Appendices

A. BIBLIOGRAPHY

Abramson, E., Barron, Y., Quaresimo, J., & Kaushal, R. (2011). Electronic prescribing with an electronic health record reduces ambulatory prescribing errors. *The Joint Commission Journal on Quality and Patient Safety*, 470-478.

Alamgir, H., Muazzam, S., & Nasrullah, M. (2012, Dec). Uninentional falls mortality among elderly in the United States: time for action. *Injury, 43*(12), 2065-71.

American Cancer Society. (2016, January 7). *Cancer Statistics Report: Death Rate Down 23% in 21 Years*. Retrieved from American Cancer Society: https://www.cancer.org/latest-news/cancer-statistics-report-death-rate-down-23-percent-in-21-years.html

American Diabetes Association, Standards of Medical Care in Diabetes—2016. (2016). Retrieved from Diabetes Care 39(S1): http://care.diabetesjournals.org/content/suppl/2015/12/21/39.Supplement_1.DC2/2016-Standards-of-Care.pdf

American Diabetes Association, Statistics About Diabetes. (2016, August 31). Retrieved from Diabetes Basics: http://www.diabetes.org/diabetes-basics/statistics/

American Heart Association. (2016, Aug 31). *Coronary Artery Disease - Coronary Heart Disease*. Retrieved from http://www.heart.org/HEARTORG/Conditions/More/MyHeartandStrokeNews/Coronary-Artery-Disease---Coronary-Heart-Disease_UCM_436416_Article.jsp#.V9aVvjtEzmF

Ammenwerth, E., Schnell-Inderst, P., Machan, C., & Siebert, U. (2008, Sep-Oct). The Effect of Electronic Prescribing on Medication Errors and Adverse Drug Events: A Systematic Review. *Journal of the American Medical Informatics Association, 15*(5), pp. 585-600.

Andale. (2017, April 1). *Propensity Score Matching: Definition & Overview*. Retrieved April 17, 2017, from Statistics How TO: http://www.statisticshowto.com/propensity-score-matching/

Anderson, R. T., Yang, T.-C., Matthews, S. A., Camacho, F., Kern, T. M., Kimmick, G., . . . Yao, N. (2014, Apr). Breast Cancer Screening, Area Deprivation, and Later-Stage Breast Cancer in Appalachia: Does Geography Matter? *Health Services Research, 49*(2), 546-67.

Baicker, K., & Chandra, A. (2004). Medicare spending, the physician workforce, and beneficiaries' quality of care. *Health Affairs*, W4-184-97.

Baillargeon, J., Wang, Y., Kuo, Y., Holmes, H., & Sharma, G. (2013). Temporal Trends in Hospitalization Rates for Older Adults with Chronic Obstructive Pulmonary Disease. *he American Journal of Medicine, 126*(7), 607-614.

Barry, D., & Sherrod, M. (2014, October 16). *Ensuring Access to Sexually Transmitted Infection Care for All*. Retrieved from Center for American Progress: https://www.americanprogress.org/issues/women/reports/2014/10/16/99135/ensuring-access-to-sexually-transmitted-infection-care-for-all/

Behringer, B., & Friedell, G. (2006). Appalachia: Where Place Matters in Health. *Preventing Chronic Disease: Public Health Research, Practice, and Policy*, 1-4.

Bell, J., Mora, G., Hagan, E., Rubin, V., & Karpyn, A. (2013). *Access to Healthy Food and Why it Matters: A Review of the Research.* PolicyLink. Retrieved from The Food Trust: http://thefoodtrust.org/uploads/media_items/access-to-healthy-food.original.pdf

Bergen, J., Gotz, H., Richardus, J., & C., H. (2004). Prevalence of urogenital Chlamydia trachomatis increases significantly with level of urbanisation and suggests targeted screening approaches: result from the first national population based study in the Netherlands. *Sexually Transmitted Infection*, 17-23.

Berkman, L. F., & Breslow, L. (1983). Review: Health and Ways of Living: The Alameda County Study. *Journal of Public Health Policy*, 413-415. doi:10.2307/3342407

Berkman, L., & Syme, S. (1979, February). Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology* , 186-204. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/425958

Berkman, N. D., Dewalt, D. A., Pignone, M. P., Sheridan, S. L., Lohr, K. N., Lux, L., . . . Bonito, A. (2004). Literacy and Health Outcomes: Summary. *AHRQ Evidence Report Summaries*.

Besser, L. M., Marcus, M., & Frumkin, H. (2008). Commute Time and Social Capital in the U.S. *Am J Prev Med, 34*(3), 207-11.

Bhattacharya, R., Shen, C., & Sambamoorthi, U. (2014). Depression and Ambulatory Care Sensitive Hospitalizations among Medicare Beneficiaries with Chronic Physical Conditions. *National Institute of Health*, 460-465.

Bodenheimer, T., & Pham, H. (2010).). Primary Care: Current Problems and Proposed Solutions. *Health Affairs, 29*(5), 799-805.

Bodenheimer, T., Chen, E., & Bennett, H. (2009). Confronting the Growing Burden of Chronic Disease: Can the U.S. Health Care Workforce do the Job? *Health Affairs*, 28(1): 64–74.

