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Association Between Generational Trauma and Progressive Dementia Types

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Abstract: BIPOC individuals (Black, Indigenous, and other People of Color) aged 75+ in the U.S. are over 4 times more likely to die from dementia than non-BIPOC individuals. Generational trauma and the epigenetic effects of stress could be a critical underlying factor for this stark difference. To date, no large-scale quantitative studies have explored the relationship between generational trauma and dementia. A first step in addressing that gap is to establish racial disparities in the rates of dementia between racial/ethnic communities. This project investigates whether, Black/African American, Indigenous/Native American, and Latinx American individuals have a higher rate of death due to dementia than White/European Americans. Mortality data from years 2017 through 2019 was gathered from the CDC WONDER public database. Results suggest that there are differences in the rate of dementia deaths between the racial/ethnic groups ($p < .001$). The difference in dementia mortality rates between the white/European group and the BIPOC groups is alarming and raises many questions as to why this is. Generational trauma and epigenetic stress could be a potential reason, however there is very little research discussing this theory or the phenomenon of generational trauma in general. This investigation opens a discussion regarding accurate reporting and surveillance documentation, especially regarding vulnerable communities. With a better understanding of generational trauma and the transgenerational effects of stress we can better understand the importance of trauma-informed care and in turn create and implement appropriate, effective, culturally relevant preventative strategies targeted for individuals who are uniquely predisposed to dementia.

There is evidence of a statistical association between dementia and psychological trauma, such as prolonged depression and stress (Korczyn & Halperin, 2009). However, there is very little empirical literature discussing the relationship between dementia and epigenetic stress, such as that experienced in the phenomenon of generational trauma.

This report opens a discussion regarding the potential relationship between generational

trauma and the prevalence of dementia mortality. A first step in addressing this relationship is to investigate racial disparities between different racial/ethnic communities. Therefore, this report aims to address the following research question: are deaths due to types of progressive dementia such as Alzheimer's disease and vascular dementia more prevalent in specific communities that have an established history of generational trauma?

The existence of a relationship between generational trauma and dementia suggests the need for further investigation of the epigenetic etiology of dementia and the creation and implementation of appropriate, effective, culturally relevant preventative strategies and trauma-informed care targeted for individuals who are uniquely predisposed to dementia.

Background

According to *Neuroscience Fundamentals for Communication Sciences and Disorders* (Anndreatta, 2020), dementia is an umbrella term for both chronic and progressive brain diseases. There are many different types of dementia, with different areas of the brain being affected in each. For any dementia diagnosis, the individual must have impairments in memory and one other cognitive function, such as language (Andreatta, 2020).

The two most common types of dementia are Alzheimer's disease and vascular dementia; Alzheimer's disease is heavily characterized by the buildup of protein in the brain, specifically, beta-amyloid plaques and tau tangles, initiating a domino-like effect of deterioration of brain structures and processes and cognitive decline. Vascular dementia, however, most often results from ischemic, or stroke-induced vascular damage which can largely be attributed to vascular disease, high cholesterol, and other stroke risk-factors (O'Brien & Thomas, 2015). Vascular brain damage is characterized by damage to the vascular system, or brain tissue, due to impairments in blood flow (John Hopkins Medicine, 2022). The risk factors for Alzheimer's disease include smoking, high cholesterol, and obesity; the cause of beta-amyloid plaques and tau tangles seen in Alzheimer's disease is very obscure and still unclear, but likely due to one or more of these factors (O'Brien & Thomas, 2015). Many of the risk factors for Alzheimer's disease overlap with those for vascular dementia. According to the National Institute of Aging (2017), high cholesterol, obesity, and vascular disease are also some of the most common risk factors for vascular dementia.

