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Final Project

Stranded Without a Vehicle: Those Living in Food Deserts Without Vehicle Access at Increased Risk for Colorectal Cancer

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Abstract

Background: Food deserts are neighborhoods, census tracts, or zip codes with poor access to healthy foods and linked to a variety of poor health outcomes (Gany et al., 2022; Fong et al., 2021; Masdor et al., 2022). Oftentimes, convenience stores are the primary source of food in food deserts. These stores typically contain a large variety of ultra-processed foods, with increased intake associated with an increased risk of colorectal cancer (Wang et al., 2022). In addition, increased rates of obesity in food deserts are linked to poor cancer outcomes (Bevel et al., 2023). Because of this, it is critical to evaluate the association of living in a food desert and the incidence of colorectal cancer.

Methods: Data on healthy food access was found via <https://www.ers.usda.gov/data-products/food-access-research-atlas/download-the-data>. Data at the census tract level in Ohio was used for cross-reference via <https://odh.ohio.gov/explore-data-and-stats/interactive-applications/ohio-public-health-data-warehouse1>. The data was analyzed via R statistical software to look for significance.

Results: Data analysis found that living in a food desert significantly increased the rate of colorectal cancer, stage at diagnosis, and risk of death from colorectal cancer when controlling for already known risk factors such as obesity, tobacco use, and alcohol use, indicating that healthy food access itself is a risk factor.

Conclusion: Increasing access to healthy foods is critical to reducing the incidence of colorectal cancer for those living in food deserts without access to vehicles.

Background

Food deserts are neighborhoods, census tracts, or zip codes with poor access to healthy foods and linked to a variety of poor health outcomes. Fong et al. (2021) found that living in urban food deserts was associated with increased mortality from breast and colorectal cancers. Gany et al. (2022) showed similar findings for the association of both worsened morbidity and increased mortality from all types of cancer for those experiencing food insecurity that are diagnosed with several forms of cancer. Masdor et al. (2022) performed a systematic review of eight studies, including six from the United States, one from Africa, and one from Switzerland. They found an association between increased colorectal cancer (CRC) mortality and living in both rural and urban food deserts, in addition to high availability of red meat and alcoholic beverages. While studies have shown that living in a food desert is associated with increased risk for CRC diagnosis and death from CRC, what specific aspects of living in a food desert are most associated with the incidence of CRC?

Methods

Data on healthy food access was found via <https://www.ers.usda.gov/data-products/food-access-research-atlas/download-the-data>. Data includes information on the proportion of residents (by both census tract and zip code) that live near stores that contain fresh produce at the 0.5 and 1 mile level in urban areas and 10 and 20 mile levels in rural settings. Data at the census tract level in Ohio was used for cross-reference via <https://odh.ohio.gov/explore-data-and-stats/interactive-applications/ohio-public-health-data-warehouse1>. This data warehouse was chosen because the data is publicly available and includes information on the incidence of CRC by census tract.

Data was downloaded from online and saved to desktop. The data was then cleaned in Excel for ease of use. Data was chosen to be included for analysis if sufficient data was available in the census tract, for all variables recorded. There was sufficient sample size when comparing the groups

R with R studio was the software used for further variable cleaning. The variables from the Food Access Research Atlas were proportions (e.g., prevalences), and therefore recoded in R as numerical, despite being listed as character when downloaded directly into R. The variables from the Ohio Public Health Data Warehouse were coded as numerical.

In order to analyze the effects of numerous continuous predictor variables from the Food Access research Atlas with the outcome variable also being a continuous variable (the incidence of colorectal cancer by census tract), a multiple linear regression model was created in R. Many variables were highly collinear and were subsequently removed.

Results

When looking at numerous predictor variables from the Food Access research Atlas with outcome variable being the incidence of colorectal cancer, a multiple linear regression model was performed. Many variables were highly collinear and were subsequently removed. In the end, only three were significant: Poverty rate, the proportion of the census tract with low access to healthy food at ½ mile (“lapophalfshare”), and the proportion of the census tract with low access to healthy food at ½ mile and no vehicle access (“lahunvhalfshare”). Surprisingly, both poverty rate and “lapophalfshare” were significantly inversely correlated with increased incidence of colorectal cancer. However, “lahunvhalfshare” was significantly positively correlated with increased incidence of colorectal cancer. See figures below.

