A Correlative Study of Epidemiological Mortality and Morbidity Rates: Appalachian vs. Non-Appalachian Counties within Kentucky

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Abstract

Introduction:

The isolated geographical location and historical context of economic divestment, unreliable government assistance, and subsequently maladaptive behaviors within Appalachia has confounded significant medial issues within the population compared to the rest of Kentucky. The aim of this research is to determine what these medical issues are and postulate their causes with correlations to established health – risk factors and socio – economic trends with an end goal of proposing solutions to this health crisis. Estill County, located in Appalachian Kentucky was also specifically examined for its mortality and health – risk factor rates due to the researcher's connection to and interest in the overall health of the population where he works as a paramedic with Estill County Emergency Medical Services. By examining a specific county within the Kentucky Appalachia, specific socio – economic factors can be explored as to how and in what way they affect the attitudes of Appalachian populations towards their own health, and the healthcare field in general.

Methods:

The frequency of mortality rates for the top five diseases in two study groups, Kentucky Appalachian populations (KACP) and Kentucky non-Appalachian populations (KnACP), were compared using a Variance One-Way Test on 2013 data along with associated socio – economic and health – risk variables to determine the underlying reasons for observed health disparities. Four health – risk factors: a.) prevalence of smoking, b.) diabetes, c.) hypertension, d.) prevalence of obese adults were statistically analyzed using a standard T-Test to determine any significance between the study groups. Two socio-economic factors: e.) percentage of primary

care physicians, f.) median household income were also statistically analyzed using a standard T-Test to determine any significance between the two study groups.

Results:

By comparing the results of the Variance One-Way Test, it was determined that there was a significant increase in mortality rates of *malignant neoplasms* and *heart disease* in the KACP population compared to KnACP. The KACP population also has significantly increased rates of all four health – risk factors. However, only socio – economic factor (f) showed a significant decrease for KACP compared to KnACP, while factor (e) did not show any significant difference. Estill County also showed an increase in mortality rates including *malignant neoplasms, heart disease, cerebrovascular disease,* and *accidental injuries,* though a variance test was not applicable for this data. Health-risk factors (a) and (b) as well as socio – economic factor (f) also showed increases in Estill County compared to KACP.

Conclusion:

These findings indicate that the populations of KACP are at higher risk of dying from malignant neoplasms and heart disease due to a significant increase in hypertension, smoking, diabetes, and obesity. In addition, the lack of household income prohibits KACP's from both visiting their primary care physicians, and paying for subsequent medical needs such as prescription medications, follow-up visits, and surgeries.

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Within the Commonwealth of Kentucky, lies a region of the United States that has long been associated with as G. Santopietro (2002) states, "lower levels of income than the rest of the nation, […] poor health of the population, and a distinct subculture" (p. 893 & 898). This region, known as Appalachia and seen in white in Figure 1, was determined based on the Appalachian Regional Commission (ARC) classification and is the focus of this research study. In an effort to better provide for the medical needs of such an isolated and distinct region of Kentucky, there arises the necessity to study the population of this region in an effort to decipher:

Figure 1

1. What are the most common mortality rates in Kentucky, KACP, KnACP, and specifically Estill County (KACP)?
2. What health-risk and socio-economic factors most affect KACP, KnACP, and Estill County?
3. How do these factors compare to each study-group?
4. How best to treat these factors in the context of governmental and community support?

Mortality rates for this research were obtained from the Kentucky Department for Public Health and statistically analyzed for significance. Health-risk and socio-economic factors were obtained via the Foundation for a Healthy Kentucky and the County Health Rankings & Roadmaps program. For the purpose of this research, health-risk factors were limited to

hypertension, smoking, diabetes, and obesity, all of which are chronic, long-term diseases. The hypothesis of this research is that within the KACP, there will be high prevalence of mortality rates due to higher instances of health-risk and socio-economic factors, as compared to the KnACP. Many of the socio-economic and health-risk issues are rooted in the history and subsequent perspectives of citizens in the Appalachian region.

Background and History of Appalachia

Historically, many descendants of Appalachia emigrated from Scotland and Ireland, specifically the Ulster region of Ireland (C. Cooper et al, 2011, p. 463). These emigrants came to the secluded region of the newly founded American colonies seeking not only religious freedom from the monarchy of England, but also more lucrative economic advantages. The hills and valleys they called home were already sprawling with vast acres of woods and pasture land that made many agricultural opportunities such as lumber and livestock sales prominent and economically feasible. However, it was not until the early 1900's that Appalachia saw its biggest boom in economic growth with the discovery of coal.

Coal not only powered the steel factories of Midwest America, but also the power-plants of America's biggest cities. This time in Appalachia was one of great growth and promise. Cities grew within eastern Kentucky and more workers migrated to the once secluded area now made accessible by the addition of the rail system, which also allowed coal to be mined and processed faster and more efficiently (Santopietro, 2002, p. 897). Coal at this time was priced at near $100 a ton, and many of the original families that had settled the area centuries earlier became rich as outside companies bought their land for their mining rights (Santopietro, 2002, p. 898). It is at this pivotal point that the Appalachian region sealed its own fate. As the 1900's progressed, oil was discovered and along with it, its ability to be produced cheaply. As the United States began

to switch its private and public sector electric demands over to oil, the once lucrative coalmines began to shut down, with coal dropping to a mere 20% of its original worth. The companies that once poured so much money into the small towns and communities left, leaving behind a high demand for money, but no feasible way to earn it. This phenomenon, described by Santopietro (2002) as *absentee ownership*, "tended to siphon off funds that might have been reinvested in the region" (p. 898). With this siphoning of funds came a decrease in public works, such as roads, schools, hospitals and the rail system which had allowed for ease of access to the mountainous region. Once again, Appalachia was secluded from the rest of the country, and associated with this seclusion was the exacerbation of common medical problems.

Appalachian Attitudes

Santopietro (2002) describes Appalachians as, "fatalistic, oriented towards [family] existence rather than status, and antagonistic towards the government" (p. 898). These three themes: personal fatalistic thinking, family existence over self-advancement, and an antagonistic attitude towards not just government, but outsiders to the area as well, begin to explain why social and environmental issues played such a large part in the decline of the overall health of the region.