Bolin, J. B. (2015). Rural Healthy People 2020: New Decade, Same Challenges. *Journal of Rural Health, 31*(3), 326-333.

Bradley, E., & Taylor, L. (2016, August 17). *How Social Spending Affects Health Outcomes.* Retrieved 2017, from Robert Wood Johnson Foundation Culture of Health Blog: http://www.rwjf.org/en/culture-of-health/2016/08/how_social_spending.html

Braveman, P., & Gruskin, S. (2003). Poverty, Equity, Human Rights, and Health. *Bulletin of the World Health Organization*, 539-545.

Brody, G. H., Yu, T., Chen, E., Miller, G. E., Kogan, S. M., & Beach, S. R. (2013). Is Resilience Only Skin Deep? Rural African Americans' Preadolescent Socioeconomic Status-Related Risk and Competence and Age 19 Psychological Adjustment and Allostatic Load. *Psychological Science, 24*(7), 1285-1293. doi:10.1177/0956797612471954

Brody, J. E. (2013). *Commuting's Hidden Cost.* Retrieved from New York Times: http://well.blogs.nytimes.com/2013/10/28/commutings-hidden-cost/

Brummett, B., Barefoot, J., Siegler, I., Clapp-Channing, N., Lytle, B., Bosworth, H., . . . Mark, D. (2001, Mar-Apr). Characteristics of socially isolated patients with coronary artery disease who are at elevated risk for mortality. *Psychosomatic Medicine,* 267-272.

Buchanich, J. e. (2014). Disparities in Diabetes Mellitus Mortality Rates in Coal Mining and Non-Coal Mining Areas of Appalachia. *APHA 142nd Annual Meeting and Expo.* New Orleans, LA.

Bureau of Health Workforce, Health Resources & Services Administration. (2016, October). *Health Professional Shortage Areas (HPSAs)*. Retrieved from https://bhw.hrsa.gov/shortage-designation/hpsas

Bureau of Transportation Statistics. (2000). *The Changing Face of Transportation, Chapter 3: Safety*. Retrieved from Bureau of Transportation Statistics: https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/the_changing_face_of_transportation/html/chapter_03.html

Callaghan, R., Gatley, J., Veldhuizen, S., Lev-Ran, S., & Mann, R. A. (2013, Apr). Alcohol- or drug-use disorders and motor vehicle accident mortality: a retrospective cohort study. . *Accid Anal Prev., 53*, 149-155.

Canadian Mental Health Association. (2017). *Connection Between Mental and Physical Health*. Retrieved from Canadian Mental Health Association: https://ontario.cmha.ca/documents/connection-between-mental-and-physical-health/

Cardiovascular Health Branch, Division of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, CDC. (1999, August 6). Achievements in Public Health, 1900-1999: Decline in Deaths from Heart Disease and Stroke -- United States, 1900-1999. *Mortality and Morbidity Weekly Report*, 649-656.

Casalino, L. R. (2010). Speciality Physician Practices as Patient-Centered Medical Homes. *New England Journal of Medicine, 362*, 1555-1558.

Case, A., & Deaton, A. (2015, Dec 8). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proceedings of the National Academy of Sciences, 112*(49), 15078-15083.

Catlin, B. J. (2015). *2015 County Health Rankings Key Findings Report.* University of Wisconson , Population Health Institute. Madison, Wis: County Health Rankings & Roadmaps.

Cavanaugh, K. (2011). Health Literacy in Diabetes Care: Explanation, Evidence and Equipment. *Diabetes Management*, *1*(2), 191-199.

Centers for Disease Control and Prevention. (2015, August 10). *Heart Disease Facts*. Retrieved from https://www.cdc.gov/heartdisease/facts.htm

Centers for Disease Control and Prevention. (2016, August 31). *Chlamydia - CDC Fact Sheet*. Retrieved from Chlamydia - CDC Fact Sheet: https://www.cdc.gov/std/chlamydia/stdfact-chlamydia.htm

Centers for Disease Control and Prevention. (2016, March 30). *Depression*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/mentalhealth/basics/mental-illness/depression.htm

Centers for Disease Control and Prevention. (2016, Aug 31). *Heart Disease Facts*. Retrieved from Heart Disease Facts: http://www.cdc.gov/heartdisease/facts.htm

Centers for Disease Control and Prevention. (2017, April 20). *Health Effects of Cigarette Smoking*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm

Centers for Disease Control and Prevention. (Diabetes 2015, March 31). *Basics About Diabetes*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/diabetes/basics/diabetes.html

Centers for Disease Control and Prevention. (Diabetes(a) 2016, August 15). *A Snapshot: Diabetes In the U.S.* Retrieved from Centers for Disease Control and Prevention: http://www.cdc.gov/diabetes/pubs/statsreport14/diabetes-infographic.pdf

Centers for Disease Control and Prevention. (Diabetes(b) 2016, October 17). *Diabetes Home. Data and Statistics.* Retrieved from http://www.cdc.gov/diabetes/data/index.html

Centers for Disease Control and Prevention. (Obesity(a), 2016, August 15). *Adult Obesity Causes & Consequences*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/obesity/adult/causes.html

Centers for Disease Control and Prevention. (Obesity(b), 2016, Aug 31). *Overweight and Obesity. Adult Obesity Facts.* Retrieved from https://www.cdc.gov/nchs/data/databriefs/db219.pdf