Figure 1

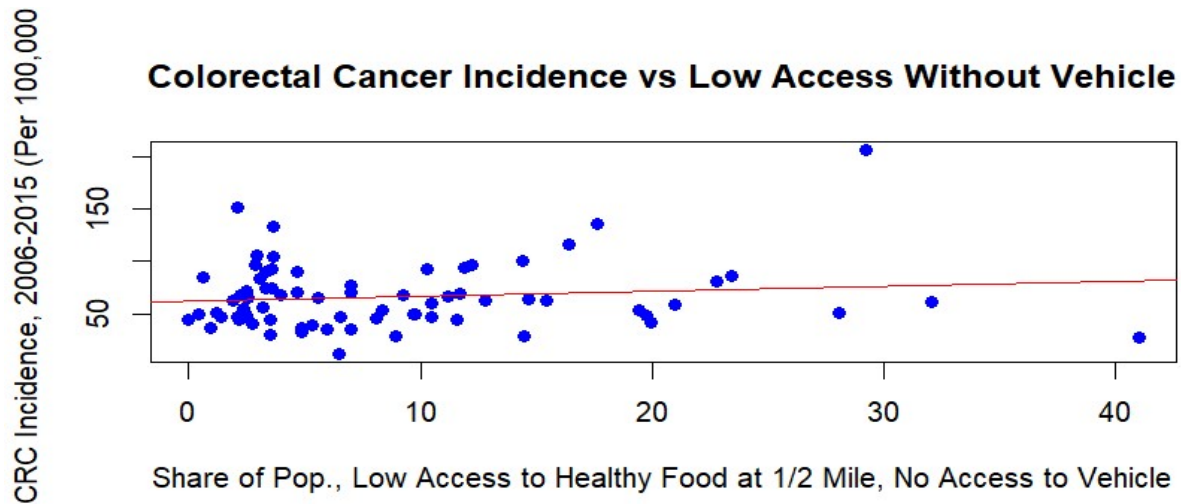


Figure 2

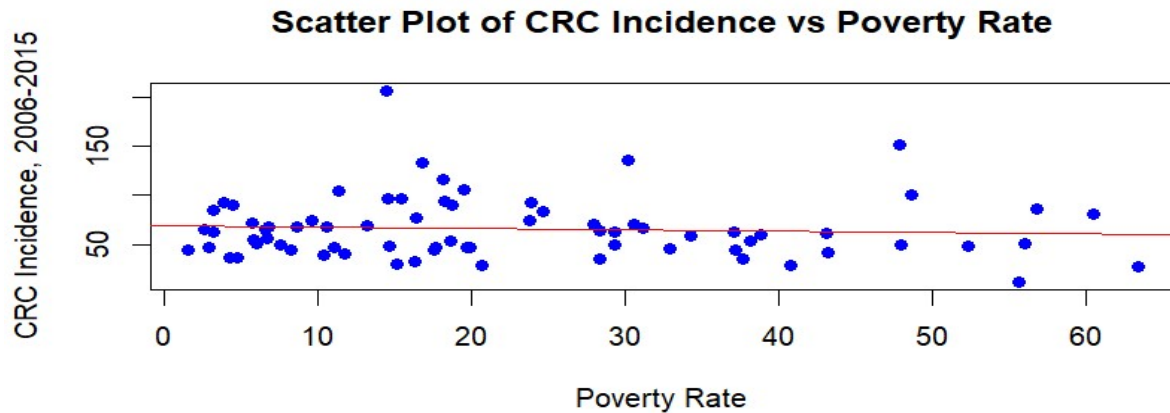
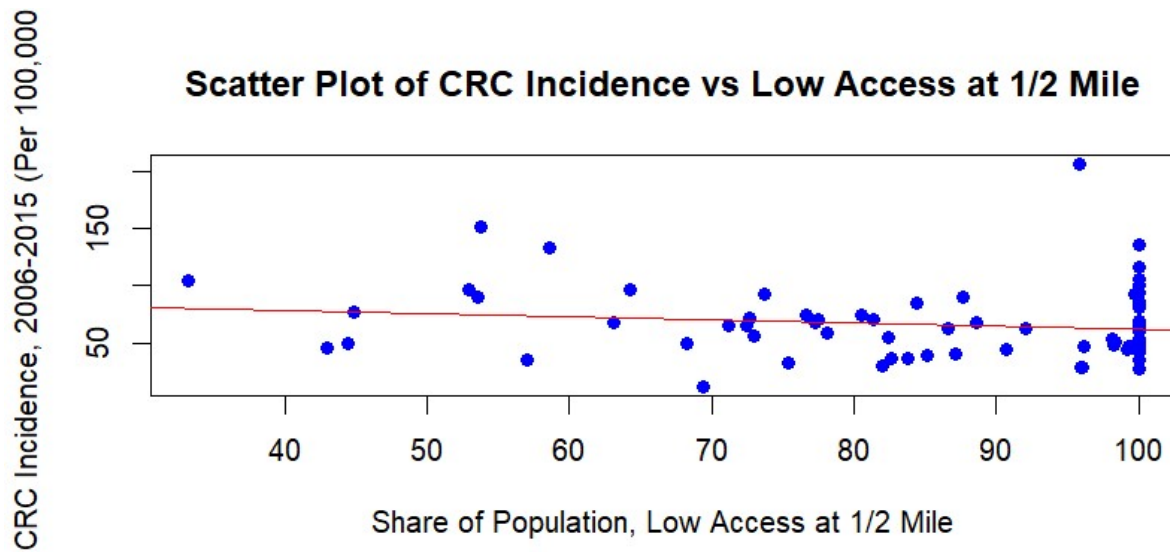


