration from 1947 and 1951. Ayesh (2023) finds that for families displaced to Pakistan, children obtained more years of education when compared to native counterparts living in Pakistan prior to Partition. The author points to the movement of forced migrants to urban areas that provided greater access to educational infrastructure, as well non-agricultural professions. Notably, these migrants lacked state support. However, their access to educational facilities fueled a shift in preferences towards investment in human capital rather than physical capital. (Ayesh, 2023)

Displacement episodes have significant impacts on the labour market outcomes of refugees, and the effectiveness of integration policies play a crucial role in long term prospects. Contemporary research conducted in Denmark over the last three decades (Foged et al., 2022) reveals that policies that support language training and placing refugees in strong labour markets drastically enhance their employment probability and long-term outcomes. Refugees face unique circumstances such as displacement, trauma and, potential loss of physical capital, which differentiates them from other migrants. These factors place them at a greater skill disadvantage in the labour market (Foged et al., 2022), and such policies can help individuals overcome these disadvantages.

Forced displacement exerts lasting impacts on mental health, even persisting for several decades after the traumatic event. The study by Freitag et al. (2013) examines the role of forced

displacement in the case of World War II as a predictor for mental health disorders and its influence on health-related quality of life. Their findings indicate that displaced individuals bear a heightened physiological burden and experience elevated levels of PTSD, depression, and anxiety, while also reporting lower levels of physical health and quality of life, especially among older populations. (Freitag et al., 2013)

The forced displacement of Indigenous Americans to less economically and environmentally inviting lands has resulted in profound and longstanding socioeconomic disparities. Research quantifying the exposure to climate change, mineral value potential, presence of oil and gas reserves, agricultural suitability, and proximity to federally managed land has revealed that the present-day lands of the Indigenous population are more susceptible to environmental challenges such as wildfires which exacerbates economic inequalities. Low land value and limited access to resources on tribal lands has implications for the opportunities available for development and growth. (Farrell et al., 2021)

Historically, Indigenous individuals have faced numerous restrictions and barriers when it comes to owning land and starting businesses, impacting their socioeconomic outcomes. The imposition of the Dawes Act of 1887, and the development of reservation systems, limited land ownership, which also led to widespread loss of territory. This deprived Indigenous communities of cultural connection and hindered their ability to engage in economic activities. Additionally, discrimination has led to their exclusion from the mainstream economic activities and restricted their access to capital and credit. (Carlos et al., 2022)

Data and Methods:

I analyze multiple years of mortality data, specifically deaths by suicide, in my effort to examine how historical displacement impacts intergenerational trauma. I use data from the U.S.

Centre for Disease Control and Prevention (CDC), which provides detailed information at the level of the individual deceased person, based on death certificates for US residents. The data includes information on cause of death (including if there were multiple causes) and location of death, as well as the individual characteristics of the deceased, such as county of residence, birthplace, educational attainment, age group, gender, and race. Although physicians can report multiple causes of death on a death certificate, the cause of death reported here is the event that initiated the events leading directly to death and is based on the order the physician reports. (*Multiple Cause of Death 1999-2020*, CDC WONDER)

From 2005 onwards, the CDC changed their policy on publicly releasing detailed geographic information on each death observation; since I need information on the county the deceased resides in, the latest year I can use is 2004. And prior to 1999, the CDC did not release public data on the individual's manner of death. Since I need to be able to determine if the death was a suicide, the earliest year I use is 1999.[1]

Consequently, one limitation of this analysis is the time period (1999-2004). Suicide rates in America increased by 1% annually between 1999 and 2006 and 2% per year from 2006 to 2018. Cumulatively this means that the suicide has increased by 35% between 1999 and 2018. Given the rising prevalence of suicide, it would be informative to assess more recent years of data. In the future, this analysis could be extended to include more recent mortality data (after 2004). In addition, suicides are rare events; more years of data could also improve our estimation precision and yield more robust findings (Hedegaard et al., 2020) and reassure us that results are not the consequence of a fluke in rare event data (Quick, 2019).