Centers for Disease Control and Prevention, About Teen Pregnancy. (2017, May 9). Retrieved from Reproductive Health: Teen Pregnancy: https://www.cdc.gov/teenpregnancy/about/index.htm

Centers for Disease Control and Prevention, Alcohol and Public Health. (2016, September 7). *Text Description for Prevalence Map on Data and Maps Page*. Retrieved from https://www.cdc.gov/alcohol/data-table-text.htm#prevalence

Centers for Disease Control and Prevention, Alcohol Use. (2016, August 31). Retrieved from National Center for Health Statistics: http://www.cdc.gov/nchs/fastats/alcohol.htm

Centers for Disease Control and Prevention, Breast Cancer. (2017, May 08). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/cancer/breast/

Centers for Disease Control and Prevention, Challenges in HIV Prevention. (2016, August). *Challenges in HIV Prevention Fact Sheet.* Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/challenges-508.pdf

Centers for Disease Control and Prevention, Chlamydia-CDC Fact Sheet. (2017, March 14). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/std/chlamydia/stdfact-chlamydia.htm

Centers for Disease Control and Prevention, Chronic Obstructive Pulmonary Disease (COPD). (2016, August 31). Retrieved from Centers for Disease Control and Prevention: http://www.cdc.gov/copd/index.html

Centers for Disease Control and Prevention, Conditions that Increase the Risk for Stroke. (2017, January 17). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/stroke/conditions.htm

Centers for Disease Control and Prevention, Depression. (2016, March 30). Retrieved from Centers for Disease Control and Prevention: http://www.cdc.gov/mentalhealth/basics/mental-illness/depression.htm

Centers for Disease Control and Prevention, Diabetes. (2014). *National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014.* Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from National Diabetes Statistics Report, 2014: https://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf

Centers for Disease Control and Prevention, Diabetes FastStats. (2016, August 31). *National Center for Health Statistics*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/nchs/fastats/diabetes.htm

Centers for Disease Control and Prevention, Fast Facts. (2017, March 29). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/fast_facts/index.htm

Centers for Disease Control and Prevention, Health Effects of Cigarette Smoking. (2017, April 20). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/index.htm

Centers for Disease Control and Prevention, Healthy Foods. (2016, March). Retrieved from https://www.cdc.gov/healthyplaces/healthtopics/healthyfood_environment.htm

Centers for Disease Control and Prevention, Heart Disease Facts. (2016). Retrieved from CDC: http://www.cdc.gov/heartdisease/facts.htm

Centers for Disease Control and Prevention, HIV. (2016, July 12). *HIV Basic Statistics.* Retrieved from http://www.cdc.gov/hiv/basics/statistics.html

Centers for Disease Control and Prevention, HIV and Viral Hepatitis. (2014, March). *HIV and Viral Hepatitis.* Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/hiv/pdf/library_factsheets_hiv_and_viral_hepatitis.pdf

Centers for Disease Control and Prevention, HIV by Group. (2017, March 10). *HIV by Group.* Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/hiv/group/index.html

Centers for Disease Control and Prevention, HIV Prevention. (2016, December 21). *Prevention*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/hiv/basics/prevention.html

Centers for Disease Control and Prevention, HIV Transmission. (2016, December 21). *HIV*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/hiv/basics/transmission.html

Centers for Disease Control and Prevention, How to Prevent Cancer or Find it Early. (2016, July 20). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/cancer/dcpc/prevention/other.htm

Centers for Disease Control and Prevention, Increase Access to Healthy Foods and Beverages. (2016, November 1). Retrieved from https://www.cdc.gov/nccdphp/dnpao/state-local-programs/nutrition.html

Centers for Disease Control and Prevention, Infant Mortality. (2016, Jan 12). Retrieved from http://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm

Centers for Disease Control and Prevention, Opioid Overdose-Understanding the Epidemic. (2016, December 16). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/drugoverdose/epidemic/index.html

Centers for Disease Control and Prevention, Physical Activity. (2016, Aug 30). Retrieved from https://www.cdc.gov/physicalactivity/index.html

Centers for Disease Control and Prevention, Prescription Opioids. (2016, March 16). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/drugoverdose/opioids/prescribed.html

Centers for Disease Control and Prevention, Preventing Chronic Disease: Appalachian Health. (2006, October). *Preventing Chronic Disease: Appalachian Health*. Retrieved from https://www.cdc.gov/pcd/issues/2006/oct/toc.htm

Centers for Disease Control and Prevention, Quitting Smoking. (2017, February 1). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/cessation/quitting/

Centers for Disease Control and Prevention, Reproductive and Birth Outcomes. (2016, August 31). Retrieved from https://ephtracking.cdc.gov/showRbLBWGrowthRetardationEnv.action

Centers for Disease Control and Prevention, Reproductive Health: About Teen Pregnancy. (2016, Aug 31). Retrieved from http://www.cdc.gov/teenpregnancy/about/

Centers for Disease Control and Prevention, Social Determinants and Eliminating Disparities in Teen Pregnancy. (2017, May 18). Retrieved from https://www.cdc.gov/teenpregnancy/about/social-determinants-disparities-teen-pregnancy.htm