Numerous studies have explored the etiology of dementia and found several factors linked to the disease. However, currently there are no established causal mechanisms for any dementia type. O'Brien and Thomas (2015) argue that vascular health, or lack thereof, is an influential component for both dementia types. In fact, they argue that Alzheimer's disease is usually never just Alzheimer's disease, as Alzheimer's disease very commonly coexists with other cerebrovascular impairments. Research regarding the pathophysiology of vascular dementia is fairly new and proving just as variable as with the pathophysiology of Alzheimer's disease. Cerebral atrophy is also associated with dementia; post-mortem studies reveal that the brain is significantly smaller in volume, specifically in the hippocampal region, in individuals who died from dementia,

regardless of the type (Logue et al., 2011). Other secondary risk factors for dementia include age, diet and physical activity, drug/alcohol consumption, socioeconomic status, genetic factors, and environmental factors such as vitamin deficiencies (Chen et al., 2009).

Dementia and stress

A less recognized risk factor for both vascular dementia and Alzheimer's disease is depression (Korczyn & Halperin, 2009; O'Brien & Thomas, 2015). Evidence suggests individuals living with depression have significantly elevated cortisol levels, the hormone released during a state of stress, and thus depression can be compared to a state of chronic, prolonged stress (Deuschle et al., 1997). Additionally, like with dementia, post-mortem studies show cerebral atrophy in cases of depression, specifically in the hippocampal region (Gradin & Pomi, 2008). This suggests that elevated cortisol levels may contribute to cerebral atrophy.

The bodily response to stress can be defined by the hypothalamic-pituitary-adrenal (HPA) axis. During a state of stress, such as a situation that induces fear or intense anxiety, the body inhibits synaptic transmission of the hippocampus which in turn activates the hypothalamus. An active hypothalamus produces corticotropin-releasing hormone (CRH), which stimulates the pituitary gland. The pituitary gland then releases the adrenocorticotropic hormone, which stimulates the adrenal gland to release cortisol (Guidi et al., 2020). Normally, the cortisol would then activate the hippocampus, re-inhibiting the hypothalamus and turning the stress response off. However, with prolonged exposure to stress, the body eventually enters a state of allostatic overload, suppressing the body's ability to return to an unstressed state (Guidi et al., 2020). During allostatic overload the body is in constant "fight or flight" mode, which means that the body is devoting all its energy to the most vital organs. In this state, the body cannot keep up with the constant stress stimuli which leads to overall negative health effects.

There is a strong evidence base suggesting that trauma causes allostatic overload. In a longitudinal study of midlife women which included multi-ethnic participants, trauma induced by racial discrimination and hostility significantly predicted high allostatic load levels in individuals (Guidi et al., 2020). These high allostatic loads, induced by trauma in an individual's life, may in turn cause cerebral atrophy, and thus may also be a possible cause of dementia.

Generational Trauma

Generational trauma is a phenomenon in which the psychosocial suffering and emotional damage from a traumatic event are passed down from generation to generation, even when the event is years past (Maxwell, 2014). The mechanism that allows transgenerational effects of stress to perpetuate through generations is largely unknown and understudied. Currently theories suggest that epigenetic mechanisms are manipulated and triggered at a subgene level (Jiang et al., 2019). 'Epigenetics' can be described as the study of how behaviors and environmental factors cause changes in how an individual's genes work together, which influences an individual's systemic health and later health outcomes (Center for Disease Control and Prevention, 2021). According to Rozek et al. (2014) and Trerotola et al. (2015), epigenetic changes to gene expression are

dynamic, differ by tissue and disease state, and can be genetically inherited or environmentally acquired changes. Due to this, epigenetic changes can be used as a "biomarkers of exposure and disease and as targets for modification through preventive and therapeutic interventions (Rozek et al., 2014)."

Generational trauma can be caused by a multitude of different traumatic experiences. The most obvious examples of generational trauma can be observed through marginalized communities living in the United States, such as Black or African Americans, Indigenous or Native Americans, and Latinx Americans due to their histories of slavery, genocide, colonization, racism, discrimination, and isolation (Goosby & Heidbrink, 2013; Brown-Rice, 2013; Falconier, 2013).