In her paper "Rural Appalachian Perspectives on Heart Health: Social Ecological Contexts," G. Mudd-Martin et al. (2013) conducted a "thematic analysis [of] 88 participants from 6 counties in Central Appalachian Kentucky" and analyzed these three themes in detail (p. 135). The authors found that a common fatalistic attitude of Appalachian residents was, "it happened to my mom and dad; it's going to happen to me no matter what" (p. 136). This fatalistic thinking not just hampers KACP residents from making educated medical decisions, but also leads to another common theme, "[Appalachians] know better, but they still choose to

do what they want to do" (p. 136). These themes can be explained due to the history of the Appalachian region, i.e. my family has always had to struggle economically and personally, so why should my life be any different? In fact, Mudd-Martin et al. (2013) found that "[Appalachian] parents do not encourage [their] children to engage in healthy behaviors, do not provide healthy role modeling, and do not attend to health [prevention]" (p. 137). It is apparent that this fatalistic thinking is passed down from generation to generation not just within the family unit, but also the KACP population as a whole.

While it would be wrong to say that the Appalachian family actively wants to merely survive rather than thrive, the economic conditions stemming from the boom-bust cycle of the region exacerbate the inability to create a healthy home environment. C. Cooper et al., (2011) site 60% of Appalachians to live at or below the poverty line, and only 20% to be college educated (p. 467). This lack of monetary funds lends to another common theme identified by Mudd-Martin et al. (2013), that "healthier foods are more expensive than less healthy options" (p. 138). In short, this means that while a family may know they should buy their own food and cook for themselves, they do not have the economic means to do so and thus resort to buying unhealthy options such as McDonalds, Burger King, Wendy's, and Arby's, just to name a few. In addition, Mudd-Martin et al. (2013) site that traditional foods such as tenderloin sandwiches (typically a breakfast sandwich comprised of a fried egg with cheese and pork meat between a biscuit) and snow-cream (a mixture of snow, vanilla extract, and sugar) are "high [in] salt, fat, and sugar content and central to social life" (p. 137).

Antagonistic views of outsiders and persons in governmental or highly educated positions was also found by Mudd-Martin et al. (2013). In addition to limited availability of community-based specialized clinics, "frustration regarding unnecessarily repeated procedures and a lack of

communication between healthcare providers and patients" was voiced by participants of the study (p. 138). This frustration leads to a barrier between doctors and patients within KACP as well as a lack of follow-up by patients about their medical problems. This lack of follow-up leads not only to more mistrust, but also the exacerbation of untreated medical issues which could be prevented, if not managed better with proper, regular care. Mudd-Martin et al. (2013) also found cost barriers to be an issue for obtaining proper medical treatment, citing one participant as saying "people cannot afford follow-up care and therefore only seek care when advanced diseases [states are] present" (p. 138). This fiscal barrier too hampers the ability of KACP populations to receive, and continue with proper medical care and screening.

Previous Research of Appalachian Medical Issues

While our current study seeks to make statistical correlations between mortality rates and provenances of health-risk and socio-economic factors, previous examinations of Appalachian health has provided a background of information which has been drawn from. A. Schandera-Ochsner et al., (2014) published a paper titled "Comparing the Trends of Elevated Blood Pressure in Appalachian and Non-Appalachian Regions." In this research, Schandera-Ochsner et al., (2014) "investigated the incidence of elevated [blood-pressure] in Kentucky through analysis of data collection from community screening events conducted by the University of Kentucky Stroke Care Network" (p. 713). This investigation was accomplished by manually measuring blood-pressure readings via sphygmomanometer in Appalachian (n=1134) and Non-Appalachian (n=1224) sample populations. Schandera-Ochsner et al., (2014) sites hypertension for the study was established as greater than 140 millimeters of Mercury (mmHg) systolic or greater than 90 mmHg diastolic (p. 714). Schandera-Ochsner et al., (2014) found that 41.5% of Appalachians examined presented with hypertension, while 42.6% of Non-Appalachians examined presented

the same. The P value for the experiment was found to be 0.886 which showed no significance (p. 714). This indicates that more research of the entire population is required to make a more comprehensive evaluation of the overall medical issues of the KACP.

Experimental Procedure

Mortality rates provided by KDPH for 2013 were cataloged and assigned per cause of death per county for each county in Kentucky (n=120). Mortality rates for KACP and KnACP were then summed to determine top five mortality rates for each. Kentucky Total (KT) top ten mortality rates was provided by KDPH and can be seen in Chart. 1. Top 5 mortality rates for KT (n=4,399,583), KACP (n=1,179,052), and KnACP (n=3,220,531) was then divided by corresponding study-group population per 1000. 2013 populations were provided by The County Health Ranking and Roadmap System.

Individual mortality rates for each county was then divided in the same way, by county population per 1000. This established the MR per 1000 population per county. These values were then statistically analyzed via 1-way ANOVA test to determine if there was significance between top 5 mortality rates values for KACP and KnACP. The P-value of significance for this study was set at ($P<0.05$). Estill County specifically was examined in the same way to compare top 5 mortality rates per 1000 population to KACP and KT. An ANOVA or T-test analysis was not possible for Estill County due to only one value per mortality rates being available.

Health-risk and socio-economic factors were then separated per study-group and statistically analyzed using a T-test analysis to determine if there was significance between KACP and KnACP.

Results

The results for this study are compelling. While KACP showed higher instances of all top 5 mortality rates compared to KnACP, only malignant neoplasms ($p<0.001$) and heart disease ($p<0.0001$) showed significance. All four health-risk factors showed significance ($p<0.032$) when compared between KACP and KNACP. Of the two socio-economic factors, only median house-hold income ($p<0.0001$) showed significance while percentage of adults with primary care physicians ($p=0.8978$) did not. The figure legend below details the corresponding data for each figure, while each chart is titled.

