Determinants of Native American Drowning Rates

Marina Mileo Gorsuch, Samuel Myers, Jr, and Yufeng Lai

Research question

Among people under 30 years old, drowning is one of the leading causes of death from unintentional injury.[1] There are also striking racial disparities in drowning; in 1999 to 2010, the African American drowning rate was 1.4 times the white drowning rate and the American Indian/Alaska Native drowning rate was 2 times the white drowning rate.[2] Racial disparities in drowning are particularly pronounced for drownings that occur in swimming pools.[3]

Most research on the racial disparities in drowning focus on the African American drowning rates with some research on the Latino drowning rate. However, the American Indian/Alaska Native (AI/AN) rate is actually higher than both the African American and Latino drowning rate.[2] While the drowning rate has declined nationally, our research team has discovered that in the last five years the female AI/AN drowning rate has spiked.

In this project, we first seek to accurately describe the geographic patterns of AI/AN drowning rates. We will examine if the drowning disparities for the AI/AN population are concentrated in certain states, if the disparity is more pronounced in pools or open water and in urban or rural areas. We then will identify what policies, practices, economic changes, and geographic factors are associated with the AI/AN drowning disparity, particularly the recent increase in AI/AN women who have drowned.

Significance

As shown in Figure 1, the national drowning rate for the AI/AN population is persistently higher than both African Americans and white Americans. While the female drowning rate is far lower than the male drowning rate for all races, the AI/AN female drowning rate has sharply increased in the past five years.

The drowning rates shown in Figure 1 are the result of a combination of factors. Most obviously, a person drowns when exposed to water.[4] Drowning is also affected by the safety of the swimming area, condition of the water[5], presence of lifeguards[5], use of life preservers[7], alcohol use[8], and a person's swimming ability.[9,10,11] Public policy often focuses on passive measures to reduce accidental exposure to water – for example fences or pool covers that keep children out pools[12,13,14] – and swimming instruction.[15]

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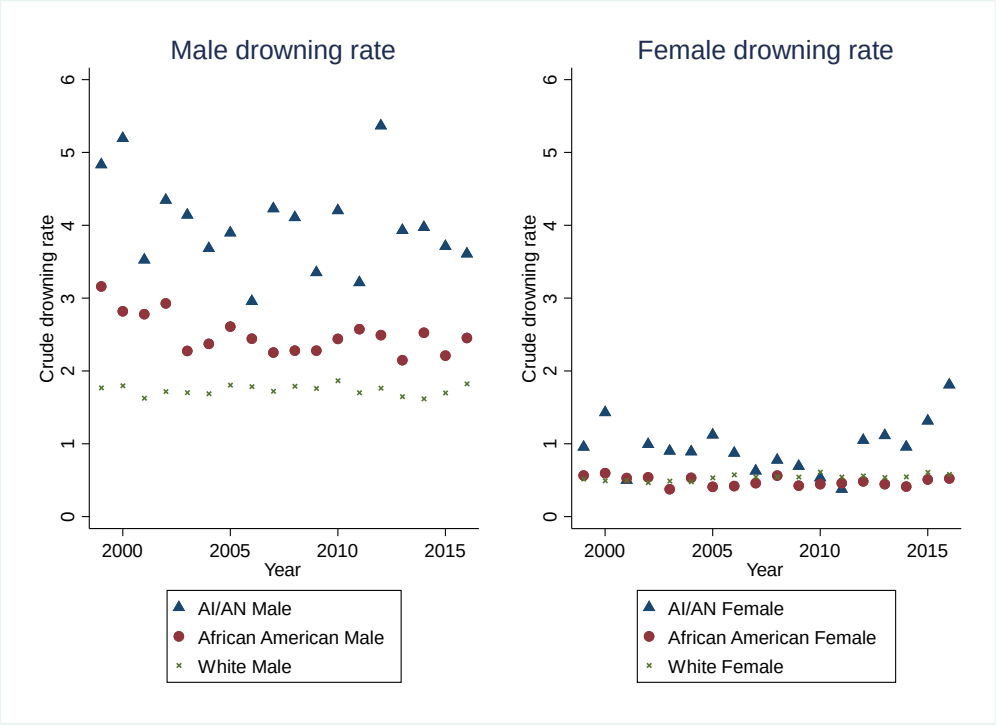