The Black/African American communities within the U.S. have an inconceivably vast history of being subject to slavery, racism, discrimination, and isolation. Discussed by scholar and journalist Nikole Hannah-Jones (2019), "almost nothing about modern life has been left untouched by the very first enslaved Africans in the United States in 1619." The end of the Jim Crow era was not until the mid 1900s (Alexander, 2010). The trauma experienced by the Black communities in the U.S. have perpetuated for hundreds of years, much more than just a few generations. Decades of such traumatic experiences follow the trajectory to transgenerational effects of stress. According to Goosby and Heidbrink:

"African American health trajectories are shaped in part by maternal life conditions including the experiences of racism and discrimination that can shape later outcomes of their offspring through potential changes in the child's metabolic functioning subsequently elevating the risk of experiencing obesity and other chronic illnesses (Goosby & Heidbrink, 2013, p. 10)."

While Black/African Americans are subject to the transgenerational effects of stress, they and other marginalized communities in the U.S. are also experiencing current life stress because the U.S. is still being a race-conscious society. Scholar Michelle Alexander (2010) argues that modern slavery exists, but through more elusive tactics, such as systematic mass incarceration and police brutality against BIPOC (Black, Indigenous, or other Persons of Color) and Latinx communities. "In each generation, new tactics have been used for achieving the same goals—goals shared by the Founding Fathers. Denying African Americans citizenship was deemed essential to the formation of the original union. Hundreds of years later, America is still not an egalitarian democracy (Alexander, 2010; p. 1)." In addition to perpetuated marginalization, transgenerational effects of slavery are well documented within the African American community (e.g., Graff, 2014).

Like African Americans, the Indigenous American community has experienced immense psychosocial trauma. Atrocities toward Indigenous Americans are heavily documented and have persisted for decades. The Indigenous American community has endured genocide, colonization, forced assimilation, unfree labor, and stolen land. Brown-Rice (2013) states that for the last 500 years Native and Indigenous persons have been subject to purposeful and systematic destruction by European communities. "As a result of the loss of people,

land, and culture, a systematic transmission of trauma to subsequent generations occurred that has resulted in historical loss symptoms for many Native American individuals (Brown-Rice, 2013, p. 123)." Indigenous communities are still subject to racial and ethnic discrimination, continuing the cycle of chronic, prolonged stress. As with African American individuals, transgenerational trauma and its effects have been well documented among Indigenous Americans (e.g., Wiechelt et al., 2019).

The Latinx American community is another group that likely suffers the transgenerational effects of stress. All Latinx countries have been subject to colonization, racism, discrimination, and isolation. European countries, such as Spain and Portugal, were the first groups to begin colonizing the Indigenous people of Latin America. The United States has a history of colonizing Latin America as well. During World War II, the U.S. utilized the underpaid labor of Mexican workers through the Bracero Program of 1942 (Molina, 2011). "As many other immigrant groups, Latinx immigrants are likely to have experienced or witnessed traumatic events either in their country of origin and/or during the migration process or post-migration" (Falconier, 2013, p. 1). The historical and current cruelties that Latinx American communities face suggests that they very likely experience the phenomenon of generational trauma (Cerdeña et al., 2021).

Generational Trauma and Dementia

States of extreme chronic stress, such as those caused by generational trauma, and an overactive stress response eventually leads the body into allostatic overload, in which the body cannot recover from the response and return to a normal "unstressed" state (Deuschle et al., 1997; Guidi et al., 2020) When the body cannot recover from this stressed state, overall health levels in many different categories begin to decline (Guidi et al., 2020).

High allostatic loads may not be simply limited to the individuals who experience trauma. Rodent research has demonstrated that stress can cause transgenerational or epigenetic effects. Zucchi et al. (2013) discovered that stressing a pregnant rat caused higher levels of stress in the offspring, even if the offspring were not directly stressed. This theory lays the groundwork to the claim that transgenerational effects of stress experienced through generational trauma is possibly correlated to dementia mortality. The transgenerational effects of stress, in the form of generational trauma, can potentially lead to allostatic overload in successive generations, increasing the likelihood of developing dementia.