Figure 3



Discussion

This analysis had significant limitations. The multiple linear regression model only had an R^2 of 23.8%, indicating that much of the variance can be explained via other predictor variables not included in this analysis. This was to be expected, as there was no data available at the census tract level for known risk factors for colorectal cancer, such as tobacco use, alcohol abuse, or red meat consumption. Furthermore, the variables that were proportions did not consider census tract population size differences, and all census tracts were considered equal data points.

Future research controlling for more confounding factors such as lack of access to healthcare should be performed. Research regarding alcohol abuse, tobacco use, and dietary patterns should be gathered as well to account for differences in the groups. Other research looking at the implementation of programs to improve access to healthy foods in groups not normally receiving assistance (such as Meals on Wheels) or weekly farmers' markets in low access areas should also be done.

References

- Bevel, M.S., Tsai, M.H., Parham, A., Andrzejak, S.E., Jones, S., Moore, J.X. (2023). Association of food deserts and food swamps with obesity-related cancer mortality in the US. *JAMA Oncology*, 9(7):909-916. <https://doi.org/10.1001/jamaoncol.2023.0634>.
- Fong, A.J., Lafaro, K., Ituarte, P.H.G., & Fong, Y. (2021). Association of living in urban food deserts with mortality from breast and colorectal cancer. *Annals of Surgical Oncology*, 28(3):1311-1319. <https://doi.org/10.1245/s10434-020-09049-6>.
- Gany, F., Melnic, I., Wu, M., Li, Y., Finik, J., Ramirez, J., Blinder, V., Kemeny, M., Guevara, E., Hwang, C., & Leng, J. (2022). Food to overcome outcomes disparities: a randomized controlled trial of food insecurity interventions to improve cancer outcomes. *Journal of Clinical Oncology*, 40(31):3603-3612. <https://doi.org/10.1200/JCO.21.02400>.
- Masdor, N.A., Nawi, A.M., Hod, R., Wong, Z., Makpol, S., & Chin, S.F. (2022). The link between food environment and colorectal cancer: a systematic review. *Nutrients*, 14(19):3954. <https://doi.org/10.3390/nu14193954>.
- Wang, L., Du, M., Wang, K., Khandpur, N., Rossato, S.L., Drouin-Chartier, J.P., Steele, E.M., Song, M., & Zhang, F.F. (2022). Association of ultra-processed food consumption with colorectal cancer risk among men and women: results from three prospective US cohort studies. *BMJ*, 378:e068921. <https://doi.org/10.1136/bmj-2021-068921>.