Centers for Disease Control and Prevention, State and Local Programs, Nutrition: Strategies and Resources. (2016, June 21). Retrieved from https://www.cdc.gov/nccdphp/dnpao/state-local-programs/nutrition.html

Centers for Disease Control and Prevention, Stroke. (2017, February 6). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/stroke/

Centers for Disease Control and Prevention, Stroke Treatment. (2017, March 27). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/stroke/treatments.htm

Centers for Disease Control and Prevention, Suicide. (2017). Retrieved from Suicide and Self-Inflicted Injury: https://www.cdc.gov/nchs/fastats/suicide.htm

Centers for Disease Control and Prevention, TB and HIV Coinfection. (2016, June 29). *TB and HIV Coinfection*. Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/tb/topic/basics/tbhivcoinfection.htm

Centers for Disease Control and Prevention, Trends in Reportable Sexually Transmitted Diseases in the United States. (2009, January 13). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/std/stats07/trends.htm

Centers for Disease Control and Prevention, What are Health Disparities? (2013, November 1). Retrieved from Disparities Analytics: http://www.cdc.gov/DisparitiesAnalytics/

Centers for Medicare and Medicaid Services. (2017, July 25). *Medicare Enrollment Dashboard*. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Dashboard/Medicare-Enrollment/Enrollment%20Dashboard.html

Centers for Medicare and Medicaid Serivces. (2016, December 31). *Medicare.gov| Hospital compare*. Retrieved from Medicare.gov The Official US Government Site for Medicare: https://www.medicare.gov/hospitalcompare/about/what-is-HOS.html

Centers for Medicare and Medicaid Services, Depression is not a normal part of growing older. (2016). Retrieved from https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/Health-Observance-Mesages-New-Items/2015-05-14-depression.html

Chan, L., Hart, L., & Goodman, D. (2006). Geographic Access to Health Care for Rural Medicare Beneficiaries. *Journal of Rural Health, 22*, 140-146.

Chandran, A., Hyder, A., & Peek-Asa, C. (2010). The Global Burden of Unintetional Injuries and an Agenda for Progress. *Epidemiological Reviews, 32*(1), 110-120.

Chaple, M., Searcy, M., Rutkowski, B., & Cruz, M. (2016). Building the Capacity for Behavioral Health Services within Primary Care and Medical Settings. *Addiction Technology Transfer Center Network*, http://attcnetwork.org/advancingintegration/ATTC_WhitePaper5_10_16Final.pdf.

Chicago Department of Public Health. (2013, February). *Healthy Chicago: Tranforming the Health of Our City*. Retrieved from http://www.cityofchicago.org/content/dam/city/depts/cdph/CDPH/HCPolicyBrief_Feb2013.pdf

Child Trends. (2016, Aug 31). *Low and Very Low Birthweight Infants*. Retrieved from DataBank: http://www.childtrends.org/?indicators=low-and-very-low-birthweight-infants

Child Trends. (2016, November). *Teen Births*. Retrieved from Child Trends Databank: https://www.childtrends.org/indicators/teen-births/

Choi, S., Kim, T., Lim, S., & al., e. (2011, February 18). *Hemoglobin A1c as a diagnostic tool for diabetes screening and new-onset diabeties prediction: a 6-year community-based prospective study*. Retrieved from ncbi.nlm.nih.gov: http://www.ncbi.nlm.nih.gov/pubmed/21335372

Christian, T. J. (2012). Trade-Offs Between Commuting Time and Health-Related Activities. *Journal of Urban Health, 89*(5), 746-757.

Chronic Obstructive Pulmonary Disease (COPD). (2016, September 16). Retrieved from Centers for Disease Control and Prevention : https://www.cdc.gov/copd/index.html

Cohen, R., & Stitzel, J. (2015). *Improving Dental Care Access in Rural America.* Retrieved from http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2015/11/18/improving-dental-care-access-in-rural-america)

Cohen, S. (2004, November). *Social Relationships and Health.* Retrieved from Carnegie Mellon Univeristy, American Psychologist: http://www.psy.cmu.edu/~scohen/AmerPsycholpaper.pdf

Commission to Build a Healthier America. (2008). *How could neighborhoods affect health?* Princeton, NJ: Robert Wood Johnson Foundation.

Commonwealth Fund. (2016, Aug 31). *Who Are the Remaining Uninsured and Why Haven't They Signed Up for Coverage?* Retrieved from http://www.commonwealthfund.org/publications/issue-briefs/2016/aug/who-are-the-remaining-uninsured

Cooper, R.A., Cooper, M.A., McGinley, E.L., Fan, X., & Rosenthal, J.T. (2012). Poverty, Wealth, and Health Care Utilization: A Geographic Assessment. *Journal of Urban Health : Bulletin of the New York Academy of Medicine, 89*(5), 828-847.