Figure 1: *National drowning rate per 100,000 people (Source: Author's analysis of CDC mortality files)*

Historical and present-day discrimination in access to pools is a large component of racial differences in swimming ability.[9,10,16] However, more pools per county is also associated with higher drowning rates.[4] Previous work has shown a strong connection between black competitive swim teams and lower black drowning rates.[17] The condition of the water is also an important factor in drowning – during a rip current, even a skilled swimmer can be pulled out far from shore.[19]

Our previous work also shows that there is significant variation in the black/white drowning disparity by state. Despite persistent national racial disparities in drowning rates, some states have eliminated their drowning disparity. For example, Florida had a dramatic racial disparity in drowning in the 1970's. Florida has undertaken numerous measures to reduce drowning, including organizations promoting swimming skills among African Americans and strong competitive swimming team with black swimmers. By 2005, Florida eliminated their overall racial disparity in drowning.[20]

Despite the attention paid to the racial disparity in drowning, previous analyses have largely occurred at the national level and focus on the black/white drowning gaps. These approaches highlight the overall black/white disparity in drowning, but miss two important patterns. First, there is significant variation in this disparity at the state level. Second, it is the AI/AN population who actually has the highest drowning rates.

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Innovation

While AI/AN drowning rate is higher than any other racial group, it is dramatically under-studied because of a lack of public data. The CDC restricts access to state-level mortality data if a "cell" will have fewer than 10 people. For example, if fewer than 10 AI/AN women died from drowning in Minnesota in 2017, the CDC will suppress that data. Because the AI/AN population is small, in a typical year there is no public state-level data on AI/AN drowning rates. This makes it impossible to use public data to examine any sub-national variation in AI/AN drowning rates. Detailed data on the cause of drowning (open water versus pool) is also suppressed, due to small cell size. There are important differences in the location of African American and white drowning deaths[3] – suggesting this may also be important for the AI/AN drowning disparity.

Our team has applied for access to the detailed cause of death, location, and uncensored death counts for AI/AN. Marina Gorsuch holds "special sworn status" with the Census Bureau, giving her the ability to apply for access to confidential data that can be accessed through the secure data enclave at the University of Minnesota. This will allow our team to be the first to examine state-level variation in the AI/AN drowning rate and determine what factors are associated with this group's extremely high drowning rate.

Approach

Data

Outcome variable: Drowning

Our outcome variable is the state-level drowning rate by race and sex. We will analyze the age-adjusted death rates for people who died from accidental drowning by submersion. This includes people who drowned in pools, oceans, boating accidents, floods, and bathtubs (ICD-10 codes W65-W74).

We have already analyzed the public data to examine national trends in drowning (see Figure 1). However, the public data do not allow us to examine AI/NA drowning rates by state, urban versus rural area, or separate drownings that occurred in pools from those that occurred in other bodies of water.

While the publicly available data is censored, the National Institute of Health Statistics has more detailed data that is accessible only through a Research Data Center, a secure data enclave managed by the Census Bureau. This data would include more detailed geography and also more detail on the type of drowning (pool versus open body of water). The University of Minnesota has a Research Data Center where Dr. Gorsuch will go to access this data. By the time of the 2019 PAA conference, we expect to have gained access to the confidential data and performed analysis of the data.

Contextual data: Weather

We will collect daily data on temperature from a National Oceanic and Atmospheric Administration (NOAA) weather stations in each state from 1996 to 2015.[21] We will collapse this daily data into three population-weighted measures of temperature for each state in each year: average temperature, number of days where the temperature was over 95 degrees, and maximum temperature. Additionally, NOAA publishes a database that lists each extreme

weather event that occurs, including floods and riptides.[22] We collapse this detailed data into yearly number of extreme weather events in each state in each year.

Contextual data: Pools and exposure to water

Numerous states publish public data that we can use to infer the number of pools. For example, Florida publishes the number of pools that were inspected each year and the number of pools that passed the inspection.[23] We are able use the total number of inspected pools as a proxy for total number of pools.[24] We will repeat this investigative process for all states and collect information on the number of pools in each state (when available). The Census Bureau publishes the area of lakes and miles of coastline for each state.[25]

Contextual data: Boats and boating accidents

Many states track the number of boats and boating accidents. For example, the Florida Fish and Wildlife Conservation Commission track the total number of boats owned in each county in each year as well as the number of boating accidents in each county in each year.[26] We will collect this data for all states where it is available.