[1] It is possible to request more information from the CDC, but because of time constraints, I restrict this assessment to the publicly available information (*NVSS - Public Use Data File Documentation*, 2022).

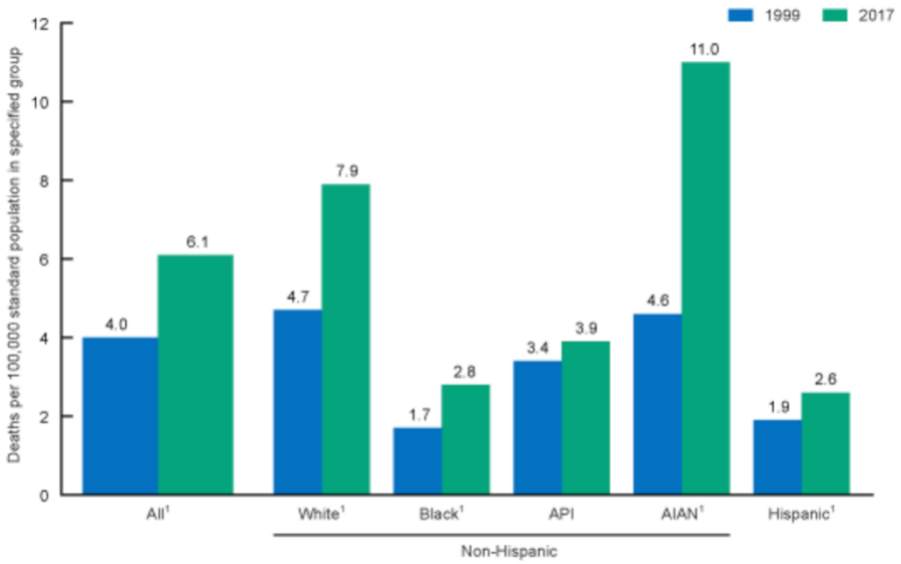

Figure 1. Suicide Rates per 100,000 people in America in 1999 and 2017 by race (Products-Health E Stats - Suicide Rates for Females and Males by Race/Ethnicity,

Figure 1 was produced by the CDC based on the same data as I use in my study and depicts the suicide rates per 100,000 people in 1999 and 2021 by racial group. The figure shows an alarming increase in suicide rates in the last two decades, particularly among Non-Hispanic American Indian/Alaska Natives.

I use the National Bureau of Economic Research (NBER) publicly available version of the CDC mortality data (*NBER*, 2023). I clean and subset each year of the CDC dataset to include only observations where the deceased was classified as "American Indian". Each CDC observation includes a categorical "manner of death" indicator, which I used to subset the sample to only deaths classified as suicides. Appending each aggregated data year, I obtain a county-year panel indicating the number of Indigenous suicide deaths in county *c* and year *t*.

One issue with our analysis is that some counties are missing, and they are not missing at random. The CDC suppresses some information in their publicly available data on mortality for confidentiality reasons. In particular, they suppress any statistics that represent fewer than 10 deaths (*Multiple Cause of Death 1999-2020*, CDC WONDER). In our case they supress the

individual observation's county if that individual is member of a sub-group, such as a racial group, with fewer than 10 observations in the data (Quick, 2019). This missing data represent a source of endogeneity in this analysis. As mentioned, past research suggests that Indigenous suicide risk is higher in states with lower Indigenous populations (Hill, 2009). But because the count of Indigenous people will likely be lower in these counties, Indigenous observations from these counties are more likely to have county identifiers suppressed due to data sparsity. Hence, our data is not missing at random: it is missing in a way that could be statistically correlated with the outcome. This could make my estimates less representative: I urge the reader to exercise caution when reading the results.

My Indigenous suicides per 100,000 Indigenous people in the county variable includes multiple counties with missing counts which represent counties unrecorded in the CDC data for a given year. This is either because there were zero Indigenous suicides or because the count of suicides fell below the data censorship threshold. As I cannot infer whether the count is zero or nonzero in these counties, I removed these observations before performing my analysis.

