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Data Analytics Research (MATP 4910)

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Rensselaer **Institute for Data Exploration and Applications**

Social Determinants Cleanup - Problem

- Social Determinants (SD) visualizations for states show lots of raw numbers as protective/destructive factors
  - Best practice is to view *rates* and averages to get better picture of [...]
- SD charts repeat many attributes (i.e. *# Infant Deaths* & *% Infant Deaths*
  - Both give the same information → redundant to include both in graphs
- Some factors are not of interest for COVIDMINDER analysis
  - Latitude
  - Longitude

Social Determinants Cleanup - Solution

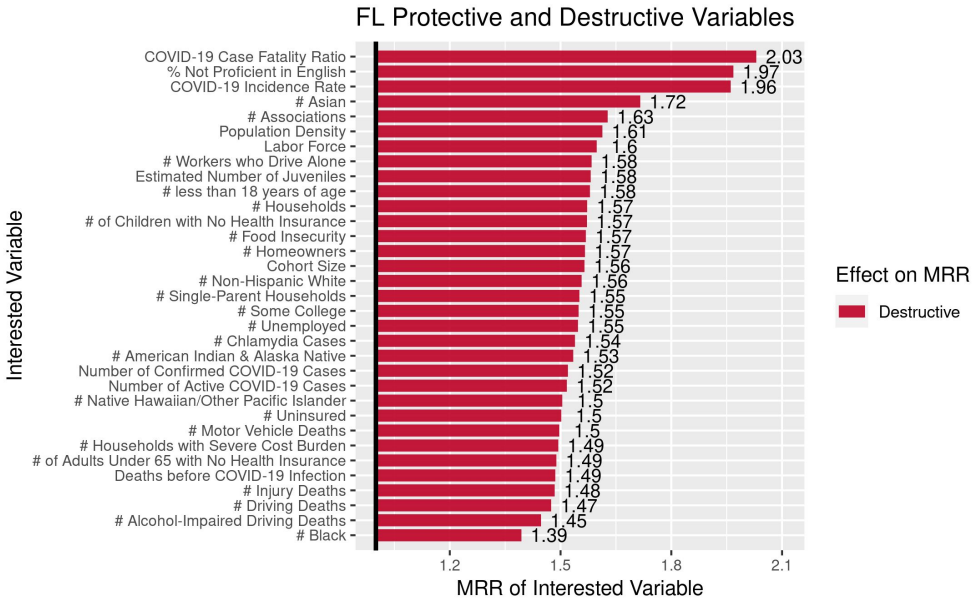
- Remove raw value factors from data prior to building SD graphs
  - Avoids repetition of attributes
  - Allows for more fair comparison between states of different populations and demographic compositions

```
# remove unneeded attributes

#tempb4 <- nrow(GWAS_MRR) # check the number of rows before extracting non_rate variables
#tempb4
#namesb4 <-rownames(GWAS_MRR)
#namesb4

GWAS_MRR <- GWAS_MRR[ !(row.names(GWAS_MRR) %in% non_rate), ]

#tempAFTR <- nrow(GWAS_MRR) # check that rows have been removed
#tempAFTR
#namesAFTR <- rownames(GWAS_MRR)
#namesAFTR
```

```
# factors that are not rates, to be removed before analysis
non_rate <- c("Lat", "Long_", "# Alcohol-Impaired Driving Deaths", "# Driving Deaths", "# Chlamydia Cases", "# Chlamydia Cases", "# Uninsured", "# Primary Care Physicians", "# Dentists", "# Mental Health Providers", "# Some College", "# Unemployed", "# Single-Parent Households", "# Households", "# Associations", "# Injury Deaths", "# Workers who Drive Alone", "pre_covid_deaths", "child_deaths", "infant_deaths", "# HIV Cases", "# Food Insecure", "# Limited Access", "# Drug Overdose Deaths", "# Motor Vehicle Deaths", "# Uninsured_1", "# Uninsured_2", "# Firearm Fatalities", "# Homeowners", "# Households with Severe Cost Burden", "# less than 18 years of age", "# Black", "# American Indian & Alaska Native", "# Asian", "# Native Hawaiian/Other Pacific Islander", "# Hispanic", "# Non-Hispanic White", "# Not Proficient in English", "# Rural")
```

Social Determinants Cleanup - Next Steps

- Charts look a bit messy now
  - Rearrange to improve aesthetics
- R code is very repetitive with 5000+ lines of code
  - Wish to consolidate to optimize run-time



Social Determinants Cleanup - Next Steps

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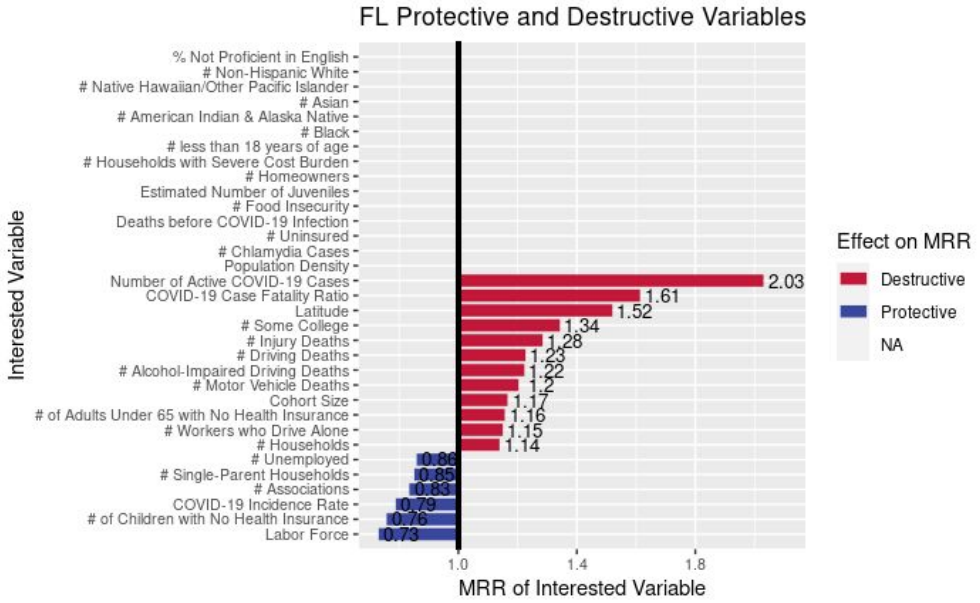


MortalityMinder Visualization Attempt - Plan

- Social Determinants and Risk Groups Relationship Box Plot.
- Social Determinants, COVID-19 Mortality and Risk Groups Relationship Scatter Plot.
- Deaths of COVID-19 Trends for Risk Groups across single state.
- Kendall Correlation between social and economic factors and mortality risk groups.