Figure Legend

Figure 1	State of Kentucky with KACP & KNACP outlined
Figure 2	Mortality Rates for each study group.
Figure 3	Health-Risk and Socio-Economic Factors comparison
Figure 4	KACP and KNACP comparison in mortality rates, and Kentucky total Mortality Rates
Figure 5	Comparison of Prevalence of Smoking of Adults and Prevalence of Adults with Diabetes between KACP & KNACP with significant finding labeled
Figure 6	Comparison of Prevalence of Obese Adults and Prevalence of Hypertension between KACP & KNACP with significant finding labeled
Figure 7	Comparison of Adults with Primary Care Physicians and Median Household Income between KACP & KNACP
Figure 8	Comparison of Mortality Rates between KACP & Estill County, Kentucky
Figure 9	Comparison of Prevalence of Adults with Diabetes and Prevalence of Adults who Smoke between KACP & Estill County
Figure 10	Comparison of Percentage of Fast Food Restaurants between KACP and KNACP
Figure 11	Health-Risk comparison between KACP and Estill County
Figure 12	Route 52 located in Estill County, Kentucky showing “fast-food” style restaurants

Figures

Figure 2

2013 Kentucky Top 5 Mortality Rates		2013 Kentucky Top 5 Mortality Rates per 1000 Pop.	
Malignant Neoplasms	10,017	**Malignant Neoplasms**	2.28
Heart Disease	9,894	**Heart Disease**	2.25
Chronic Lower Respiratory Diseases	3,156	**Chronic Lower Respiratory Diseases**	0.97
Accidental Injuries	2,320	**Accidental Injuries**	0.53
Cerebrovascular Diseases	1,891	**Cerebrovascular Diseases**	0.43
Total	27,278	**Kentucky Population/1000**	4399.58

2013 KACP Top 5 Mortality Rates		2013 KACP Top 5 Mortality Rates per 1000 Pop.	
Heart Diseases	3,339	**Heart Diseases**	2.83
Malignant Neoplasms	3,233	**Malignant Neoplasms**	2.74
Chronic Lower Respiratory Diseases	1,109	**Chronic Lower Respiratory Diseases**	0.95
Accidental Injuries	778	**Accidental Injuries**	0.67
Cerebrovascular Diseases	533	**Cerebrovascular Diseases**	0.49
Total	8,992	**KACP Population/1000**	1179.05

2013 KnACP Top 5 Mortality Rates		2013 KnACP Top 5 Mortality Rates per 100 Pop.	
Malignant Neoplasms	6,784	**Malignant Neoplasms**	2.11
Heart Diseases	6,555	**Heart Disease**	2.04
Chronic Lower Respiratory Diseases	2,047	**Chronic Lower Respiratory Diseases**	0.64
Accidental Injuries	1,542	**Accidental Injuries**	0.49
Cerebrovascular Diseases	1,358	**Cerebrovascular Diseases**	0.44
Total	18,286	**KnACP Population/1000**	3220.53

Figure 3

Health Risk & Socio-Economic Factors	KACP	KNACP	P VALUE
Mean Percentage of Smoking*	0.3261	0.279	< 0.0001
Mean Percentage of Adults with Diabetes*	0.1346	0.1054	0.0002
Mean Percentage of Obese Adults*	0.3533	0.3175	0.0035
Mean Percentage of Hypertension*	0.4467	0.3902	0.0001
Mean Percentage of Adults with Primary Care Physicians	0.8207	0.822	0.8978
Mean Household Income*	31127	42863	< 0.0001