In addition, the CDC defines American Indian or Alaska Native as including North, Central and South American Indians, Eskimos and Aleuts. However, race data on death certificates only allow reporting of a single race category. Past research suggests persons who self-reported as American Indian (and some other races) on census surveys may be reported as white on their death certificate, resulting in underestimation of deaths for the racial subgroup (*Multiple Cause of Death 1999-2020*, CDC WONDER). A study by the CDC points to a 21% underestimation of death rates for the American Indian population (Rosenberg & National Center for Health Statistics (U.S.), 1999).

I account for time-varying, county-invariant phenomena by including a year fixed effect. This allows us to isolate the relationship between the independent variables on Indigenous suicide rates accounting for temporal trends and systematic changes over the period that influence suicide rates across the county. (*Fixed Effects Panel Regression*, n.d.)

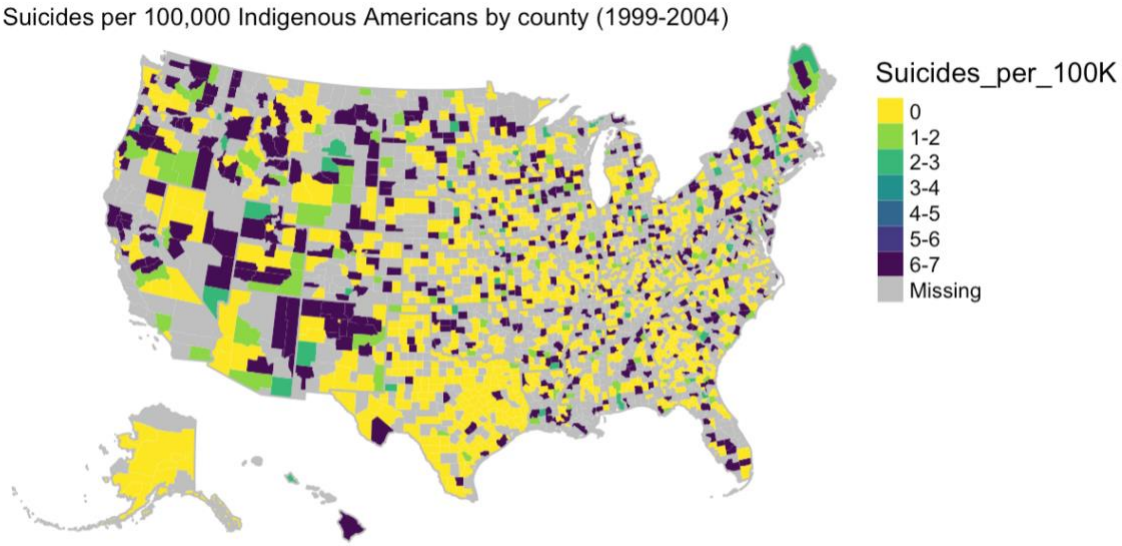

Figure 2. Indigenous suicides per 100,000 Indigenous Americans by county between 1999 and 2004

Figure 2 depicts Indigenous suicide rates per 100,000 Indigenous people at the county level, a noticeable trend appears to be emerging. It is evident that there is a concentration of higher suicide rates in the area encompassing the Navajo nation. This finding suggests that there might be specific factors or challenges within this region that contribute to the higher rates of Indigenous suicides. This result may also be compounded by the presence of the Suicide Belt in the same region.

Figure 3. Map of displacement destinations in the USA, (TIGER/Line Shapefile, 2018, n.d.)

Studies indicate that American Indians living on reservations have a higher prevalence of suicidal behaviors. Suicide clusters that are defined as a period where multiple suicide attempts happen at the same timpe and place, often occur on reservations. The theories behind this trend range from inadequate access to services, especially on rural reservations, to stories travelling quickly through these communities increasing suicidal ideations. (SAMHSA, 2017)

Furthermore, the map also reveals a compelling interaction between the distribution of federal and state recognized American Indigenous reservations as well as off reservation trust land areas and the prevalence of Indigenous suicides. It is noticeable that much of these lands are clustered on the West coast of the USA, and this seems to align with an increased number of Indigenous suicides in those areas. This observation raises questions about the potential impact of historical and socio-economic factors as well as exposure to suicidal behavior associated with reservation communities and their vulnerability to suicide risk.