Methods

To test the hypothesis that generational trauma may increase the likelihood of death due to dementia, mortality data from years 2017 through 2019 was gathered from the CDC WONDER public database. The CDC WONDER is a public-use database that collects mortality and underlying cause of death data via ICD-10 codes on U.S. resident death certificates (Centers for Disease Control and Prevention, 2023). The years 2017 through 2019 were chosen to exclude possible health influences of COVID-19 that began in 2020. The mortality data was categorized by racial/ethnic demographic, sex, age at time of death, and underlying cause of death. Racial and ethnic

demographics available through the search query included: 'Black/African American', 'White', 'American Indian/Native Alaskan', and 'Hispanic or Latino'. All individuals were categorized as either male or female and all individuals were aged 75-85+ at the time of their death. Individual search queries were performed for each racial/ethnic demographic, per sex and per year of death. A total death count and population count was retrieved from each search, as well as a count of how many individuals' underlying cause of death was reported as 'Dementia, unspecified', 'Vascular dementia', or 'Alzheimer's disease' (see Appendix A for raw data counts). The control group included 558,409 White, non-Hispanic/Latinx individuals aged 75-85+ who died from dementia between 2017 and 2019. The comparison groups were chosen based on their established histories of experiencing the phenomenon of generation trauma, such as African Americans, Indigenous Americans, and Latinx Americans. A total of 35,738 dementia deaths were included for the Hispanic/Latinx group, 50,661 dementia deaths for the Black/African American group, and 1,969 dementia deaths for the Indigenous/Native American group. Aggregate counts for each group by year are provided in Appendix A.

Statistical tests were conducted to determine whether there is evidence of a difference in the rates of dementia deaths between the different demographic groups. If generational trauma is indeed correlated to dementia death, then compared to White, non-Hispanic/Latinx individuals, all other groups will have higher rates of dementia deaths.

Using RStudio (R Studio Team, 2020), the data was fit to a Poisson regression model, with the number of dementia deaths as the response variable, the total deaths as the offset variable, race/ethnicity as the main explanatory variable, and gender and population size as covariates. Interactions between the covariates and explanatory variable were tested, and none were found to be significant. Therefore, the final model included only main effects for each of the covariates. To evaluate whether there is any difference between White non-Hispanic Americans and African American, Indigenous American, or Latinx American individuals, we first conducted an ANOVA test. Comparisons between each racial/ethnic groups were then made using post-hoc tests with Tukey's HSD correction for *p*-values.

Results

Results suggest that there are differences in the rate of dementia deaths between the racial/ethnic groups. The main effects model fit to the data resulted in a model R-squared value of .959, indicating strong model fit. The results of the ANOVA test suggest that there are indeed differences between White individuals and BIPOC individuals ($p < .001$; See Figure 1). Pairwise examination of the incidence rate ratios estimate that relative to White Americans, Black Americans are 4.47 times as likely to have dementia as a cause of death (Table 1: 95% CI: 4.4 to 4.6; $p < .001$), Indigenous Americans are 4.39 times as likely (Table 1: 95% CI: 4.1 to 4.7; $p < .001$), and Latinx Americans are 4.62 times as likely (Table 1: 95% CI: 4.5 to 4.7; $p < .001$). There were no meaningful differences in the estimated ratios rates between Black Americans, Indigenous Americans, or Latinx

Americans, as all estimates were very close to a value of 1, indicating equivalent rates (see Table 2).

Discussion

This investigation explored the potential relationship between the transgenerational effects of stress, in the form of generational trauma, and progressive dementia types such as vascular dementia and Alzheimer's disease. The Poisson regression model results reveal that in the years of 2017-2019 African American, Indigenous American, and Latinx Americans aged 75+ were over 4 times as likely to die from dementia than White/European Americans aged 75+ were. These troubling results provide a call to action and further investigations about why these disparities may be so pervasive.