MortalityMinder Visualization Attempt - Progress

Percentage of Rural Area and COVID-19 Risk Groups Relationship Box Plot for Ohio

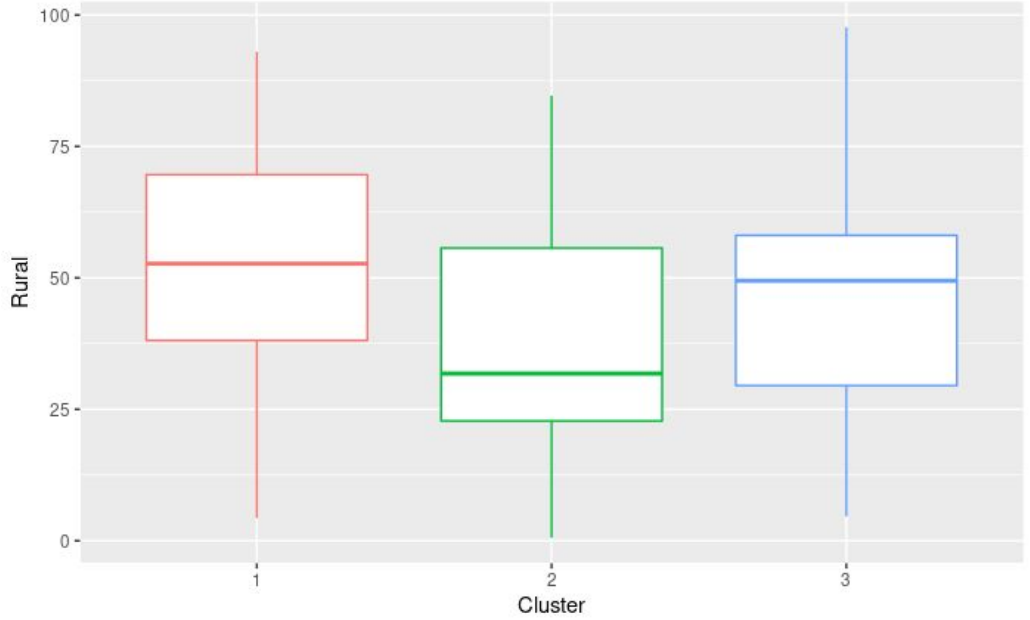
- Time Period: 3/23 ~ 9/23 monthly

- Risk Group distribution:

  Cluster 1: Low

  2: Medium

  3: High



MortalityMinder Visualization Attempt - Progress

Percentage of Rural Area and COVID-19 Mortality Relationship Scatter Plot for Ohio

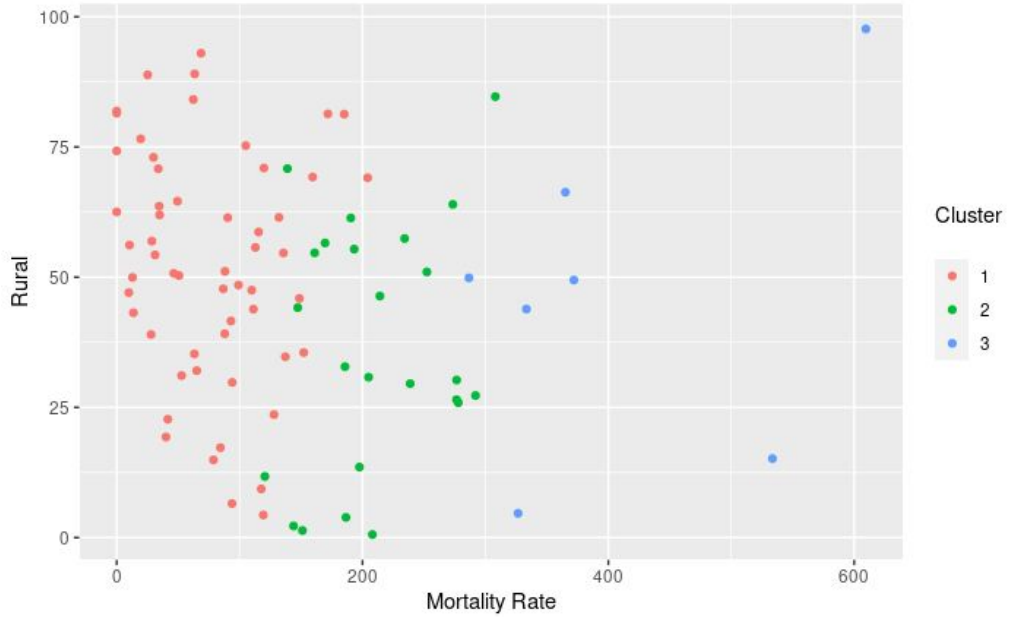
- Time Period: 3/23 ~ 9/23 monthly

- Risk Group distribution:

  Cluster 1: Low

  2: Medium

  3: High



MortalityMinder Visualization Attempt - Progress

Deaths of COVID-19 Trends for Risk Groups across Ohio

- Time Period:

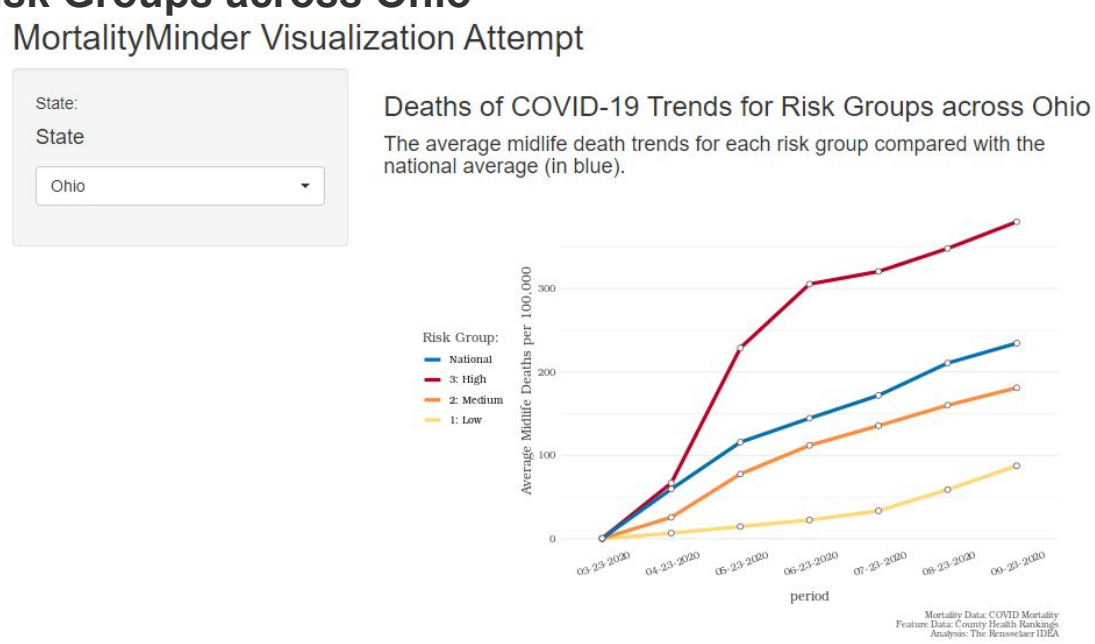
  3/23 ~ 9/23 monthly

- Risk Group distribution:

  Cluster 1: Low

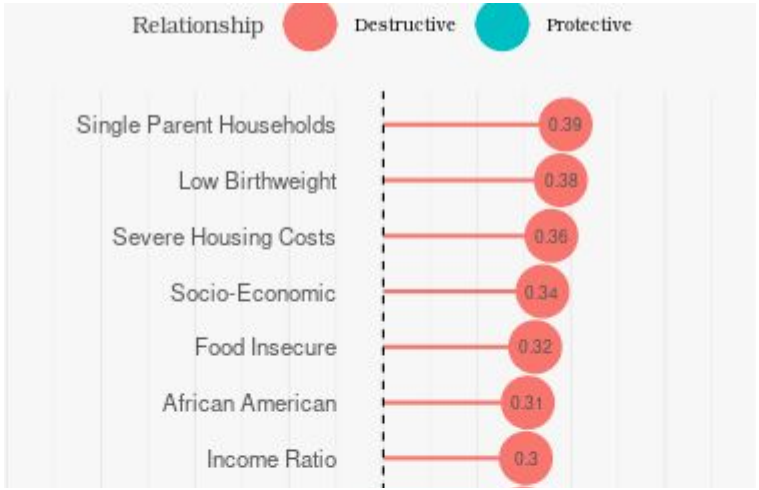
  2: Medium

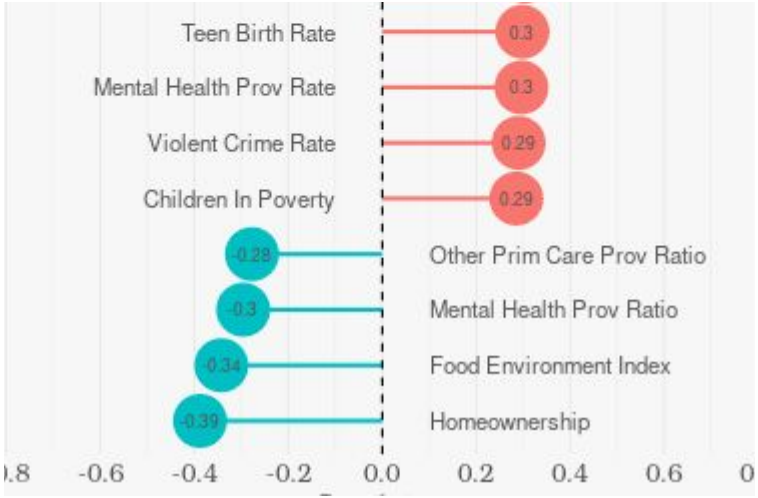
  3: High

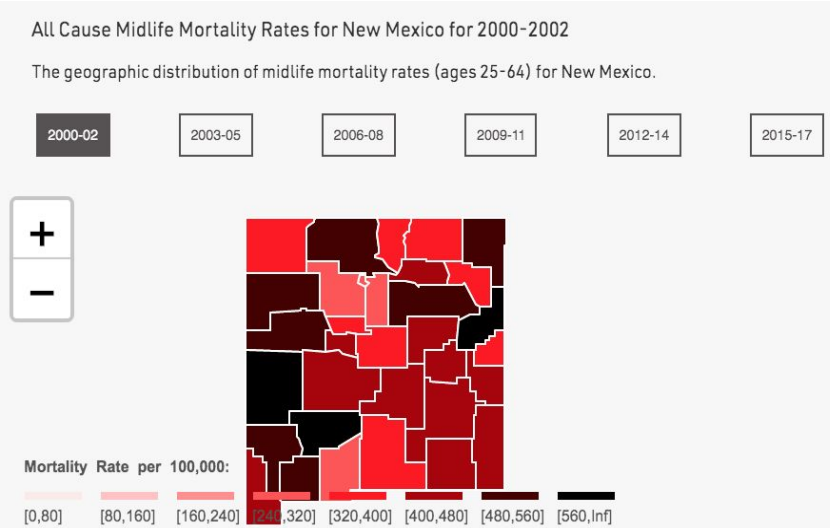


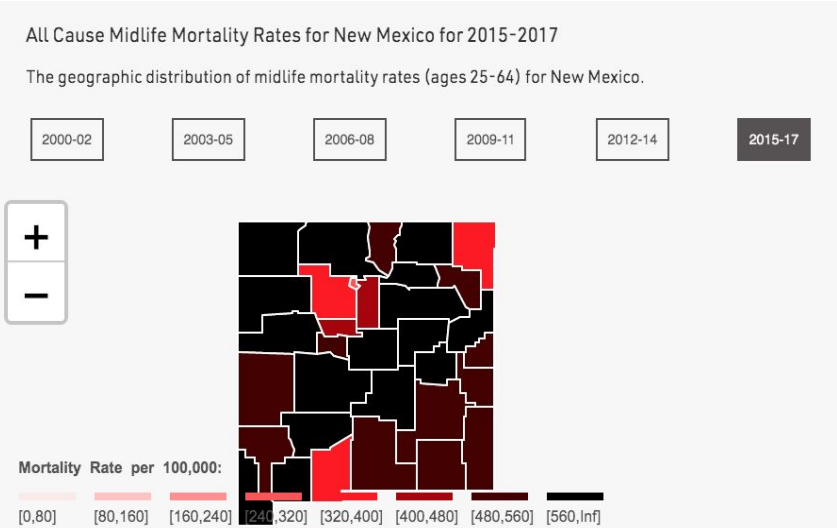
MortalityMinder Visualization Attempt - Next Steps

- Abnormal output in Mortality Trends for Risk Groups across single state.
- Kendall Correlation between social and economic factors and mortality risk groups.