I combine the CDC county-year information with publicly available data on Indigenous displacement in North America from Farrell et al. (2021). The authors built a unique data set that quantifies the degree of land dispossession for each tribe, the distances tribes were forced to migrate, as well as the distances between the tribe's historical territory and the lands that

American colonists and settlers displaced them to. The authors compiled data from the earliest recordings of occupants on American soil, as well as present-day US census data, to demonstrate the effects displacement had on the economic and environmental vulnerabilities of Indigenous people. The present-day data was obtained from American Indian/Alaska Native/ Native Hawaiian area national shapefile which contains all federally and state recognized American Indian reservations and off reservation trust land areas, this includes Oklahoma Tribal Statistical Areas, Tribal Designated Statistical Areas and State-Designated Tribal Statistical Areas. The study discovered a substantial reduction in the value and resilience of territories, with present-day lands on average being more exposed to climate change risks and having less positive economic value. (Farrell et al., 2021)

My hypothesis is that tribes, or subtribes, who were forcibly displaced further distances experienced greater levels of historical trauma and may experience higher suicide rates in the present day. For instance, if we compared, the Cherokee people who were forced to march from Georgia to Oklahoma, to Indigenous communities in Michigan, who may not have been displaced as far of distances, my hypothesis is that, all else equal, Indigenous suicide among current-day Cherokee would be higher. (Carlos et al., 2022)

I use the geospatial centroid of a tribe's historical territory and the centroid of the contemporary county the tribe was historically displaced to, then measure the linear distance of displacement in kilometers. Because many tribes were displaced to the same contemporary county, this distance calculation results in a tribe level dataset. To match this with my county-level data, I aggregate across all tribes in a county into county-level statistics (mean, median, maximum). For my analysis, the median was chosen as the outcome variable, as median statistics are not as distorted by extreme values (outliers) and hence provide a stronger representation of

the central tendency of the distribution. I also examine the relationship between suicide and maximum displacement. This secondary analysis is motivated by the possibility that specific subpopulations who were more acutely affected by historical displacement may have a stronger influence on Indigenous suicide.

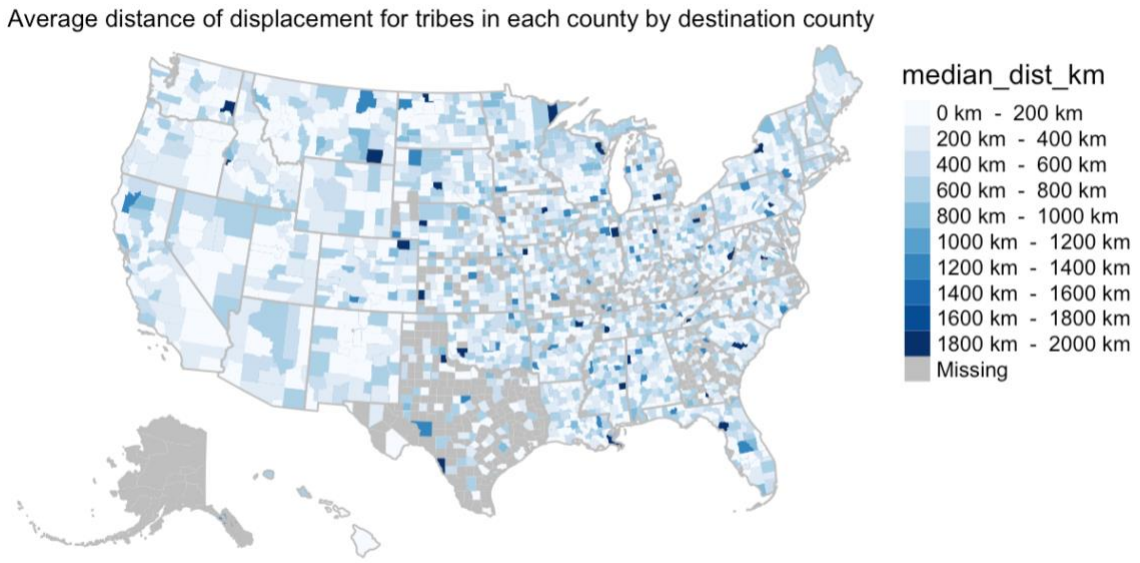

Figure 4. The average distance tribes in each county were historically forcibly displaced by destination county