County Health Rankings & Roadmaps. (2016, Aug 31). *Mental Health Providers.* Retrieved from http://www.countyhealthrankings.org/app/north-carolina/2016/measure/factors/62/description

County Health Rankings & Roadmaps, Adult Obesity. (2016). Retrieved from http://www.countyhealthrankings.org/measure/adult-obesity

County Health Rankings & Roadmaps, Dentists. (2016). Retrieved from http://www.countyhealthrankings.org/measure/dentists

County Health Rankings & Roadmaps, Diabetic Monitoring. (2016). Retrieved from http://www.countyhealthrankings.org/measure/diabetic-monitoring

County Health Rankings & Roadmaps, Mammography Screening. (2016). Retrieved from http://www.countyhealthrankings.org/measure/mammography-screening

County Health Rankings & Roadmaps, Physical Inactivity. (2016). Retrieved from http://www.countyhealthrankings.org/measure/physical-inactivity

County Health Rankings & Roadmaps, Poor Mental Health Days. (2016). Retrieved from http://www.countyhealthrankings.org/measure/poor-mental-health-days

County Health Rankings & Roadmaps, Poor Physical Health Days. (2016). Retrieved from http://www.countyhealthrankings.org/measure/poor-physical-health-days

County Health Rankings & Roadmaps, Primary Care Physicians. (2016). Retrieved from http://www.countyhealthrankings.org/measure/primary-care-physicians

County Health Rankings & Roadmaps, Social Associations. (2016). Retrieved from http://www.countyhealthrankings.org/measure/social-associations

County Health Rankings & Roadmaps, Some College. (2016). Retrieved from http://www.countyhealthrankings.org/measure/some-college

County Health Rankings & Roadmaps, Uninsured. (2016). Retrieved from http://www.countyhealthrankings.org/measure/uninsured

County Health Rankings. (2016). *Sexually transmitted infection rate*. Retrieved from http://www.countyhealthrankings.org/measure/sexually-transmitted-infection-rate

Craddock Lee, S., Higashi, R., Inrig, S., Sanders, J., Zhu, H., Argenbright, K., & Tiro, J. (2016). County-level outcomes of a rural breast cancer screening outreach strategy: a decentralized hub-and-spoke model (BSPAN2). *Behavioral Medicine Practice Policy Resolution*, 427-430.

Criner, G., Bourbeau, J., & Diekemper, R. e. (2015). Review: Influenza vaccination and inhaled therapies prevent acute exacerbations in COPD. *Chest*, 894-942.

Cubbin, C., LeClere, F., & Smith, G. (2000, Jul). Socioeconomic status and injury mortality: individual and neighbourhood determinants. *J. Epidemiol Community Health, 54*(7), 517-24.

Cummins, S., Flint, E., & Matthews, A. (2014, Feb). New Neighborhood Grocery Store Increased Awareness Of Food Access But Did Not Alter Dietary Habits Or Obesity. *Health Affairs, 33*(2), 283-291.

Curtin, S. C., Warner, M., & Hedegaard, H. (2016, April). *Increase in Suicide in the United States, 1999-2014*. Retrieved from National Center for Health Statistics : https://www.cdc.gov/nchs/products/databriefs/db241.htm

Cutler, D. (2007). *Education and Health: National Poverty Center Policy Brief #9.* University of Michigan: ERIC.

David, C. (2007). *Policy Brief: Education and Health.* Ann Arbor: National Poverty Center.

Dean, O., Skopec, L., Sung, J., & Waidmann, T. (2015). Uninsured Rate Dropped by Nearly Half between December 2013 and March 2015. *Insight on the Issues*.

DeNavas-Walt, C., & Proctor, B. (2015). *Income and Poverty in the United States: 2014.* U.S. Census Bureau, Current Population Reports, P60-252.

Division of Diabetes Translation. (2015). *Diabetes Public Health Resource: Methods and Limitations*. Retrieved from Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion: http://www.cdc.gov/diabetes/statistics/incidence/methods.htm

Doescher, M., & Keppel, G. (2015). *Dentist Supply, Dental Care Utilization, and Oral Health Among Rural and Urban U.S. Residents.* University of Washington: RHRC.

Dominick, K. L., Ahern, F. M., Gold, C. H., & Heller, D. A. (2002). Relationship of health-related quality of life to health care utilization and mortality among older adults. *Aging Clin Exp Res, 14*, 499-508.

Dorn, S. (2008, January). *Updating the Institute of Medicine Analysis on the Impact of Uninsurance on Mortality.* Retrieved from Urban Institute: http://www.urban.org/sites/default/files/alfresco/publication-pdfs/411588-Uninsured-and-Dying-Because-of-It.PDF

Dragisic, T., Dickov, A., Dickov, V., & Mijatovic, V. (2015, June). *Drug Addiction as Risk for Suicide Attempts* . Retrieved from National Center for Biotechnology Information : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4499285/

Dranger, E., & Remington, P. (2004). *YPLL: A Summary Measure of Premature Mortality Used in Measuring the Health of Communities.* Madison: Wiscosin Public Health and Health Policy Institute.

Druss, B., Zhao, L., Von Esenwein, S., Morrato, E., & Marcus, S. (2011). Understanding Excess Mortality in Persons with Mental Illness: 17-Year Follow Up of a Nationally Representative US Survey. . *Medical Care, 49*(6), 599-604.

D'Souza, A., Shah, M., Dhamane, A., & Dalal, A. (2014, October 10). Clinical and economic burden of COPD in a medicaid population. *COPD: Journal of Chronic Obstructive Pulmonary Disease*, 212-220. doi:10.3109/15412555.2013.836168

Dunn, K., Saunders, K., Rutter, C., Banta-Green, C., Merill, J., & Sullivan, M. (2010). Opioid prescriptios for chronic pain and overdose: a cohort study. *Annals of Interal Medicine*.