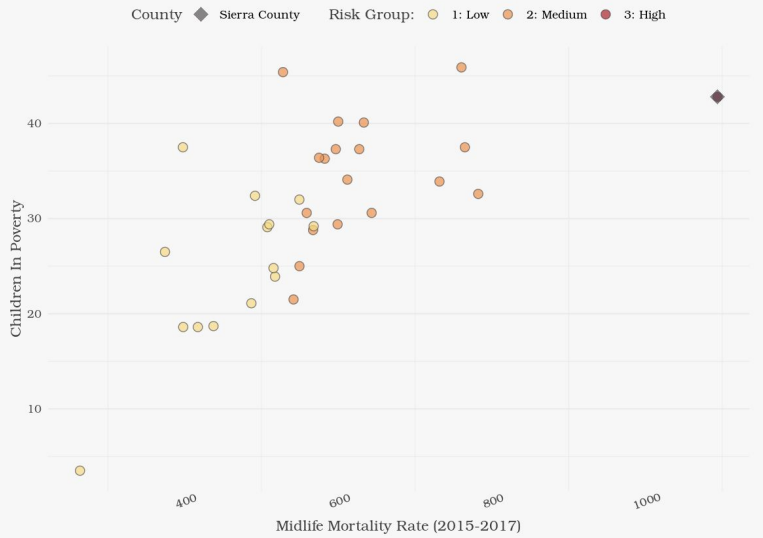
New Mexico

proposed MortalityMinder use case

MORTALITYMINDER

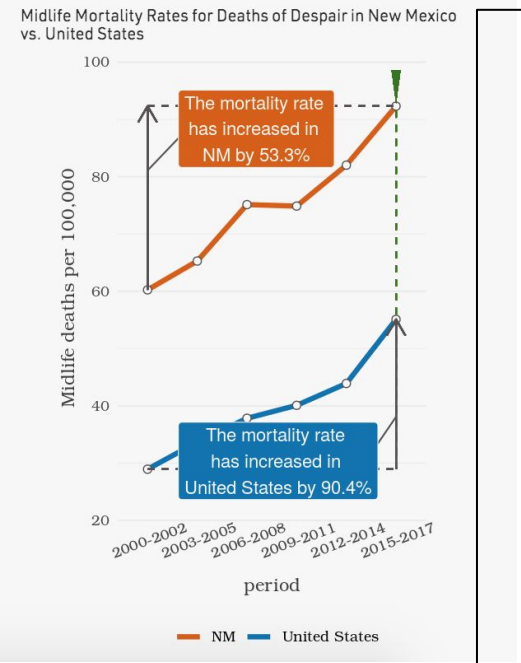
Children In Poverty and Mortality Relationship for New Mexico

Each dot represents a county's midlife mortality rate, factor, and risk group. Click county to see map location and name.

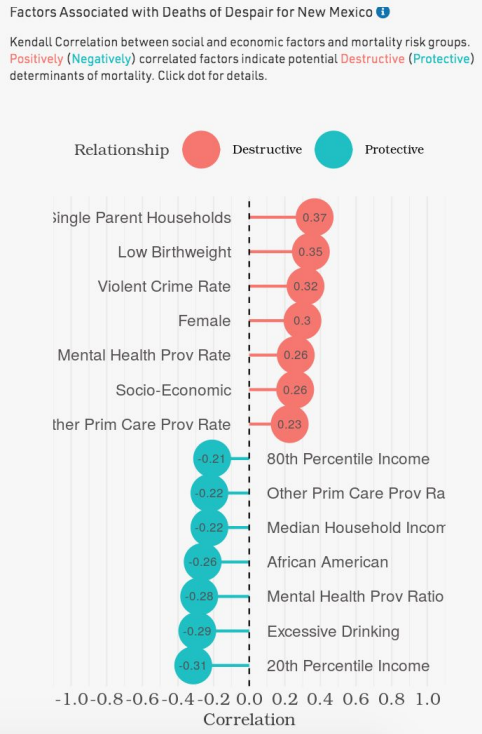


- Leading factor for all cause midlife deaths is children in poverty
- Correlation between midlife mortality and children in poverty
- Sierra County experiences extremely high rates of both midlife mortality and children in poverty
- Policy aimed at reducing rates of impoverished children may also reduce rates of midlife mortality

MORTALITYMINDER



- Deaths of despair on the rise
- Factors such as access to health care could be changed at the state policy level



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SANTA FE NEW MEXICAN

UNDERSTANDING DISABILITIES

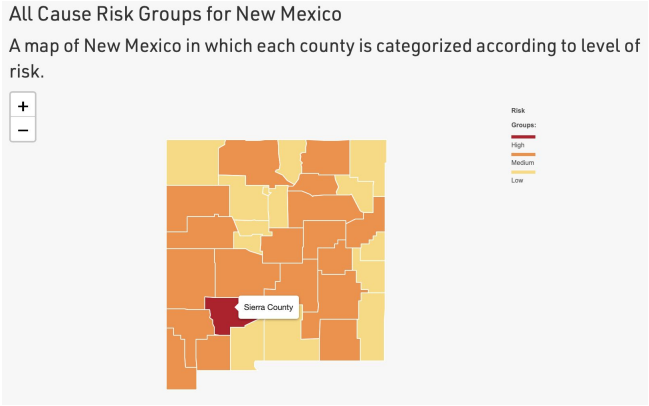
Difficulties of finding a primary care doctor

By Andy Winnegar Sep 12, 2020 Updated Sep 12, 2020 0

"Economics might play a role in New Mexico's shortage of primary care doctors.