My model also incorporates other control variables that may also play a county's suicide rate. Some factors that are statistically correlated with increased vulnerability to suicide are: substance abuse, history of incarceration, education level, sex, age, unemployment, poverty, access to healthcare, population, and community involvement as it relates to social isolation (Health, 2001). Although many of these attributes could contribute to suicide risk, and may show up in the error term, the controls are limited by access to data. Mental health data collection comes with a host of considerations, including how to maintain respondents' anonymity and what measurements to use to effectively assess and quantify various aspects of mental well-being. There is limited research and data on suicide within AI/AN communities as well as in the general

population (SAMHSA, 2017). It has also been proposed that suicides within racial minorities have been consistently underreported over many years (Smith & Kawachi, 2014).

I use annual population estimates at the county level from the US Census. Indigenous people only make up 2% of the U.S. population, so a standardized mortality indicator based on overall county population will not accurately convey variation in Indigenous suicide deaths (*USA - IWGIA - International Work Group for Indigenous Affairs*, n.d.). Fortunately, the census population counts are disaggregated by racial group (US Census Bureau, n.d.). I use the county-level American Indian or Alaska Native, not Hispanic or Latino population to determine suicides per 100,000 Indigenous people. Population also serves as a control variable. One reason for including population is that consistently higher suicide rates are found in rural areas compared to urban areas (Smith & Kawachi, 2014).

Additionally, I incorporate poverty data sourced from the Small Area Income and Poverty estimates (SAIPE) Program, a collection initiative carried out by the US Census Bureau. The SAIPE estimates each county's population of people below the poverty line (US Census Bureau, 1999-2004). I extract the following variable from the SAIPE to use in my regression: SAEPOVRTALL_PT, which represents estimated poverty rates across all age groups.

Furthermore, I incorporate Local Area Unemployment Statistics data, specifically labour force counts and unemployment rate by county (U.S. *Bureau of Labour stastistics*, n.d.). By including these independent variables, the model accounts for the economic context of each county. The coefficient estimates also offer some insights into how employment dynamics might influence Indigenous suicide rates. Unfortunately, our insights are limited by only having labour force counts and not the participation rate as the rate is responsive to population and not just the share of people in the labor force.

Tables 1 provides mean values to offer insight into the distribution and variation of the data and context for regression analysis.

Table 1: Descriptive Statistics (Mean)

	Year	Suicides per 100k	Median Distance (km)	Max Distance (km)	Population	Unemployment rate	Labor Force	Poverty rate
1	1999	4566.33	50.17	123.93	100878.60	4.96	46493.82	13.44
2	2000	1611.64	48.48	119.74	89916.74	4.36	45555.06	13.30
3	2001	1839.38	48.48	119.74	90811.14	5.04	45933.43	13.72
4	2002	1533.03	48.48	119.74	91657.62	5.78	46269.72	13.75
5	2003	856.08	48.48	119.74	92448.82	6.04	46531.79	13.37
6	2004	1249.01	48.48	119.74	93308.43	5.72	46872.07	13.75

Table 1. Mean values of independent and dependent variables from 1999 to 2004, including mean of maximum distance displaced in each county.

Several trends in our data emerge when the descriptive statistics are presented as in Table 1. The change in both mean and median distance statistic over time may be indicative of the data censoring phenomenon within the CDC dataset. This phenomenon results in the observation of certain counties in specific years and not others. While poverty rates appear to remain relatively stable throughout the period, there is an upward trajectory of unemployment rates over time. This upward trend could signify significant shifts in economic circumstances within the studied counties. An intriguing spike in the suicide rate is observed in the year 1999. This contrasts with prevailing Indigenous suicide trends, might reflect CDC data censorship. In sum, the findings underscore the importance of acknowledging data censoring and its potential impacts on observed patterns, while also highlighting the need for cautious interpretation when analyzing trends.