Eckel, R., Kahn, S., Ferrannini, E., Goldfine, A., Nathan, D., Schwartz, M., . . . Smith, S. (2011). Obesity and Type 2 Diabetes: What Can Be Unified and What Needs to Be Individualized. *J Clin Endocrinol Metab.*, 1654-1663.

Edelstein, B., & Chinn, C. (2009). Update on Disparities in Oral Health and Access to Dental Care for America's Children. *Academic Pediatrics, 9*(6), 415-419.

Elimination of Health Disparities. (2014). Retrieved from Surgeon General: https://www.surgeongeneral.gov/priorities/prevention/strategy/elimination-of-health-disparities.html

Ellis, A., Konrad, T., Thomas, K., & Morrissey, J. (2009). County-level Estimates of Mental Health Professional Supply in the United States. . *Psychiatric Services, 60*(10), 1315-1322.

Evensen, A. E. (2010). *Management of COPD Exacerbations.* Retrieved from American Family Physician: http://www.aafp.org/afp/2010/0301/p607.html

Ferrante, J., Gonzalez, E., Pal, N., & Roetzheim, R. (2000). Effects of Physiciaan Supply on Early Detection of Breast Cancer. *JABFM*, 408-414.

Feudtner, e. a. (n.d.). Statistical Uncertainty of Mortality Rates and Rankings for Children's Hospitals.

Fingerhut, L. A. (2010, April 6). *Increases in Poisoning and Methadone-Related Deaths: United States, 1999-2005*. Retrieved from Centers for Disease Control and Prevention : https://www.cdc.gov/nchs/data/hestat/poisoning/poisoning.htm

Finkelstein, E., Trogdon, J., Cohen, J., & Dietz, W. (2009). Annual Medical Soending Attributable to Obesity: Payer- and Service-specific. *Health Affairs*, w822–w831.

Flegal, K., Carroll, M., Kit, B., & Odgen, C. (2012). Prevalence of Obesity and Trends in the Distribution of Body Mass Index Among US Adults, 1999-2010. *The Journal of American Medicial Association*, 307(5), 491-497.

Fontanella, C. A., Hiance-Steelesmith, D., Phillips, G. S., Lester, N., Sweeney, H. A., & Campo, J. V. (2015). Widening Rural-Urban Disparities in Youth Suicides, United States, 1996-2010. *JAMA Pediatr, 169*(5), 466-473.

Foundation, K. F. (2017). *Medicare Beneficiaries as a Percent of Total Population*. Retrieved from Kaiser Family Foundation.

Fraher, E., Knapton, A., Sheldon, G., Meyer, A., & Ricketts, T. (2013, May). Projecting surgeon supply using a dynamic model. *Annals of Surgery, 257*(5), 867-72.

Franz, C. (2016). Financial Empowerment and Health Related Quality of Life in Family Scholar House Participants. *Journal of Financial Therapy*, 38-57.

Froshaug, D., Dickinson, M., Fernald, D., & Green, L. (2009). Personal Health Behaviors are Associated with Physical and Mental Unhealthy Days: A Prescription for Health (P4H) Practice-Based Research Networks Study. *JABFM*, 368-374.

Gan, W., FitzGerald, J., Carlsten, C., Sadatsafavi, M., & Brauer, M. (2013). Associations of Ambient Air Pollution with Chronic Obstructive Pulmonary Disease Hospitalization and Mortality. *American Journal of Respiratory and Critical Care Medicine, 187*(7), 721-727.

Gardner, J.W., & Sanborn, J. S. (1990, July). Years of Potential Life Lost (YPLL) -What Does it Measure? *Epidemiology, 1*(4), 322-329.

Ghosh-Dastidar, B., Cohen, D., Hunter, G., Zenk, S., Huang, C., Beckman, R., & Dubowitz, T. (2014). Distance to Store, Food Prices, and Obesity in Urban Food Deserts. *American Journal of Preventive Medicine, 47*(5), 587-595.

Go, A.S. (2013). Executive Summary: Heart Disease and Stroke Statistics—2013 Update A Report From the American Heart Association. *Circulation, 127*, 143-152.

Goodman, D., & Grumbach, K. (2008). Does having more physicians lead to better health system performance? *JAMA*, 299: 335–337.

Goodman, E. (1999). The Role of Socioeconomic Status Gradients in Explaning Differences in US Adolescents' Health. *American Journal of Public Health*, 1522-1528.

Greer, S. A., Nwaise, I. A., & Casper, M. L. (2010). *Atlas of Heart Disease Hospitalizations Among Medicare Beneficiaries.* Atlanta: Centers for Disease Control and Prevention.

Guh, D.P., Zhang, W., Bansback, N., Amarsi, Z., Birmingham, C., & Anis, A. (2009). The incidence of co-morbidities related to obesity and overweight: A systematic review and meta-analysis. *BMC Public Health, 9*(88).

Halverson, J.A., Ma, L., & Harner, E. J. (2004, November). *An Analysis of Disparities in Health Status and Access to Health Care in the Appalachian Region.* Retrieved from Appalachian Regional Commission : https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=82

Hamilton, B., Martin, J., & Osterman, J. (2016). Births: Preliminary data for 2015. *National Vital Statistics Reports*, http://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_03.pdf.