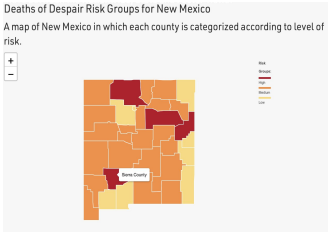
The state had the lowest pay for primary care doctors in the U.S. in 2017, with doctors here averaging around $160,780 a year, according to a report by the U.S. Bureau of Labor Statistics. That compares with an average of $237,000 per year nationwide, while specialists make $341,000 per year, according to the bureau."

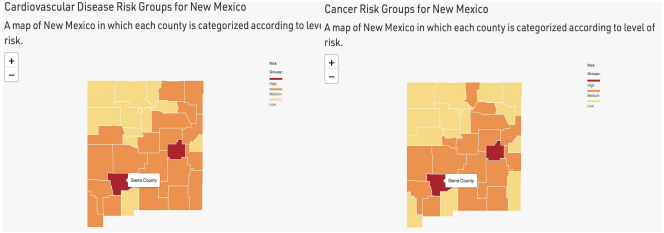
Weinnegar, Andy. (2020, September 12). "Difficulties of finding a primary care doctor". Santa Fe New Mexican. https://www.santafenewmexican.com/life/family/difficulties-of-finding-a-primary-care-doctor/article_9692e624-dd93-11ea-ae9e-bfa19b7221a8.html. Accessed on 2020, October 19.



Sierra County, New Mexico

proposed MortalityMinder use case

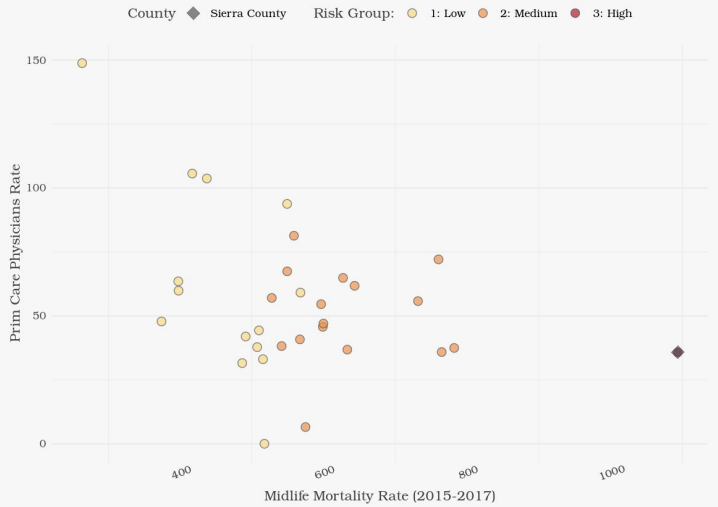




MORTALITYMINDER

Prim Care Physicians Rate and Mortality Relationship for New Mexico

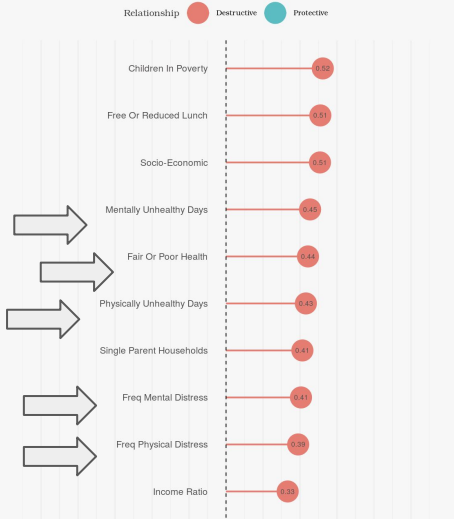
Each dot represents a county's midlife mortality rate, factor, and risk group. Click county to see map location and name.



- Low primary care rates
- High midlife mortality rates
- The impact of half of the leading factors of all cause midlife deaths may be lessened with intervention from a primary care physician

Factors Associated with All Cause for New Mexico

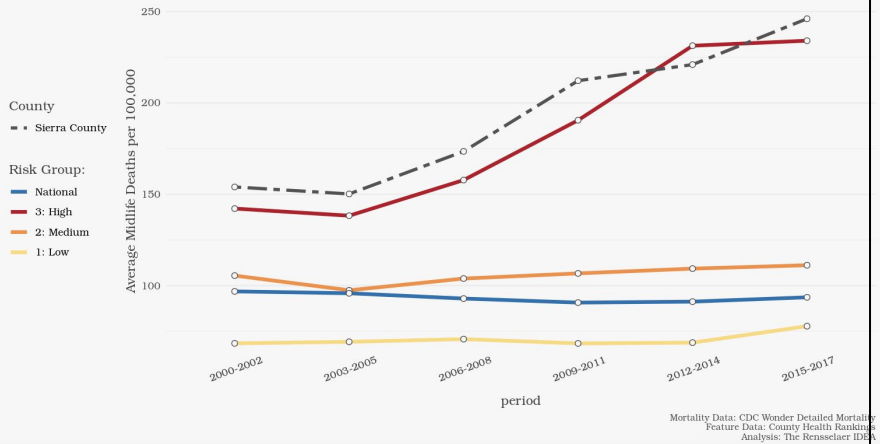
Kendall Correlation between social and economic factors and mortality risk groups. Positively (Negatively) correlated factors indicate potential Destructive (Protective) determinants of mortality. Click dot for details.



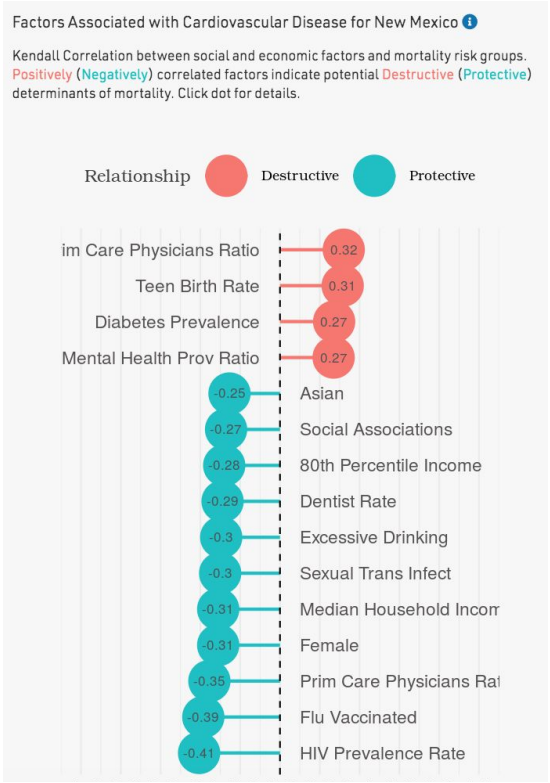
MORTALITYMINDER

Cardiovascular Disease Trends for Risk Groups across New Mexico

The average midlife death trends for each risk group compared with the national average (in blue). Click on any map to see the trend for a specific county.