I evaluate the relationship between the distances that Indigenous Americans were displaced historically and contemporary Indigenous suicide rates, while controlling for other population characteristics that may be related to suicide rates. My OLS panel regression is as follows:

$$\boldsymbol{suicide_{ct} = \beta_0 + \beta_1 Distance_c + \beta_3 LFP_{ct} + \beta_4 unemp_{ct} + \beta_5 poverty_{ct} + \beta_6 population_{ct} + \tau + u_{it}}$$

The outcome variable is the number of Indigenous suicides per 100,000 Indigenous people in county *c* in year *t.* I regress the suicide rate on the median or maximum displacement distance ($Distance_c$), my explanatory variable of interest. I control for county-year population ($population_{ct}$) as well as unemployment ($unemp_{ct}$), labor force participation (LFP_{ct}), and poverty ($poverty_{ct}$) rates.

In addition to the primary regression of interest, as seen above, I include a secondary analysis using the maximum distance that tribes were forcibly displaced in each county as my explanatory variable. I also include a few supplementary regressions using both explanatory variables in the appendix to gain a fuller understanding of my results. Initially, I removed the poverty rate, unemployment rate and labour force count variables to see how these variables may be influencing my main results. The next set of regressions I ran was with the inclusion of a new variable that represents the share of the population that is Indigenous in each county. This regression was of interest as there is research suggesting increased rates of Indigenous suicide in areas with smaller Indigenous populations (Hill, 2009). Finally, the third set of regressions I include in the appendix includes all the same variables as our initial regression but with the observations from 1999 dropped, this was motivated by the spike seen in Table 1 in Indigenous suicides in 1999.

Results:

While evaluating at the results of this analysis, the reader should proceed with caution due to endogenously missing data. As mentioned in the Data section, this analysis is limited by the suppression of CDC mortality data, time constraints, unreliable race and manner of death reporting, and lack of county level data for independent variables resulting in these missing factors showing up in the error term. Given that Indigenous suicide rates are correlated with the size and share of the Indigenous population, the missing county identifiers are not missing at random (Hill, 2009). It is also worth mentioning that the presence of the Western Suicide Belt phenomenon (discussed in the Literature Review) may also have a large influence on results, as Navajo Nation exhibits shorter displacement statistics and high suicide rates. These factors could possibly bias estimation.

Table 2: Regression Results
Median distance (km) of historical displacement by county

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Median Distance Displaced (km)	−0.3976
	(1.5217)
Total County Population	0.0018
	(0.0015)
Unemployment Rate	−659.9995**
	(261.2504)
Labor Force Count	−0.0082**
	(0.0037)
Poverty Rate	182.2691***
	(64.0107)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 2. Regression results when controlling for median distance (km) tribes in each county were historically forcibly displaced by destination county with heteroskedasticity robust standard errors.

I report my regression results in Table 2, I find that my coefficient of interest, the median distance of displacement for tribes in each county by destination county, is not significant and has a high variance. The results suggest that distance of historic displacement is unrelated to current suicide rates among Indigenous Americans.

Alternatively, county unemployment rates and our county poverty rate indicator are both statistically significant at the 1% level. The negative coefficient on the unemployment rate suggests that higher unemployment rates for the overall county population are associated with lower Indigenous suicides. This may seem surprising, as one might expect higher unemployment rates to be associated with higher levels of stress and mental health issues. This inverse relationship could be a result of data limitations or omitted variables that my model does not capture but may be a factor influencing Indigenous suicide.

But the negative unemployment coefficient has some support in the literature. Liang and Su (2022) study the relationship between income and suicide and surprisingly find that a positive relationship: an $100,000 increase in household median income is associated with an increase in the suicide rate by 12.6 %, which aligns with our findings with the unemployment rate (Liang and Su, 2022). The authors of this paper point to few factors that may contribute to this phenomenon, including higher IQ being associated with greater risk of being diagnosed with phycological disorders and perfectionist tendencies. Liang and Su also estimated a model that controlled for educational attainment and demonstrate that education plays an important role in mediating suicide rates (Liang and Su, 2022). This points to evidence that the omitted variable of education may be endogenous in my model, resulting in more biased estimates.