* Indicates significance found

Figure 4

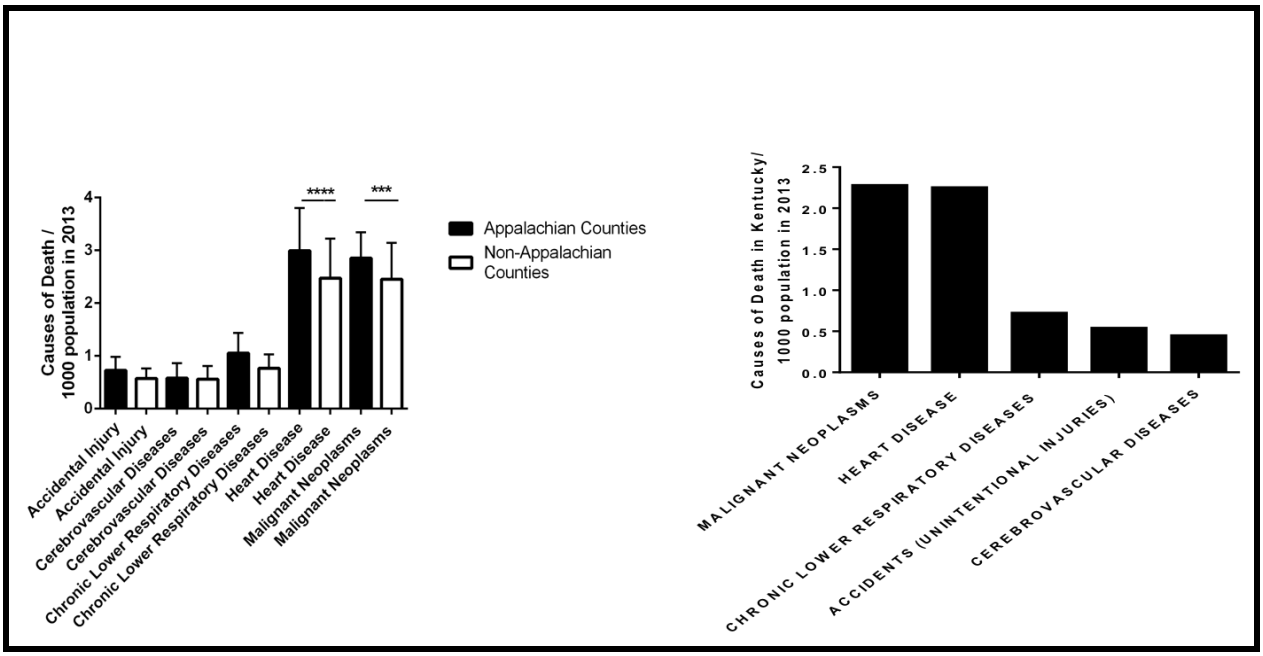


Figure 5

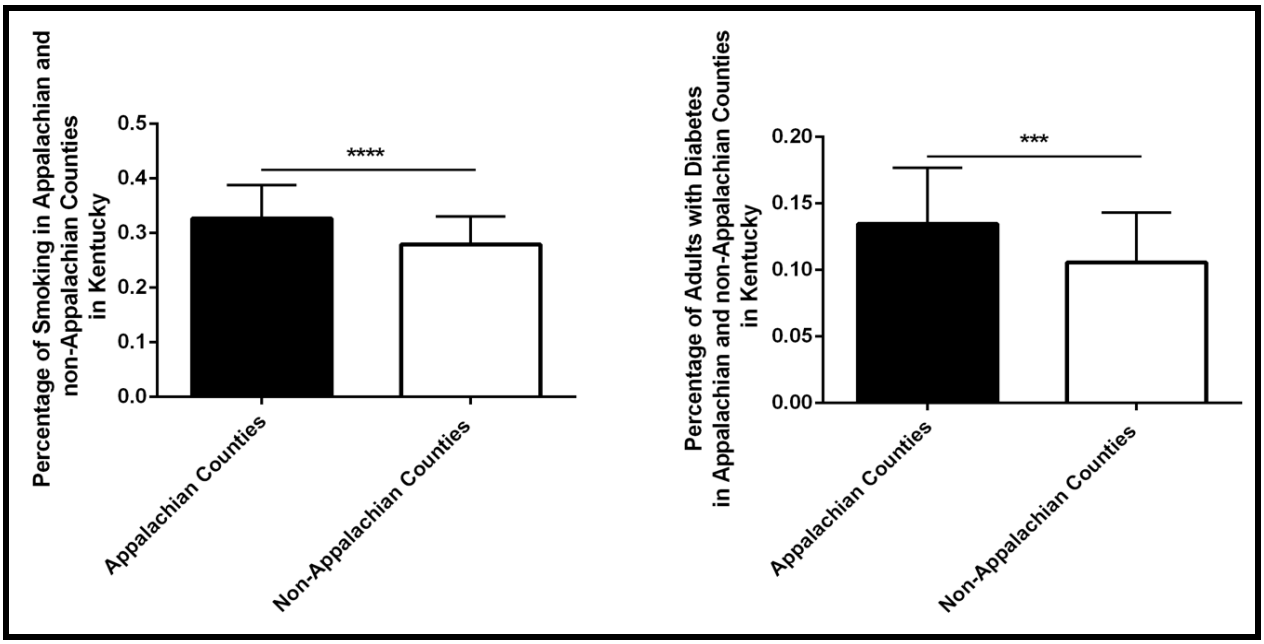


Figure 6

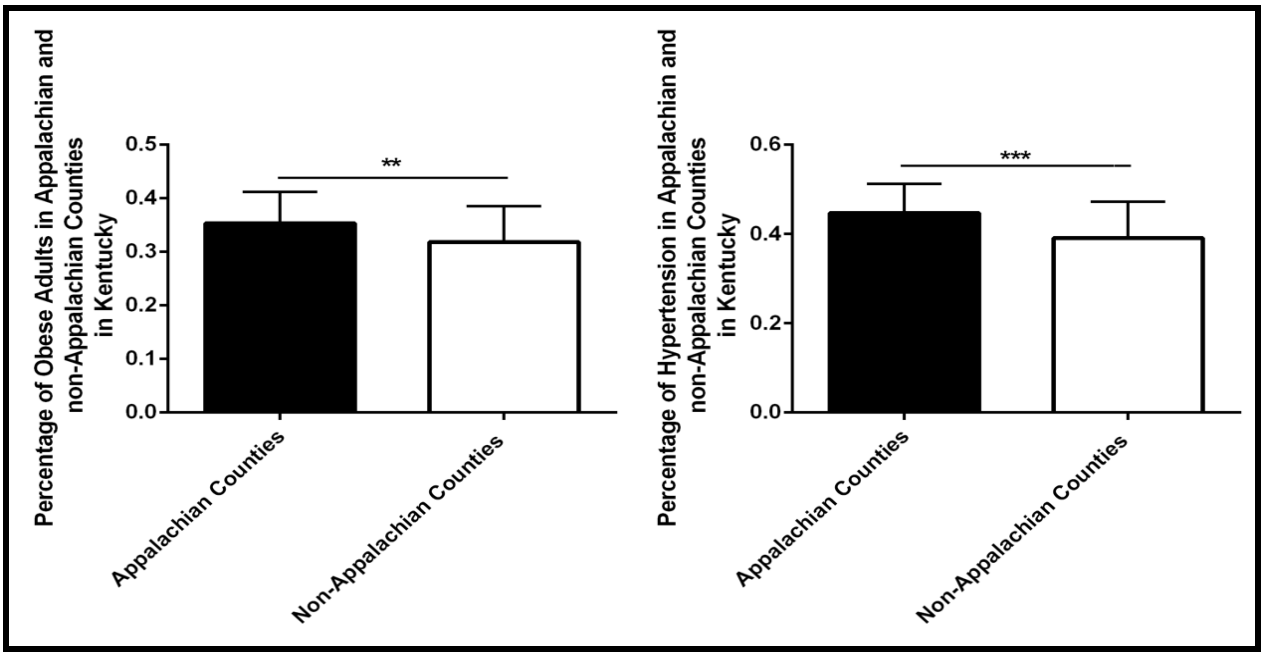
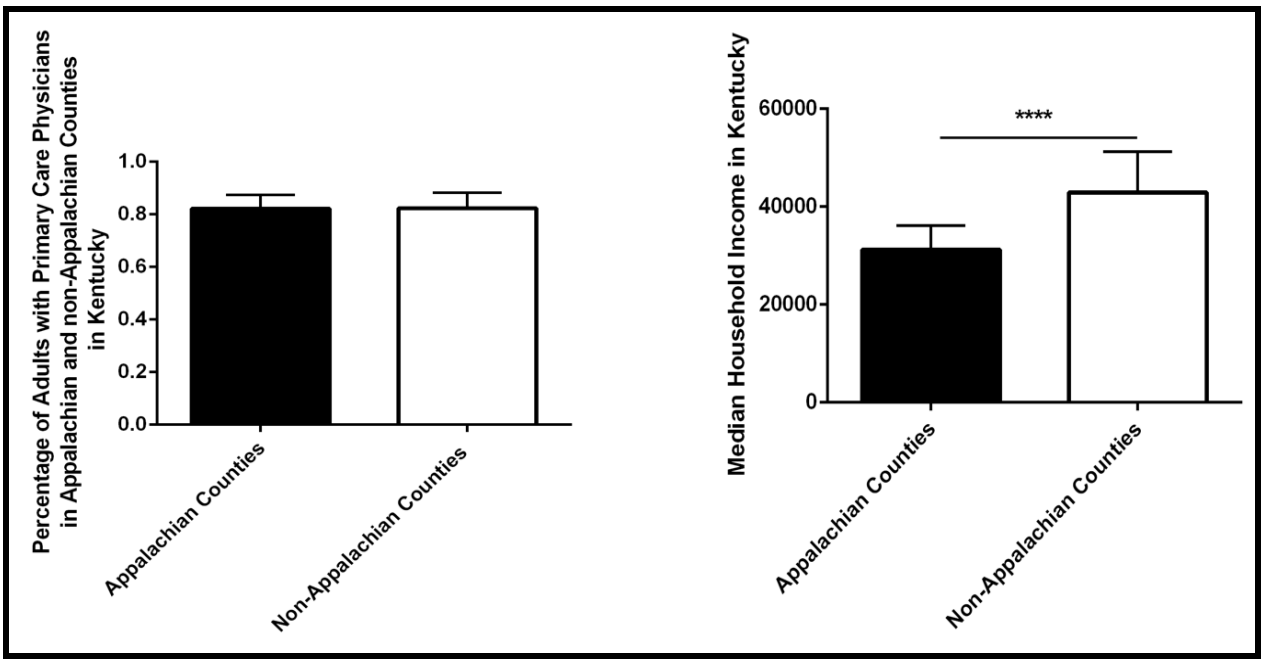