Handbury, J., Rahkovsky, I., & M., S. (2015). *What Drives Nutritional Disparities? Retail Access and Food Purchases Across the Socioeconomic Spectrum.* Retrieved from National Bureau of Economic Research Working Paper No. 21126: http://www.nber.org/papers/w21126

Harris-Kojetin, L., Sengupta, M., Park-Lee, E., & Valverde, R. (2013). Long-term care services in the United States: 2013 overview. *Vital Health Stat, 3*(37).

Hauenstein, E. P. (2007). Rurality and Mental Health Treatment. *Administration and Policy in Mental Health, 34,* 255.

Hawton, K. B. (2010, May). Toxicity of Antidepressants: rates of suicide relative to prescribing and non-fatal overdose. *J Psychiatry,*, 354-358. Retrieved November 20, 2017, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2862059/

He, X., Akil, L., Aker, W., Hwang, H.-M., Ahmad, & Hafiz. (2015). Trends in Infant Mortality in United States: A Brief Study of the Southeastern States from 2005-2009. *International Journal of Environmental Research and Public Health*, 4908-4920.

Health Equity Alliance. (2016, Dec 12). *Measures/ Economic Security*. Retrieved from Health Equity Index: https://www.sdoh.org/indicators/about/povert01

Health Indicators Warehouse. (n.d.). *Mentally unhealthy days: adults (per person).* Retrieved from http://www.healthindicators.gov/Indicators/Mentally-unhealthy-days-adults-per-person_9/Profile

Health Resources and Services Administration. (2016, Aug 31). *Diabetes HbA1c {Poor Control}*. Retrieved from http://www.hrsa.gov/quality/toolbox/measures/diabetes/

Health Resources and Services Administration. (2016, Aug 31). *Mental Health HPSA Designation Overview*. Retrieved from http://bhpr.hrsa.gov/shortage/hpsas/designationcriteria/mentalhealthhpsaoverview.html

Health Resources and Services Administration. (2016, August 31). *Shortage Designation: Health Professional Shortage Areas & Medically Underserved Areas/Populations*. Retrieved from htt[://www.hrsa.gov/shortage/

Health Resources and Services Administration, Breast Cancer Screening. (2016). Retrieved from https://www.hrsa.gov/quality/toolbox/measures/breastcancer/part6.html#8

Healthy Appalachia Institute. (2011). *Leading Causes of Death*,. Wise, VA: The University of Virginia's College at Wise. Retrieved from http://www.healthyappalachia.org/files/HAI_web_Leading_cause_of_death_11_22_1-_final.pdf

Healthy People 2020. (2017, May 15). *Disparities*. Retrieved from https://www.healthypeople.gov/2020/about/foundation-health-measures/Disparities

Heisler, E.A. (2015). *The Mental Health Workforce: A Primer*. Washington, DC: Congressional Research Service. Retrieved 2017, from https://fas.org/sgp/crs/misc/R43255.pdf

Herath, J., & Brown, C. (2013, May). An Analysis of Adult Obesity and Hypertension in Appalachia. *Global Journal of Health Science, 5*(3), 127-138.

Hoehner, C. M., Barlow, C. E., Allen, P., & Schootman, M. (2012). Commuting Distance, Cardiorespiratory Fitness, and Metabolic Risk. *American Journal of Preventive Medicine, 42*(6), 571-578.

Holmes, G. M., & Fraher, E. (In press). Developing physician migration estimates for workforce models . *Health Services Research*.

Holmes, T. C. (2007, December). Mortality and Physician Supply: Does Region Hold the Key to the Paradox? *Health Services Research*, 2233-2251. doi:10.1111/j.1475-6773.2007.00728.x

Holt, J., Zhang, X., Presley-Cantrell, L., & Croft, J. (2011). Geographic Disparities in Chronic Obstructive Pulmonary Disease (COPD) Hospitalization among Medicare Beneficiaries in the United States. *International Journal of COPD, 6*, 321-328.

Holton, A., & Brantley, T. (2014). *Telepsychiatry in North Carolina: Mental Health Care Comes to You.* North Carolina Center for Public Policy Research.

Howard, V. J., Acker, J., Gomez, C. R., Griffies, A. H., Magers, W., Michael III, M., . . . Howard, G. (2004, October). *An Approach to Coordinate Efforts to Reduce the Public Health Burden of Stroke: The Delta States Stroke Consortium* . Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/pcd/issues/2004/oct/03_0037.htm

IHI. (2011). *IHI 90-day R&D Project Final Summary: Counties of Interest: Achieving Better or Worse Than Expected Health Outcomes.* Cambridge, MA: Institute for Healthcare Improvement.

IHS, Inc. (2016). *The Complexities of Physician Supply and Demand: Projections from 2014 to 2025: Final Report.* Association of American Medical Colleges. Retrieved from https://www.aamc.org/download/458082/data/2016_complexities_of_supply_and_demand_projections.pdf

Institute for Research on Poverty. (n.d.). *How is poverty measured in the United States?* University of Wisconsin-Madison.