On the other hand, the positive coefficient on poverty indicates that higher poverty rates are associated with higher Indigenous suicides. This corresponds with my expectation of higher Indigenous suicides in contexts of greater material hardship.

The R-squared for my specification suggests that the model fit has room for improvement. Although R-squared statistics do not fully convey model suitability or precision (they mechanically rise as we add more variables), it is worth noting that the R-squared for my regression model is only 0.00612, which is very low and suggests that only 0.61% of the variation in Indigenous suicides can be explained by the independent variables included. This suggests that there may be other unobserved factors contributing to Indigenous suicides that are not accounted for in the model.

As a secondary analysis, I estimate my regression with maximum displacement distance as the outcome variable. A significant coefficient on our variable of interest would indicate that those tribes who were displaced the furthest have a strong influence on suicide rates across the county.

Table 3: Regression Results
Maxium distance (km) of historical displacement by county

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Maximum Distance Displaced (km)	-0.8654^{**}
	(0.3798)
Total County Population	0.0018
	(0.0015)
Unemployment Rate	-647.6492^{**}
	(259.9551)
Labor Force Count	-0.0083^{**}
	(0.0036)
Poverty Rate	181.0445^{***}
	(64.5707)

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 3. Regression results when controlling for maximum distance (km) tribes in each county were historically forcibly displaced by destination county with heteroskedasticity robust standard errors.

The results from this secondary analysis are interesting. The coefficients on population, poverty rate, unemployment rate and labour force are all very similar to those found in our previous model. The coefficient on our distance indicator still has a negative relationship with Indigenous suicide, although the relationship is considerably stronger and is statistically significant at the 1% level. Certus paribus, the finding suggests that a 1 km increase in maximum distance of displacement is associated with a *reduction* in suicide rates by 0.8 per 100,000 Indigenous people. Contrary to my hypothesis, this finding implies that those Indigenous tribes who were more acutely impacted by historical forced displacement in each county are slightly less exposed to suicide risk. While the results may be spurious and due to biased coefficient estimate, it is also possible that the low displacement distances in Navajo Nations mediate this result.

As mentioned in my methods, I include a few supplementary regressions in the appendix to gain an encompassing understanding of the trends occurring in the model. First, when I removed unemployment rate, labour force counts and poverty rate from the model (as seen in **A1** and **A2)**, the results for both explanatory variables median and maximum displacement distances did not substantially change from our initial model. This indicates that the inclusion of these variables may not have strong impact on our main results. With the inclusion of the new variable Indigenous share of the county population (in **A3** and **A4)**, the coefficient on median displacement distance becomes positive however it is still not statistically significant at the 1% level. The coefficient on maximum displacement distance is still negative but is no longer statistically significant. The coefficient on the Indigenous share variable in both regressions is negative and statistically significant, which follows the existing literature which states that a higher share of Indigenous people in the population is associated with lower Indigenous suicide.

However, the R-squared is still relatively small indicating the model's explanatory power is still low. When I removed all observation from the year 1999 (in **A5** and **A6)**, median displacement distance has a stronger negative coefficient and is statistically significant in explaining variation in Indigenous suicide. The maximum distance model stays relatively the same when 1999 is dropped. Although dropping this year seems to increase explanatory power, the r-squared is still low which is indicative of the need for further investigation of potential variables that may be missing from the model.

Conclusion:

Since 2004, suicide rates have seen a notable increase, particularly among Indigenous Americans. With the COVID-19 pandemic exacerbating mental health challenges between 2018 and 2021, when suicide rates increased 26% in the AI/AN population (CDC, 2023). Motivated by the alarmingly high and growing suicide rates among Indigenous Americans, my study delves into the relationship between historical displacement and contemporary suicide rates.

The findings suggest that the median distance of displacement for tribes in each county by destination county is not significantly associated with the suicide rates among Indigenous Americans in the data. Surprisingly, the relationship between maximum displacement distance and suicide rates is negative, though this may be due to biased estimates or could be due to the low displacement and high suicide rates in Navajo Nation.