Figure 7



Discussion

As the charts and graphs indicate, the only two mortality rates that showed significance between KACP and KnACP were Heart Disease ($p < 0.0001$) and Malignant Neoplasms ($p < 0.001$). In addition, all four health risk factors showed significance between KACP and KnACP. However, in the socio-economic factors, only the median household income showed significance between KACP (mean=$32,000) and KnACP (mean=$45,000), while the percentage of primary care physician did not show any significance. These finding leave the question: what does this mean?

From the statistical analysis and the historical behavioral analysis conducted by this research, five main points can be made:

1. The five most common causes of death in the State of Kentucky for 2013 was malignant neoplasms, heart disease, chronic lower respiratory diseases, accidental injuries, and cerebrovascular disease.
2. KACP showed significantly higher 2013 mortality rates for malignant neoplasms and heart disease.
3. KACP showed significantly higher 2013 rates of all four health-risk factors: smoking, obesity, diabetes, and hypertension. This indicates that these health risk factors contribute to the higher mortality rates within KACP.
4. While KACP showed significantly less 2013 median household incomes compared to KnACP, there was no significance in the percentage of adults with primary care physicians. This indicates that while the KACP study group has the same percentage of primary care physicians per person, the lack of financial mobility hampers their ability to both pay for a health visit, and subsequently the follow up treatment required.

5. The significant decrease in 2013 median household income for KACP also contributes to the prevalence of health-risk factors, by not allowing KACP residents to buy items like healthy food options, gym memberships, and smoking cessation products.

These five points summarize succinctly why the increase in health risk factors contributes to the overall decline in health for the KACP population. In addition, the socio-economic factors aid in hampering the ability of KACP populations in combating these issues and removing their populations from health-risk groups. In a specific look at Estill County, many of the causes of these health risk factors can be seen quite clearly.

Specific Example: Estill County

Estill County is listed as a "distressed county" by the ARC and is geographically just within the inclusion zone for Appalachian counties, i.e. it is one county away from Fayette County, a more prosperous and populated county which includes the city of Lexington Kentucky. The amount of poverty in Estill County, as well as the prevalence of mortality rates and health-risk factors only aids in causing the overall health of the population to be quite bad. For example, the median household income for Estill County in 2013 was $17,000, while in Fayette County, around 50 miles away and an hour by car, it was $30,000, and nationally the median household income was $52,250 (A. Noss, 2014). This lack of financial stability only aids in the lack of medical care within Estill County. In addition, there is only one hospital, which does not have an intensive care unit (ICU) and cannot perform relatively simple procedures such as child-birthing, and two clinics which serve the population of Estill, while the city of Lexington has over 5 hospitals that serve the city as well as Fayette County. In using statistical analysis, Figures 8, 9, and 10 were generated.