Dementia cannot be attributed to one cause. This investigation explored a small fraction of potential dementia etiologies, focusing on generational trauma and the psychosocial effects related to the HPA-axis and stress response. Depicted in Figure 3 is a directed acyclic graph (DAG) representing the conjectured relationships between generational trauma and dementia.

The DAG conjectures that generational trauma's effect on dementia is likely through the interplay between several factors such as stress, depression, diet and physical health, and cerebral atrophy. Through these pathways, generational trauma can cause or increase the likelihood of developing and dying from dementia.

O'Brien and Thomas (2015) suggest that depression is one of the most common comorbidities to dementia, which is not surprising due to the similarities in the pathophysiology of the two conditions, including cerebral atrophy. Furthermore, as depression is caused by trauma and stress, generational trauma is likely a major contributor to depression.

Additionally, generational trauma may lead to cerebral atrophy, which is also associated with dementia; post-mortem studies reveal that, compared to individuals who died of other causes, the brain is significantly smaller in volume, specifically in the hippocampal region, in individuals who died from dementia, regardless of the type (Logue et al., 2011).

It is important to observe that many of these factors can also be related sociodemographic/socioeconomic status; BIPOC communities typically experience widespread systemic disparities in access to healthcare, food, and other essential resources, which increase the likelihood that BIPOC communities in the U.S. will experience traumatizing situations and/or intense, prolonged feelings of distress (Chen et al., 2009). "The psychosocial stress and burden of coping with limited access to resources and the harmful challenges associated with social marginalization can place substantial wear and tear on bodily systems important for managing stress and coping (allostatic load), thus leaving individuals vulnerable to disease (Goosby & Heidbrink, 2013)."

There are many limitations in this study, the first being that all dementia types have a different pathophysiology and lesion locations, causing variability in condition severity and outcomes. However, arguably the most influential limitation is the lack of surveillance

documentation and accurate reporting regarding these BIPOC communities in the United States. One of the intended populations for this study was the refugee communities in the U.S. However, it was not possible to find public mortality data regarding this population. Similarly, very little research has been conducted regarding the phenomenon of generational trauma. Consequently, there is no way to quantify exactly what generational trauma is nor how to measure its full effect. Future investigations warrant addressing direct and indirect means to measure generational trauma, such as past abuse or depression. For this investigation, BIPOC communities in the United States were chosen as a proxy to demonstrate that transgenerational effects of stress could be a major factor in the prevalence of dementia in the U.S. However, it is important to note that the investigation analysis could not adjust for all other factors due to the variability and ambiguity in measuring stress and generational trauma. Transgenerational effects of stress can be caused by a myriad of traumatic experiences; due to the inability to accurately quantify the effects of generational trauma, individuals in the White/European American control group could potentially experience transgenerational effects of stress as well, but that are not caused by the same experiences as the BIPOC comparison groups. Lastly, this investigation was limited by the inability to quantify individuals who identify with more than one race/ethnicity. Identity is dynamic, and a huge proportion of the population, especially in the United States, is multiracial/ethnic. By excluding individuals who identified as multiracial/ethnic, a large portion of data is excluded, potentially leading to inaccurate causal inference.

The results from this investigation substantiate the idea that generational trauma may have an important correlation with dementia death. Acknowledging the presence of generational trauma and its effect on communities and individuals is a necessary step in providing effective care and facilitating appropriate research regarding individuals and families living with dementia, as well as the start to addressing the large disparities in dementia related deaths in the U.S. We still live in a racialized, marginalizing society, perpetuating the cycle of generational trauma. When, we as a society, challenge these ubiquitous disparities, we can then begin to create and implement effective, appropriate, and culturally relevant care.

