Obesity drives COVID-19 mortality rates between countries after accounting for economic and demographic variables

PURDUE UNIVERSITY | The Data Mine

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RESEARCH QUESTION

How does the prevalence of specific comorbidities within a country affect COVID-19 mortality per 100,000 people given differences in public health infrastructure and government responses to the pandemic?

INTRODUCTION

- Past research has shown comorbidities such as ***obesity, diabetes, cardiovascular disease, and respiratory disease*** are linked to a greater probability of mortality from COVID-19 [2,7,8]
- Despite the same disease, mortality rates varied drastically between countries
- Understanding the drivers of mortality rates between countries can help inform the allocation of resources and the successful application of policy

METHODS

- **Independent variables**: Measures of comorbidities, demographics, & economic factors (*See Results table*)
- **Dependent variable**: COVID-19 deaths per 100,000 people
- **Data Collection**
  - Compiled Data from: WHO, World Data Bank, Oxford's Policy Tracker, John Hopkins, & Harvard [1,3-6]
- **Data Cleaning**
  - Removed any countries missing 3+ variables ***(n=149)***
  - COVID-19 mortalities & vaccination data from 03/13/22
  - We gathered the most recent observation between 2015-2019 for our other independent variables
  - Log transformed GDP, population above 65, & population density
- **Analysis**
  - Performed a ***PCA*** analysis to identify latent variables
  - Performed several ***linear regressions*** with varying combinations of the independent variables to identify model with largest adjusted R^2

a) PCA Coordinates grouped by region b) Health care resources explain variation in data

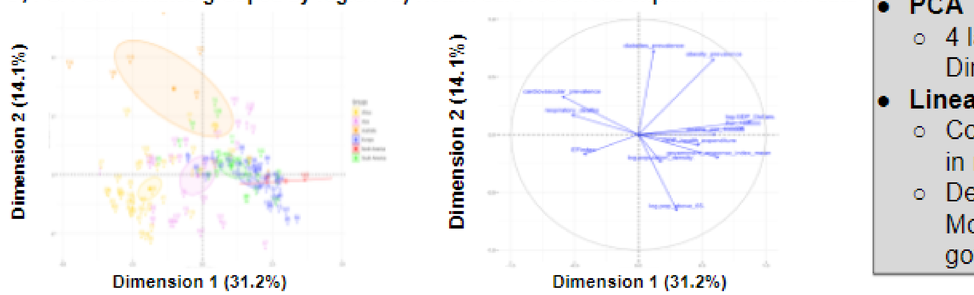


Figure 1. The visualized results of the PCA of our 15 different variables. The x and y axis correspond to the major axis of variation within the data. a) The coordinates of the PCA grouped by region. b) The effect of different variables on explaining the variation in the data

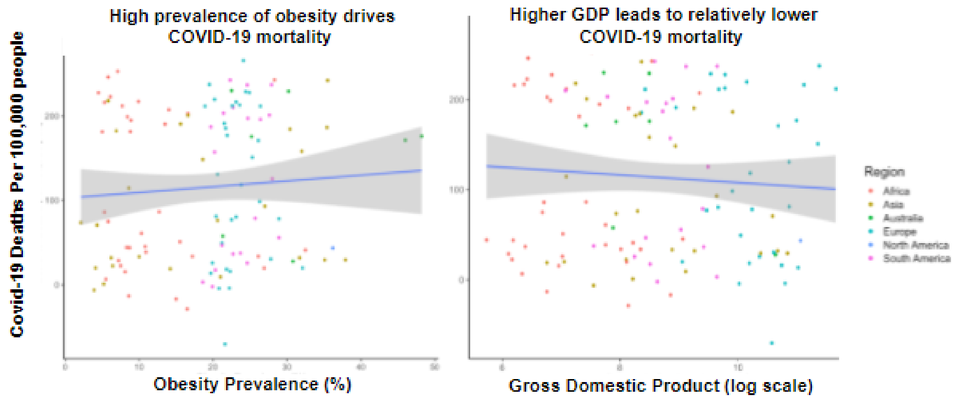


Figure 2. Predicted mortality per 100,000 people, y-axis, based on linear regression per a) percentage of population that is obese and b) the Gross domestic product of that country. Different colors correspond to the different region a country is associated with.