Figure 8

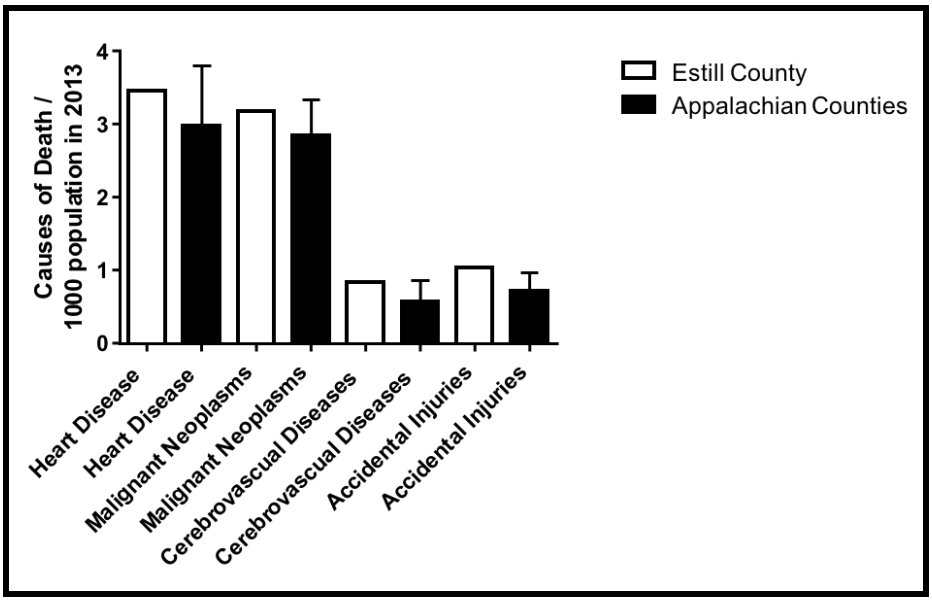


Figure 9

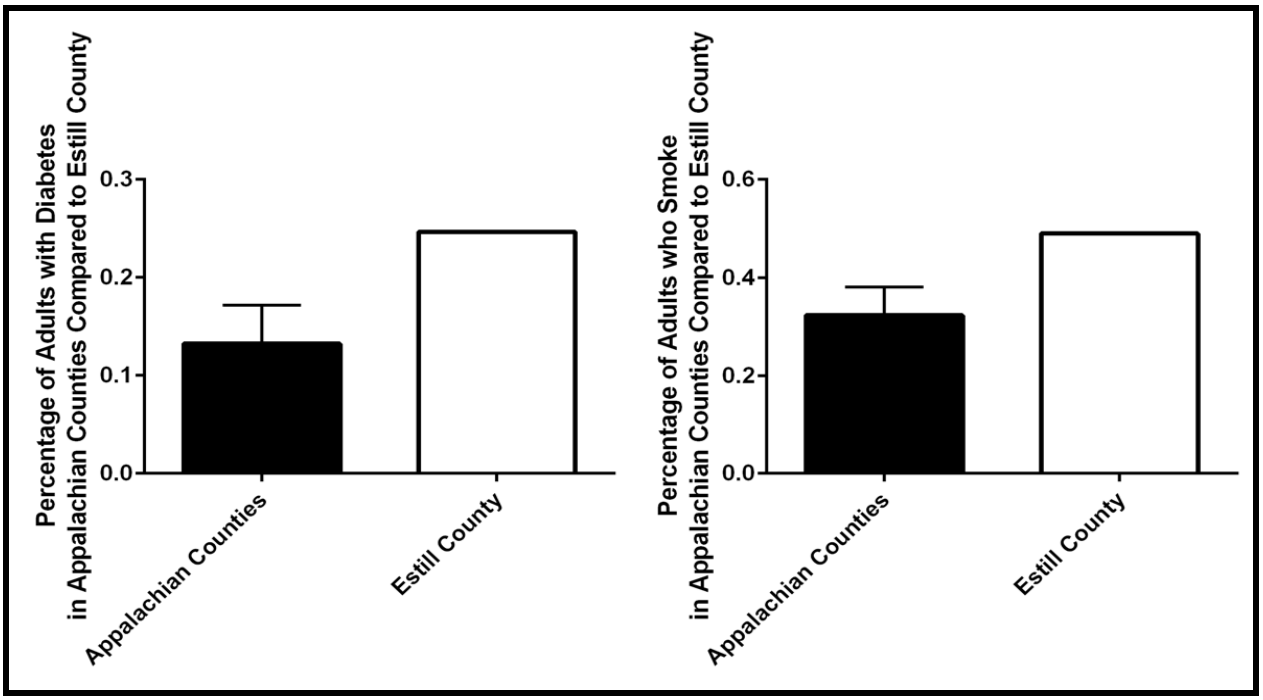


Figure 10

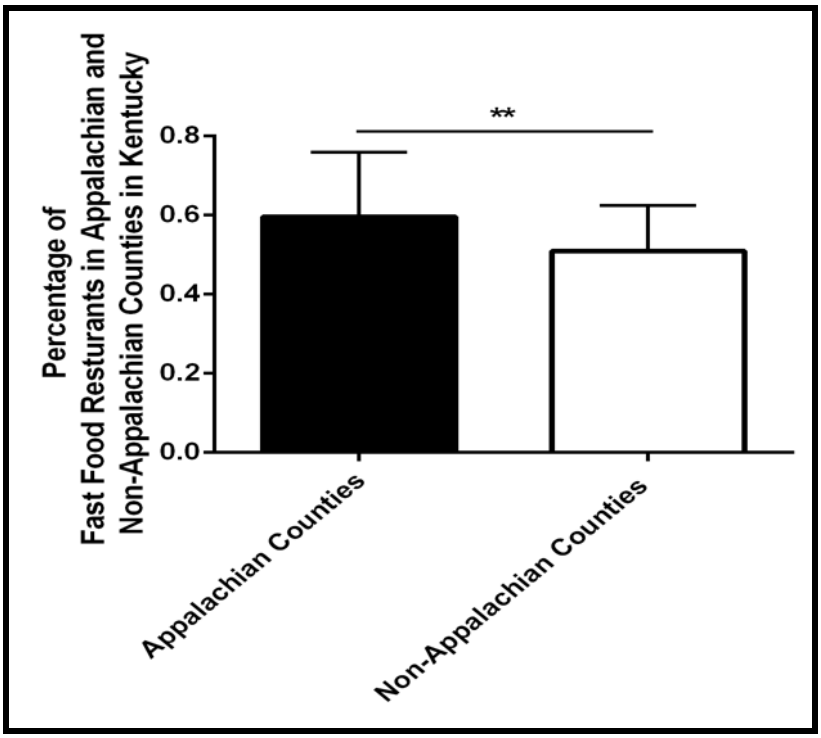


Figure 11

Health Risk Factor	Estill County	KAPC
Mean Percentage of Smoking	0.3346	0.3261
Mean Percentage of Adults with Diabetes	0.21	0.3533
Mean Percentage of Obese Adults	0.3918	0.4467
Mean Percentage of Hypertension	0.2467	0.1346