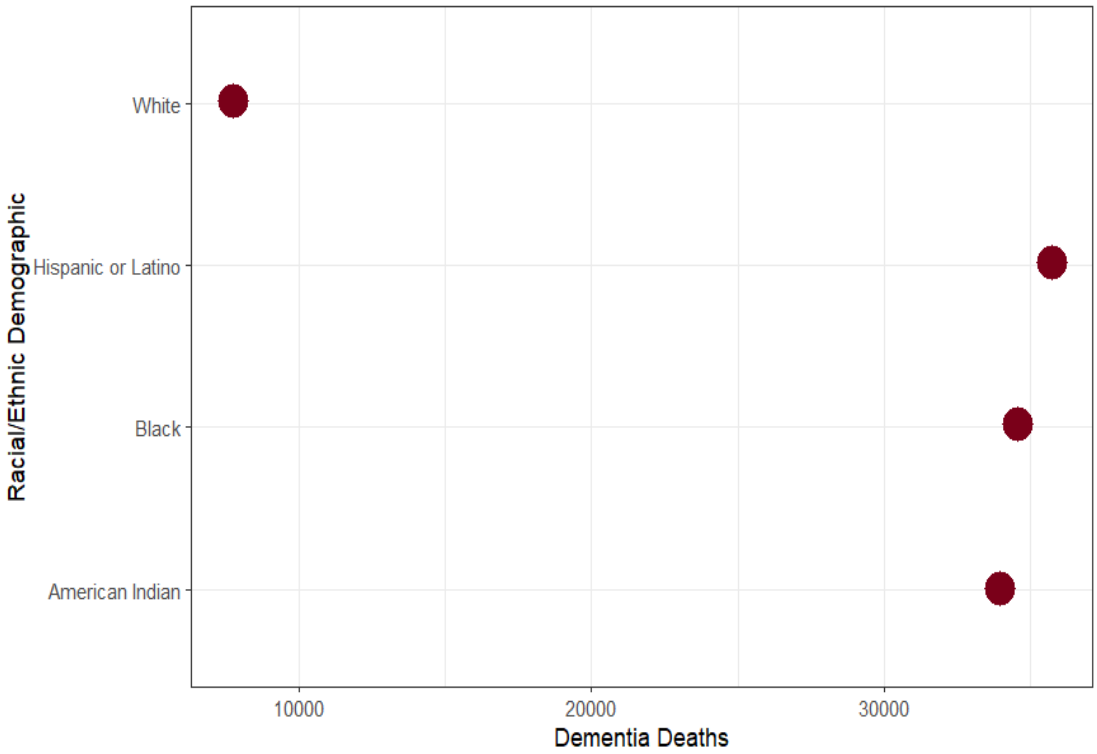

Figure 1. Poisson regression data visual depicting the number of dementia deaths per racial/ethnic demographic.

Multiple comparison of demographic group

Demographic	Estimated rate-ratio (95% CI)	p_{Tukey}
Black - White	4.47 (4.36 – 4.58)	<0.001
Latinx - White	4.62 (4.50 – 4.74)	<0.001
Ind - White	4.40 (4.12 – 4.86)	<0.001

Table 1. Pairwise rate ratios estimate comparing probability of death due to dementia in Black Americans, Latinx Americans, and Indigenous Americans (Ind) relative to White Americans using post-hoc tests with Tukey's HSD correction for *p*-values.

Demographic	Estimated rate-ratio (95% CI)	p_{Tukey}
Black - Latinx	0.97 (0.95 – 0.99)	<0.001
Black - Ind	0.98 (0.93 – 1.0)	0.8856
Latinx - Ind	0.95 (0.90 – 1.0)	0.1352

Table 2. Pairwise rate ratios estimate comparing probability of death due to dementia in Black Americans, Latinx Americans, and Indigenous Americans (Ind), using post-hoc tests with Tukey's HSD correction for *p*-values.