- Deaths due to cardiovascular disease have increased by 10.5%
- Teen birth rate and diabetes prevalence are factors that should be targeted for improval



MORTALITYMINDER

CONGRESSWOMAN
DEB HAALAND
REPRESENTING THE 1ST DISTRICT OF NEW MEXICO

New Mexico Delegation Announces $600,000 to Combat Opioid Epidemic in Rural Communities

May 30, 2019 | Press Release

WASHINGTON – U.S. Senators Tom Udall and Martin Heinrich, along with **U.S. Representatives Ben Ray Luján, Deb Haaland, and Xochitl Torres Small,** announced that the U.S. Department of Health and Human Services (HHS) has awarded three grants totaling $600,000 to rural communities across New Mexico and Indian Country in order to help combat the opioid epidemic. The funding, which was championed by the New Mexico delegation, comes through the Rural Communities Opioid Response Program administered by the Health Resources and Services Administration (HRSA) and will support treatment, prevention, and recovery efforts in Santa Fe County, San Juan County, and the rural southern counties of Catron, Chaves, Cibola, De Baca, Eddy, Grant, Hidalgo, Lea, Lincoln, Luna, Otero, Roosevelt, Sierra, and Socorro, as well as the rural-designated regions of Torrance and Valencia.

Haaland, Deb. (2019, May 30). "New Mexico Delegation Announces $600,000 to combat opioid epidemic in rural communities". Deb Haaland. https://haaland.house.gov/media/press-releases/new-mexico-delegation-announces-600000-combat-opioid-epidemic-rural-communities. Accessed on 2020, October 19.

MORTALITYMINDER

Case study : States of same population size

	Washington	Arizona	New Jersey	Massachusetts
Population	7.615 million	7.279 million	8.882 million	6.893 million
Size ranking	13	14	11	15
Despair rate	**+43.5%**	**+55.2%**	**+96.7%**	**+152.7%**

*Rates based on increase from 2000

Do states of comparable population sizes experience similar trends in mortality relating to despair?