Contextual data: Economic factors

We will use publicly available data from IPUMS USA[27] (American Community Survey and decennial Census) and IPUMS Health[28] to compute important economic and social factors. We will use this data to compute average income, unemployment rate, labor force participation rate, education, age, and alcohol use for each state in each year.

Analysis: Description & Decomposition

We will first describe the geographic variation in drowning. We will examine the difference in the age-adjusted in the AI/AN drowning rate compared to the white drowning rate in each state over time. We will examine if the raw difference in drowning rates have changed more or less in some states. For the female drowning rate, we will closely examine the last five years, during which there has been a sharp increase in the drowning rate. We will also examine if differences in drowning are more pronounced for drownings that occur in lakes or pools. All analyses will be separated by sex.

We will then investigate what policies, practices, economic changes, and geographic factors are associated with the AI/AN drowning disparity. We will use a Gelbach decomposition.[29] This decomposition begins with a base regression with no controls. $\hat{\beta}_1^{BASE}$ estimates the *total* difference between white and AI/AN drowning rates.

$$drown\ rate_{i,t,r} = \beta_0 + \beta_1^{BASE} I(AIAN_r) + \varepsilon_{i,t,r}$$

A full regression includes all contextual controls and reveals the amount of the disparity that remains unexplained after including all contextual controls. $\hat{\beta}_1^{FULL}$ estimates the difference between white and AI/AN drowning rates after accounting for the contextual variables.

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$$drown\ rate_{i,t,r} = \beta_0 + \beta_1^{FULL} I(AIAN_r) + \boldsymbol{X_{i,t}\gamma} + \varepsilon_{i,t,r}$$

A series of auxiliary regressions regress each contextual variable in $\boldsymbol{X}$ on the AI/AN indicator variable, conditional on all other contextual variables.

Evaluation of findings

The difference between $\hat{\beta}_1^{BASE}$ and $\hat{\beta}_1^{FULL}$ shows the amount of the AI/AN drowning disparity that is explainable by the contextual variables. We then calculate the about of the disparity that is attributable to a particular contextual variable by taking the product of the coefficient from the auxiliary regression (eg, the difference in income between white and AI/AN, conditional on all other contextual variables) and full regression (eg, the relationship between income and drowning, conditional on all other variables). This allows us to examine the contribution of each contextual variable the AI/AN disparity in drowning.

Analysis: Differences in risk factors

In addition to the decomposition, we will investigate if the white and AI/AN drowning rates have different relationships with the contextual variables. We will regresses the drowning rate in state *i* for time *t* for race *r* on contextual variables ($\boldsymbol{X_{i,t}}$) and an interaction between indicators for AI/AN with the contextual variables**.** This regression includes state and year fixed effects and all included contextual variables are measured at the state-year level. This regression allows us to examine if the contextual variables have a different relationship with drowning for white and AI/AN people.

$$(1)\quad drown\ rate_{i,t,r} = \beta_0 + \beta_1 I(AIAN_r) + \boldsymbol{X_{i,t}\gamma} + \boldsymbol{X_{i,t}\varphi} I(AIAN_r) + \tau_t + \mu_i + \varepsilon_{i,t,r}$$

Evaluation of findings

If the vector of estimated coefficients on the interaction term ($\hat{\varphi}$) is non-zero, it indicates that the contextual variable has a difference impact for the AI/AN drowning rate than the white drowning rate. For example, if the AI/AN community has lower average swimming skills, exposure to emergency weather events may have a larger impact on the AI/AN drowning rate than the white drowning rate.

Conclusions

Drowning is one of the leading causes of death from unintentional injury for young people and has striking racial disparities. In the past five years, the female AI/AN drowning rate has increased dramatically. Our previous work on racial disparities in drowning has shown significant variation between states in the black/white disparity in drowning. However, geographic variation in AI/AN drowning rate is under-studied because of the restrictions placed on public CDC mortality data. Our team has applied for access to the confidential mortality data. By the time of the 2019 PAA conference, we will describe the geographic patterns of AI/AN drowning rates and identify what policies, practices, economic changes, and geographic factors are associated with the AI/AN drowning disparity.

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