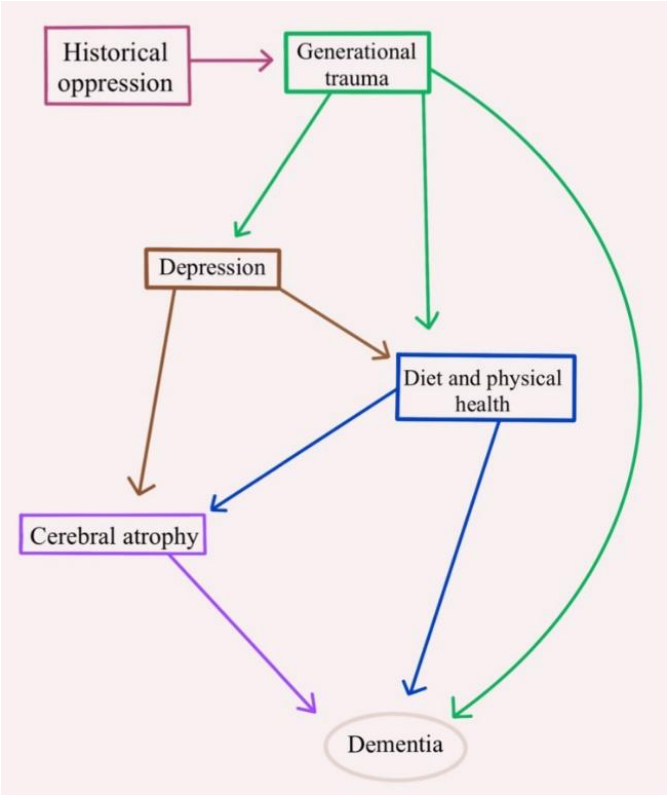

Figure 2. Directed Acyclic Graph depicting the conjectured causal relationships relative to the effects of historical oppression, generational trauma, depression, diet/physical health, and cerebral atrophy on dementia.

Appendix A

Raw data counts from CDC WONDER database

Demographic	Age	Year	Sex	Dementia Deaths	Total Deaths	Population Count
Hispanic or Latinx	75-85+ years	2017	Female	7,732	47,467	991,490
Hispanic or Latinx	75-85+ years	2017	Male	3,667	37,599	662,975
Black/African American	75-85+ years	2017	Female	12,044	74,520	1,130,806
Black/African American	75-85+ years	2017	Male	5,006	50,201	639,789
American Indian/Indigenous	75-85+ years	2017	Female	417	3,300	62,162
American Indian/Indigenous	75-85+ years	2017	Male	219	2,702	44,619
White	75-85+ years	2017	Male	58,212	561,197	6,945,380
White	75-85+ years	2017	Female	130,323	715,043	9,751,271

Hispanic or Latinx	75-85+ years	2018	Female	8,183	49,455	1,038,820
Hispanic or Latinx	75-85+ years	2018	Male	4,000	39,276	696,582
Black/African American	75-85+ years	2018	Female	11,862	75,984	1,170,384
Black/African American	75-85+ years	2018	Male	4,923	52,308	667,076
American Indian/Indigenous	75-85+ years	2018	Female	455	3,287	66,090
American Indian/Indigenous	75-85+ years	2018	Male	234	2,730	47,880
White	75-85+ years	2018	Male	58,106	569,631	7,232,720
White	75-85+ years	2018	Female	128,789	717,722	10,024,931
Hispanic or Latinx	75-85+ years	2019	Female	8,213	50,703	1,085,480
Hispanic or Latinx	75-85+ years	2019	Male	3,941	40,431	731,367

Black/African American	75-85+ years	2019	Female	11,742	76,941	1,210,903
Black/African American	75-85+ years	2019	Male	5,084	52,308	667,076
American Indian/Indigenous	75-85+ years	2019	Female	422	3,289	69,560
American Indian/Indigenous	75-85+ years	2019	Male	222	2,801	50,825
White	75-85+ years	2019	Male	58,051	576,168	7,454,555
White	75-85+ years	2019	Female	124,928	712,477	10,223,551

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