Top determinants for despair

Washington

Destructive

1. Older than 65
2. Diabetes prevalence
3. Non-Hispanic white
4. Food insecure

Protective

1. Younger than 18
2. Not Proficient in English
3. Hispanic
4. Sexual Trans Infect

Arizona

Destructive

1. Segregation (black / white)
2. Single parent household
3. Food insecure
4. Amer. indian/alaskan native

Protective

1. Food Environment Index
2. Hispanic
3. Native Hawaiian Islander
4. Air Quality

New Jersey

Destructive

1. Mentally Unhealthy days
2. Limited access to healthy food
3. Pct Unemployed
4. Adult Smoking

Protective

1. Food Environment Index
2. 80th Percentile Income
3. Asian
4. Dentist rate

Massachusetts

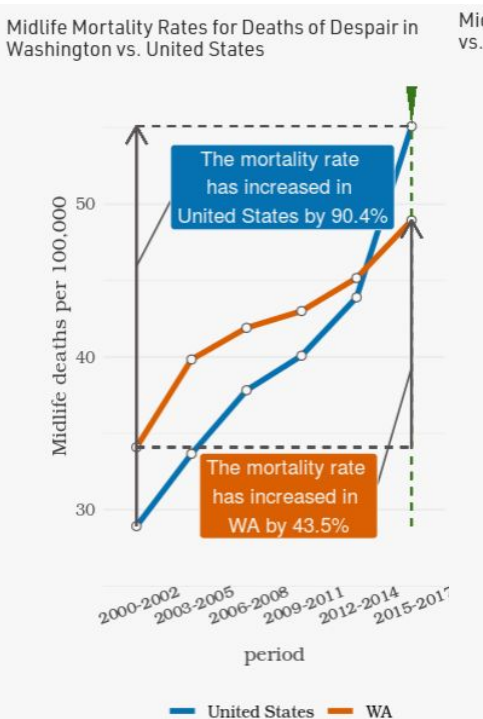
Destructive

1. Diabetes prevalence
2. Socio-economic
3. Driving alone
4. Disconnected youth

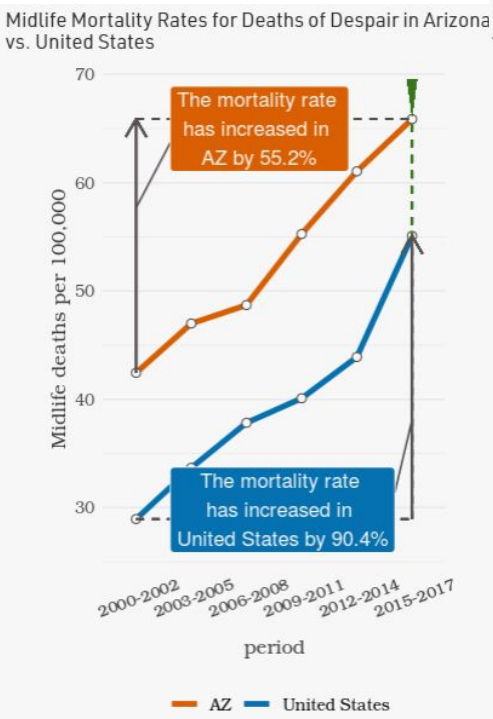
Protective

1. Some college
2. Prim Care Physicians Rate
3. Flu Vaccinated
4. Asain

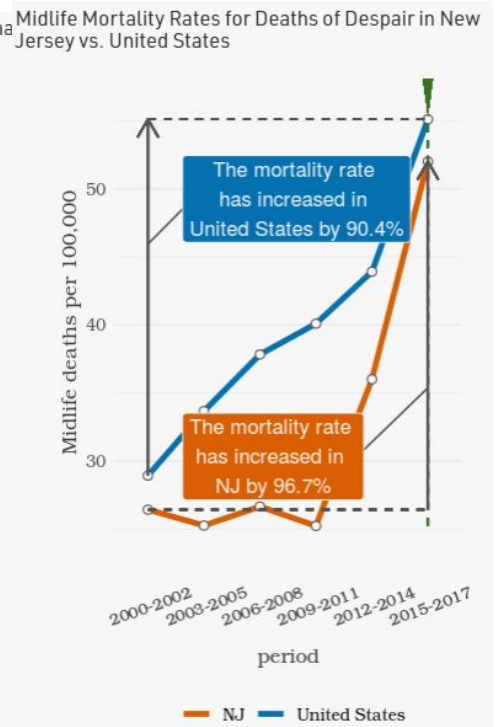
Washington



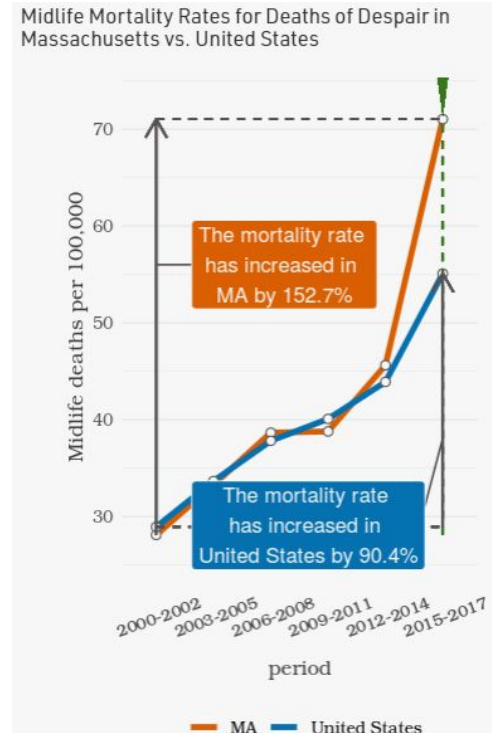
Arizona



New Jersey



Massachusetts



MORTALITYMINDER

Case study : States of same population size

Conclusions:

- The **shared** destructive **determinants** for this case study were **diabetes prevalence** and **food insecurity**
- Shared Protective determinants were being **hispanic**, **asian**, and **food environment index**
- The death rate of despair is not similar between states of same size
- Important to note that each state did not start at the same rate in 2000
  - Massachusetts had the quickest rate increase in a 2 year span
  - New Jersey had the most radical overall change

Key points:

- Each state has unique determinants to address
- States of similar population sizes typically share top determinants
- Population sizes have little to do with mortality rate for states
- Location has an effect on mortality rate

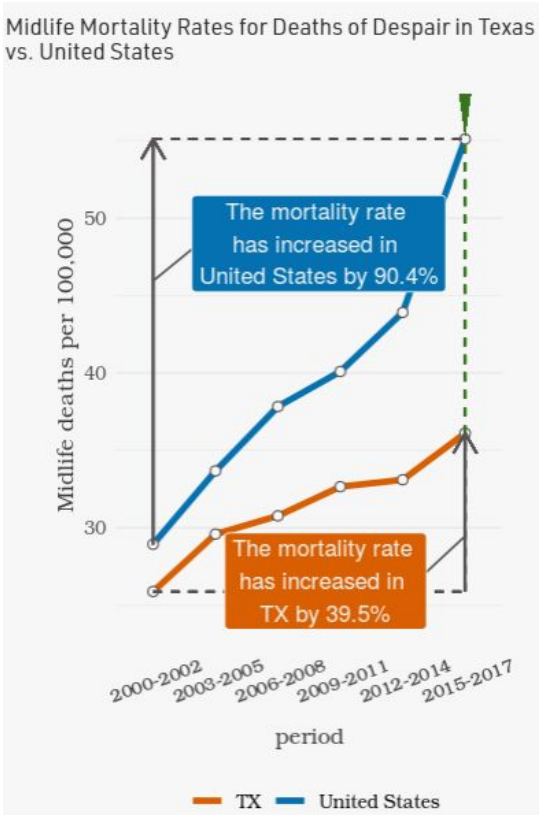
MORTALITYMINDER

Case study: States of High Mortality vs Low Mortality

How can the determinants illustrate the difference in increased rates?

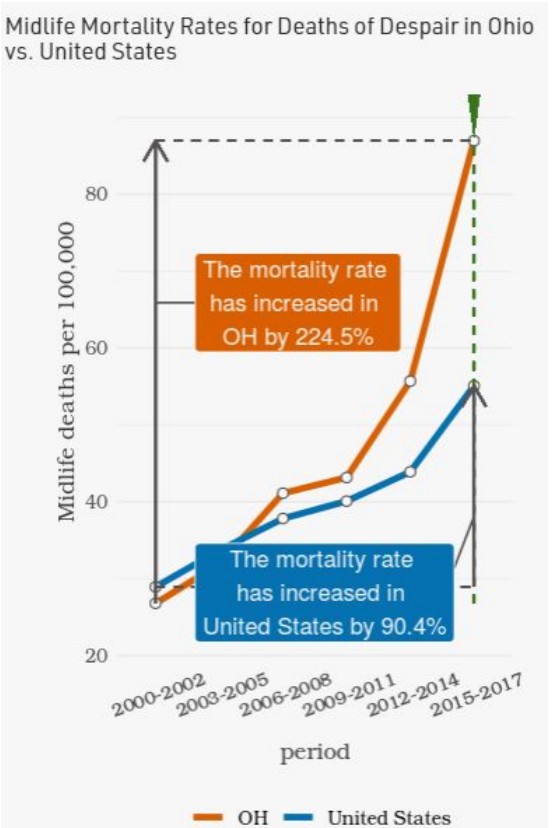
Texas:

- Lowest mortality rate
- **39.5%** increase in death of despair

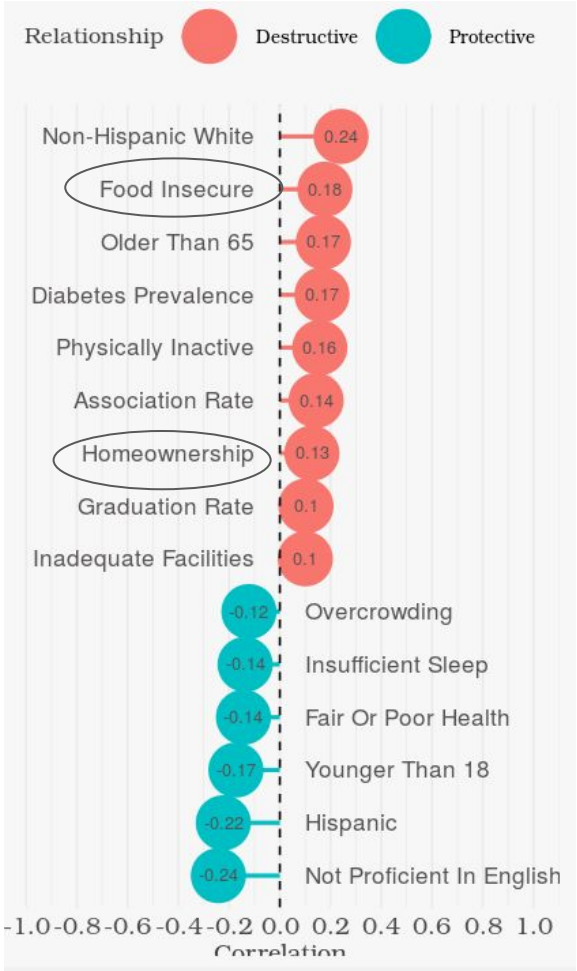


Ohio:

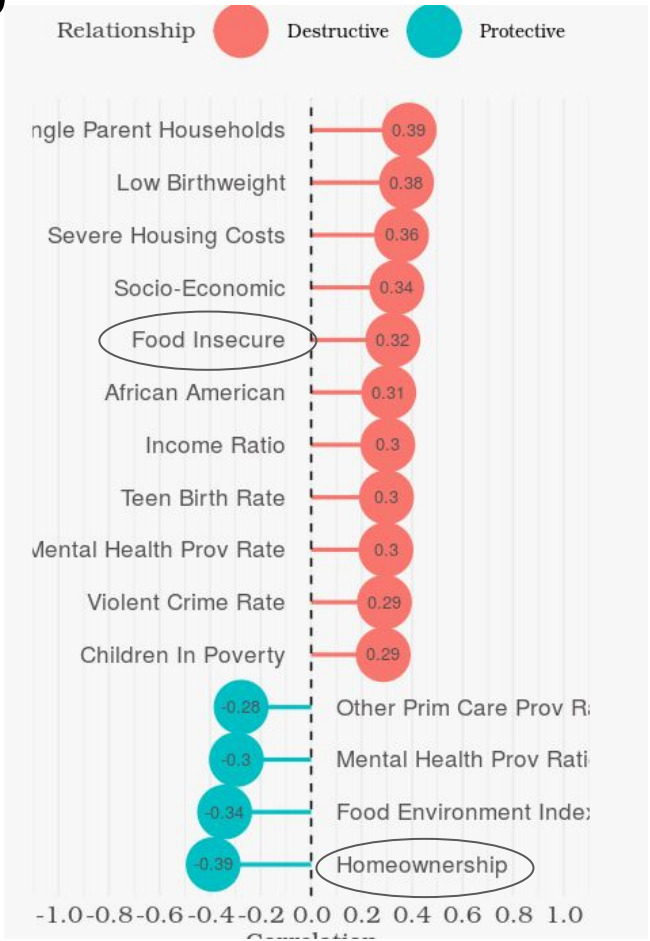
- Highest mortality rate
- **224.5%** increase in death of despair



Texas


Relationship
Destructive
Protective
Non-Hispanic White
0.24
Food Insecure
0.18
Older Than 65
0.17
Diabetes Prevalence
0.17
Physically Inactive
0.16
Association Rate
0.14
Homeownership
0.13
Graduation Rate
0.1
Inadequate Facilities
0.1
-0.12
Overcrowding
-0.14
Insufficient Sleep
-0.14
Fair Or Poor Health
-0.17
Younger Than 18
-0.22
Hispanic
-0.24
Not Proficient In English
-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0
Correlation

Ohio


Relationship
Destructive
Protective
ngle Parent Households
0.39
Low Birthweight
0.38
Severe Housing Costs
0.36
Socio-Economic
0.34
Food Insecure
0.32
African American
0.31
Income Ratio
0.3
Teen Birth Rate
0.3
Mental Health Prov Rate
0.3
Violent Crime Rate
0.29
Children In Poverty
0.29
-0.28
Other Prim Care Prov R
-0.3
Mental Health Prov Rati
-0.34
Food Environment Inde
-0.39
Homeownership
-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0

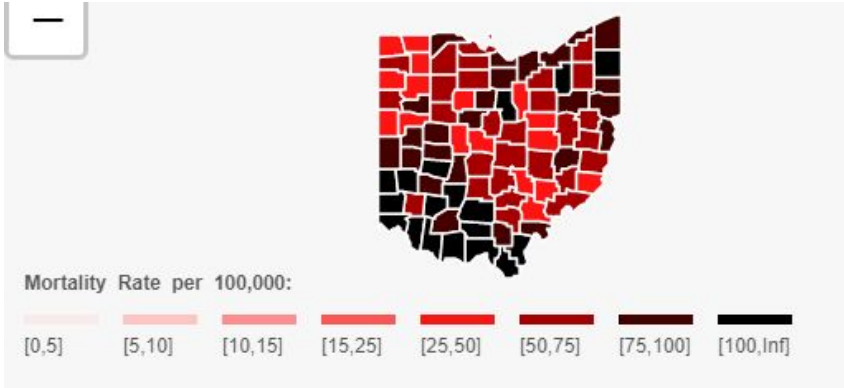
MORTALITYMINDER

Case study: States of High Mortality vs Low mortality

Conclusions:

- As hypothesized, the large difference in increased rate is shown by its determinants
  - The determinants in ohio may have greater “weight” in the increase that ohio experienced
- Each state has unique conditions that affect midlife mortality
- Location of the state has low prediction ability
  - Supported by population size case and high/low mortality case

Ohio



Texas