Main linear regression results

Independent Variables	Mean	Standard Deviation	Coefficient	p-value
Region	-	-	-	< 0.001
Africa	-	-	-142.700 *	-
Asia	-	-	-154.000 *	-
Australia	-	-	-174.300 *	-
Europe	-	-	-15.000 *	-
North America	-	-	-80.980 *	-
South America	-	-	2.789 *	-
GDP per capita (log transformed)	8.610	1.439	-10.030 *	< 0.001
Population above 65 (log transformed)	13.527	1.860	8.536 *	0.035
Population density (log transformed)	4.208	1.353	-11.700	0.322
GDP health expenditure	6.608	2.658	2.407	0.104
Diabetes prevalence	7.864	4.300	1.787	0.652
Respiratory deaths	39.102	36.009	-0.160 *	0.021
Obesity prevalence	18.956	9.465	2.331 *	0.002
Cardiovascular disease prevalence	259.648	123.734	0.061	0.325
Ethnic diversity index	0.465	0.248	9.784	0.427
Vaccination rate	48643.490	27235.690	0.000	0.814
Government response index	49.509	10.869	2.789 *	< 0.001

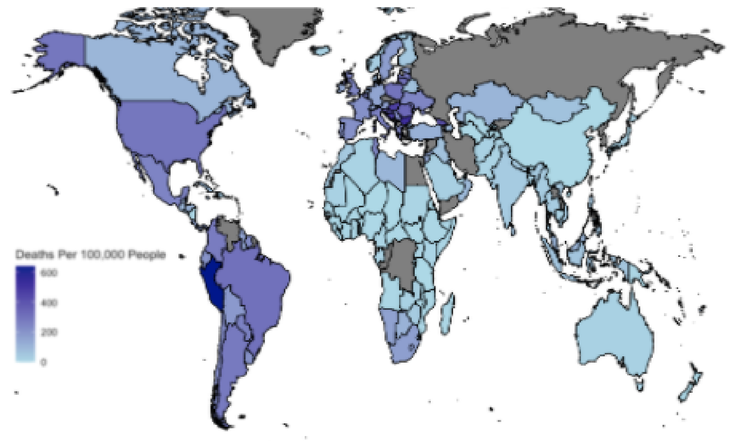
Note. Multiple R-squared = 0.524. Adjusted R-squared = 0.4521.
* Statistically significant and positive coefficient
* Statistically significant and negative coefficient

Table 1. Means and standard deviations of independent variables and results of linear regression.

RESULTS

- **PCA**
  - 4 latent variables, Dimension 1: Access to healthcare resources, Dimension 2: Longevity & comorbidity prevalence
- **Linear regression**
  - Comorbidities: Obesity & respiratory disease lead to significant increases in mortality rate
  - Demographic & economic variables: Population above 65, GDP. Mortality rate varies with region, decreases with GDP and increases with government response index and population above 65

COVID-19 Deaths per 100,000 people around the World



DISCUSSION & CONCLUSION

- Obesity prevalence, respiratory disease, & age have a significant effect on COVID-19 mortalities across the globe
- The combination of both GDP and Region suggest a strong effect of seasonality on COVID-19 mortality
- Vaccines were likely not significant because timing of data

Acknowledgements

- The Reach Public Health program collaboration between Purdue and Hashemite University
- U.S. State Department's Stevens Initiative & Aspen Institute.
- Our project mentor Dr. Qinglan Ding and Emily Wu. Special thanks to Dr. Daniel Hirleman & Dr. Mark Ward, Dr. Sukaina Alzyoud, Margaret Betz (Purdue) & all other Purdue Data Mine staff.

Citations

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