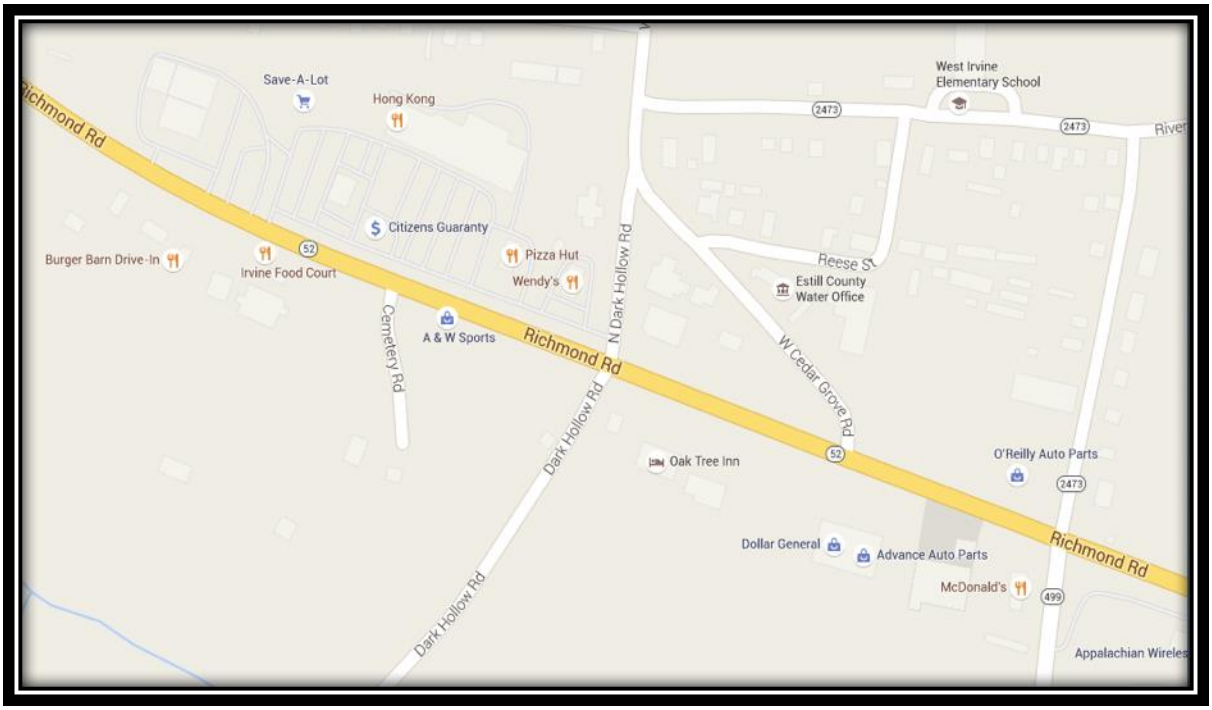
Seen above in Figure 8, Estill County ranks higher in Heart Disease, Malignant Neoplasms, Cerebrovascular Diseases, and Accidental Injuries than its counterparts in all of KACP. In addition, Estill County ranks higher in the prevalence of smoking as well as diabetes than all of KACP, as seen in Figures 9 and 11.

In addition, social factors add to the decline in health for Estill County. A 2010 study performed by the County Business Patterns division of the United States Census Bureau found that of all the restaurants within the State of Kentucky, 54% were labeled as “fast-food”

establishments. Upon statistical analysis via T-Test of this data, it was discovered that there was a significant increase in the number of "fast-food" restaurants in KACP compared to KNACP. This data can be seen in Figure. 10. In addition, Figure 12 below shows the main road into and out of the county, State Route 52. Clustered around this road are multiple "fast-food" style restaurants with very limited healthy food options.

This overabundance of "fast-food" options as well as limited financial resources makes it incredibly easy for residents to simply buy their meal for the day, rather than purchase costlier healthy food options for the week or month. These "fast-food" options peddle in food that is extremely high in carbohydrates as well as fatty triglycerides and simple sugars. All three of these factors contribute to the prevalence of diabetes in Estill County as well as all four increased mortality rates.

Figure 12



Health Care Solutions and Future Research

While it is interesting to statistically show correlation between increased mortality rates and health-risk/socio-economic factors, this research would be lacking if it did not put forth possible solutions to alleviate these issues as well as the need for future research in this area. Possible solutions for the healthcare of KACP can be broken down into two categories: Community Solutions and Governmental Support.

Community Solutions

The overall population of KACP is both distinct and isolated from that of the rest of the United States. This is due not only to its distinct sub-culture, but also the lack of public access into the region. These two factors mean that support for the health of the community can not only come from outside the region, but must also originate inside the geographical community. Possible community solutions include:

1. Cessation of smoking programs in all local government so as to lead by example within the community.
2. Community gardens to aid in distributing healthy food options for all members of KACP, even those that are extremely isolated from cities.
3. Community add campaigns both on social media as well as television and hard-copy pamphlets to warn about the dangers of smoking as well as “fast-food” style food options and overuse of carbonated soft drinks.
4. Community training for out of area doctors and medical professionals to aid in both their understanding of the region and its culture, and their communication with its residents.

5. Community action groups dedicated to brain-storming new ideas on increasing overall health in the area and lobbying local and state governments for funds to make these ideas happen.

Governmental Support

While these ideas for community involvement are much needed, so too is money and influence from the state of Kentucky. Possible ideas for governmental support are:

1. Governmental assistance for funding of gym and health classes in local schools.
2. More money allocated by the State of Kentucky to provide for more subsidies for grocery stores, community parks, and local gyms.
3. More money allocated for specialized doctors to open clinics relating to heart disease and cancer within KACP.
4. More money allocated for medical professionals to come to KACP and work in the area. This can also be done through medical schools like the University of Kentucky and the University of Louisville.
5. Nutrition requirements, set by state government selected officials, for what types of food can be bought with Kentucky Supplemental Nutrition and Assistant Program (SNAP) food cards with additional limitations on soft-drinks and "luxury" food items such as "soft drinks, candy, cookies, snack crackers, and ice cream" (USDA, 2016).
6. More training for local KACP populations in healthcare related fields to allow more jobs, financial mobility, and better access to community based healthcare.
7. Free clinics either run by the State of Kentucky or subsidized by them to allow for better access to healthcare and a minimal or nonexistent cost.

Future Research

While this study did find correlations between mortality rates and health-risk/socio-economic factors, causation cannot be proven. This is to say that while there is significant increase in heart disease and neoplasms for the KACP population, we cannot definitely say it was caused by an increase in all four health-risk factors, or if those factors were caused by some other phenomenon. Research in this area should concentrate now on determining complete causation for these mortality rates by examining all possible causes that were not looked at here in this study. This could include performing genetic testing on the KACP population to determine if any genetic factors play a role in the increased mortality and health-risk factors. In addition, specific sample groups could be made to determine specific pathologies of various diseases within the KACP compared to their counterparts in the KnACP.