Statistically significant relationships emerge between suicide rates and other variables, such as county unemployment and poverty rates. The inverse relationship between higher unemployment rates and lower Indigenous suicides may warrant further investigation to understand the underlying factors contributing to this unexpected finding.

My study has some important limitations. Missing independent variables, such as mental health data and data related to social and community factors, could potentially influence Indigenous suicides per 100,000 Indigenous people but were publicly unavailable at the county level during the early 2000s. Moreover, county identifier suppression in the CDC mortality data means that my analysis is missing many relevant counties. Given the omission of key variables from my specification and non-randomly missing CDC counties, I cannot definitively conclude that there is a zero or negative relationship between historic displacement and contemporary suicide. But within my model, these two variables are not statistically associated.

My study highlights the complexity of suicide risk among Indigenous populations and emphasizes the need for more comprehensive and updated data to better understand the underlying factors at play. Further research in this area can help inform policies and interventions to address the historical trauma and its impact on Indigenous communities and mental health outcomes. An important next effort would use the restricted CDC mortality information to improve the representativeness of my data.

Appendix.

Table A1. Regression Results: Median distance (km) of historical displacement in each county, No controls except total county population

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Median Distance Displaced (km)	−0.5246
	(1.4588)
Total County Population	-0.0024^{***}
	(0.0007)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A1. Regression results when controlling for median distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. Not controlling for labour force counts, unemployment rate and poverty rate.

Table A2. Regression Results: Maxium distance (km) of historical displacement in each county, No controls except total county population

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Maximum Distance (km)	-1.0356^{***}
	(0.3462)
Total County Population	-0.0024^{***}
	(0.0007)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A2. Regression results when controlling for maximum distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. Not controlling for labour force counts, unemployment rate and poverty rate.

Table A3. Regression Results: Median distance (km) of historical displacement in each county, Controlling for Indigenous share of county population

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Median Distance Displaced (km)	0.9787
	(1.7294)
Total County Population	0.0014
	(0.0015)
Unemployment rate	−679.7262**
	(264.7852)
Labor force counts	−0.0075**
	(0.0036)
Poverty rate	224.2908***
	(74.1545)
Indigenous population share	−125.2640***
	(35.3180)

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A3. Regression results when controlling for median distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. Controlling for indigenous share of the population and all initial controls.

Table A4. Regression Results: Maximum distance (km) of historical displacement in each county, Controlling for Indigenous share of county population

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Maximum Distance Displaced (km)	−0.3403
	(0.3968)
Total County Population	0.0015
	(0.0015)
Unemployment rate	−669.1479**
	(263.1026)
Labor force counts	−0.0077**
	(0.0036)
Poverty rate	218.6904***
	(72.5507)
Indigenous population share	−108.1845***
	(27.2754)

Note: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A4. Regression results when controlling for maximum distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. Controlling for indigenous share of the population and all initial controls.

Table A5. Regression Results: Median distance (km) of historical displacement in each county, 2000-2004

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Median distance (km)	−0.8943
	(0.8769)
Total county population	0.0044
	(0.0037)
Unemployment rate	−409.6511***
	(121.9097)
Labor force counts	−0.0121
	(0.0074)
Poverty rate	110.1752**
	(43.5901)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A5. Regression results when controlling for median distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. When 1999 was dropped from the model

Table A6. Regression Results: Maximum distance (km) of historical displacement in each county, 2000-2004

	Dependent Variable:
Independent Variables	Suicides Per 100,000 Indigenous People
Maximum Distance Displaced (km)	−0.7673***
	(0.2466)
Total county population	0.0045
	(0.0036)
Unemployment rate	−399.9108***
	(121.7966)
Labor force counts	−0.0122*
	(0.0073)
Poverty rate	108.7625**
	(43.5687)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table A6. Regression results when controlling for maximum distance (km) tribes in each county were displaced with heteroskedasticity robust standard errors. When 1999 was dropped from the model.

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