Conclusion

The conclusion of this study is, while an excellent basis for correlation and future research, still incomplete. A more thorough review of the medical conditions affecting the KACP population is required to have a more complete view of the decline in the medical health of the community as a whole. To be direct, there is a direct positive correlation between an increase in heart disease and malignant neoplasms in KACP and an increase in diabetes, hypertension, prevalence of smoking, and obesity. While this correlation is obvious to see, it does not necessarily constitute causation within the KACP. As stated in the Future Research section, more research and testing is warranted in order to determine the exact cause of the increase in health-risk factors and mortality rates within the KACP.

Special Thanks

A special thank you is necessary for Lindsay Calderon, PhD for her help in being a mentor for this research. In addition, the Honor's Program at Eastern Kentucky University has been instrumental in assisting this research with logistical coordination through university facilities and off campus programs. Estill County Emergency Medical Services should be acknowledged for giving the researcher not only a means for financial stability, but also a way to interact with this distinct section of the United States and find a calling to help the people here. Finally, the Kentucky Department for Public Health must be commended for their help in obtaining all of the raw data necessary to create the statistical analysis for this research. This research would not be possible without them.

References

Cooper, C. A., Knotts, H. G., & Elders, K. L. (2011). A geography of Appalachian identity. *Southeastern Geographer, 51*(3), 457-472. doi:10.1353/sgo.2011.0025

Cree, R. A., Lynch, J., Au, M. G., & Myers, M. F. (2009). Decisions to seek healthcare based on family health history among urban Appalachian women. *Journal of Genetic Counseling, 18*(6), 534-550. doi:10.1007/s10897-009-9236-x

Hamilton, J., MS, Noland, M. P., PhD, Riggs, R. S., EdD, & Mullineaux, D. R., PhD. (2010). Factors related to adolescent drinking in Appalachia. *American Journal of Health Behavior, 34*(2). doi:10.5993/ajhb.34.2.12

Hurley, J. L., Turner, H. S., & Floyd, D. L. (2000). Development of a health service at a rural community college in Appalachia. *Journal of the American College Health, 48*(4), 181-185. doi:10.1080/07448480009595694

Kentucky Department for Public Health (KDPH) and Centers for Disease Control and Prevention (CDC). *Behavioral Risk Factor Surveillance System Survey Data.* Frankfort, Kentucky: Cabinet for Health and Family Services, Kentucky Department for Public Health, [2013].

Mudd-Martin, G., Biddle, M. J., Chung, M. L., Lennie, T. A., Bailey, A. L., Casey, B. R., . . . Moser, D. K. (2014). Rural Appalachian perspectives on heart health: Social ecological contexts. *American Journal of Health Behavior, 38*(1), 134-143. doi:10.5993/ajhb.38.1.14

Newell-Withrow, C. (2000). Health protecting and health promoting behaviors of African Americans living in Appalachia. *Public Health Nursing, 17*(5), 392-397. doi:10.1046/j.1525-1446.2000.00392.x

Noss, A. (2014). *Household income: 2013* (September ed.) (United States of America, Census Bureau).

Santopietro, G. D. (2002). Analyzing income convergence at the county level: The case of development in central Appalachia. *Journal of Economic Issues, 36*(4), 893-906. doi:10.1080/00213624.2002.11506528

Schlomann, P., Virgin, S., Schmitke, J., & Patros, S. (2011). Hypertension among the uninsured: Tensions and challenges. *Journal of the American Academy of Nurse Practitioners, 23*(6), 305-313. doi:10.1111/j.1745-7599.2011.00616.x

Shandera-Ochsner, A. L., Han, D. Y., Rose, D., Aroor, S. R., Schmitt, F., Bellamy, L. M., & Dobbs, M. R. (2014). Comparing the trends of elevated blood pressure in Appalachian and non-Appalachian regions. *The Journal of Clinical Hypertension, 16*(10), 713-715. doi:10.1111/jch.12397

Studts, C. R., Tarasenko, Y. N., & Schoenberg, N. E. (2012). Barriers to cervical cancer screening among middle-aged and older rural Appalachian women. *Journal of Community Health, 38*(3), 500-512. doi:10.1007/s10900-012-9639-8

The Foundation for a Healthy Kentucky, www.kentuckyhealthfacts.org Data Source: Centers for Disease Control and Prevention (CDC) and Kentucky Department for Public Health (KDPH). *Personal Doctor or Healthcare Provider.* Frankfort, Kentucky: Cabinet for Health and Family Services [2012 – 2014].

The Foundation for a Healthy Kentucky, www.kentuckyhealthfacts.org Data Source: Centers for Disease Control and Prevention (CDC) and Kentucky Department for Public Health (KDPH). *Prevalence of Diabetes.* Frankfort, Kentucky: Cabinet for Health and Family Services [2012 – 2014].

The Foundation for a Healthy Kentucky, www.kentuckyhealthfacts.org Data Source: Centers for Disease Control and Prevention (CDC) and Kentucky Department for Public Health (KDPH). *Prevalence of Hypertension.* Frankfort, Kentucky: Cabinet for Health and Family Services [2011 – 2013].

The Foundation for a Healthy Kentucky, www.kentuckyhealthfacts.org Data Source: Centers for Disease Control and Prevention (CDC) and Kentucky Department for Public Health (KDPH). *Prevalence of Obesity.* Frankfort, Kentucky: Cabinet for Health and Family Services [2012 – 2014].

The Foundation for a Healthy Kentucky, www.kentuckyhealthfacts.org Data Source: Centers for Disease Control and Prevention (CDC) and Kentucky Department for Public Health (KDPH). *Prevalence of Smoking.* Frankfort, Kentucky: Cabinet for Health and Family Services [2012 – 2014].

United States of America, Bureau of the Census, Population Estimates Program. (n.d.). *Kentucky Population in 2013 (estimate) by County*. Retrieved from http://www.census.gov/popest/index.html

United States of America, Census Bureau, County Business Patterns. (n.d.). *Fast Food Restaurants*. Retrieved from http://www.countyhealthrankings.org/app/kentucky/2013/measure/factors/84/map

United States of America, United States Department of Agriculture, Food and Nutrition Service. (2008). *The food and nutrition act*. Retrieved from https://www.fns.usda.gov/snap/eligible-food-items