Institute of Medicine (US) Committee on Health and Beahavior: Research, P. a. (2001). *Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences.* Retrieved from National Center for Biotechnology Information: https://www.ncbi.nlm.nih.gov/books/NBK43750/

Jia, H., Muennig, P., Lubetkin, E. I., & Gold, M. R. (2004). Predicting Geographical Variations in Behavioural Risk Factors: An Analysis of Physical And Mental Healthy Days. *J Epidemiol Community Health, 58*, 150-155.

Johns Hopkins University. (2014, August 6). *Stroke risk, related death rates have declined over past 20 years, study shows*. Retrieved from Johns Hopkins University, The Hub: https://hub.jhu.edu/2014/08/06/stroke-rate-decline-study/

Kaiser Family Foundation. (2015). *Medicare Beneficiaries as a Percent of Total Population*. Retrieved from Kaiser Family Foundation: http://kff.org/medicare/state-indicator/medicare-beneficiaries-as-of-total-pop/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Kaiser Family Foundation. (2016, September 09). *Key Facts about the Uninsured Population.* Retrieved from http://kff.org/uninsured/fact-sheet/key-facts-about-the-uninsured-population/

Kaiser Family Foundation. (2016, Aug 31). *Status of State Action on the Medicaid Expansion Decision.* Retrieved from http://kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Kanny, D., Liu, Y., Brewer, R., & Lu, H. (2013, November 22). *Binge Drinking- United States, 2011*. Retrieved from Centers for Disease Control and Prevention : https://www.cdc.gov/mmwr/preview/mmwrhtml/su6203a13.htm

Kawachi, I., Kennedy, B., Lochner, K., & Prothrow-Smith, D. (1997). Social Capital, Income Inequality, and Mortality. *American Journal of Public Health*, 87(9),1491-1498.

Keeler, E., Guralnik, J. M., Tian, H., Wallace, R. B., & Reuben, D. B. (2010). The Impact of Functional Status on Life Expectancy in Older Persons. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 65*(7), 727-733.

Kenny, T. (2015, June 23). *Physical Activity for Health*. Retrieved from Patient: https://patient.info/health/physical-activity-for-health

Kentucky Department for Public Health. (2013). *State Health Assessment.* Frankfort.

Klaiman, T., Pantazis, A., Chainani, A., & Bekemeier, B. (2016). Using a positive deviance framework to identify Local Health Departments in Communities with exceptional maternal and child health outcomes: a cross sectional study. *BMC Public Health*, 602-610.

Klein, J. (2005). Adolescent Pregnancy: Current Trends and Issues. *American Academy of Pediatrics*, 281-286.

Kolappa, K., Henderson, D., & Kishore, S. (2013). No physical health without mental health: lessons unlearned? *Bull World Health Organ, 91*(3), 3-3A.

Kreider, B., Pepper, J., & Gunderson, C. a. (2012). Identifying the Effficts of SNAP (Food Stamps) on Child Health Outcomes When Participation is Endogenous and Misreported. *Journal of the American Statistical Association*, 958-975. Retrieved from http://batten.virginia.edu/sites/default/files/research/attachments/JASA_KPGJ_online(1).pdf

Krishna, S., Gillespie, K., & McBride, T. (2010). Diabetes Burden and Access to Preventive Care in Rural United States. *The Journal of Rural Health*, 3-11.

Kruger, T., Howell, B., Haney, A., Davis, R., Fields, N., & Schoenberg, N. (2012, Mar). Perceptions of Smoking Cessation Programs in Rural Appalachia. *American Journal Health Behavior, 36*(3), 373-384.

Krumholz, H. M., Normand, S., & Wang, Y. (2014). Trends in Hospitalizations and Outcomes for Acute Cardiovscular Disease and Stroke: 1999-2011. *Circulation, 130*(12), 966-975.

Kuempel, E. D., Wheeler, M. W., Smith, R. J., Vallyathan, V., & Green, F. H. (2009). Contributions of Dust Exposure and Cigarette Smoking to Emphysema Severity in Coal Miners in the United States. *American Journal of Respiratory and Critical Care Medicine*, 180(3):257-64.

Kulshreshtha, A., Abhinav, G., Dabhadkar, K., Veledar, E., & Vaccarino, V. (2014, Jan/Feb). Urban-Rural Differences in Coronary Heart Disease Mortality in the United States: 1999-2009. *Public Health Reports, 129*(1), 19-29.

Laditka, J., Laditka, S., & Probst, J. (2005). More may be better: Evidence of a negative relationship between physician supply and hospitalization for ambulatory care sensitive conditions. *Health Services Research*, 40: 1148–1166.

Lafree, G. (2008). *Educational Attainment, Teacher/Student Ratio and Adult Incarceration Risk Among US Birth Cohorts Since 1910.* Lafayette: New York University.

Lane, N., Lutz, A., & Baker, K. (2012). *Health Care Costs and Access Disparities in Appalachia.* Washington D.C.: ARC.

Laney, A., & Weissman, D. (2014). Respiratory diseases caused by coal mine dust. *Journal of Occupational and Environmental Medicine*, 56; Supplement 10:S18-22.

LaVallee, R. A., & Yi, H.-y. (2011). *APPARENT PER CAPITA ALCOHOL CONSUMPTION: NATIONAL, STATE, AND REGIONAL TRENDS, 1977–2009.* National Institute on Alcohol Abuse and Alcoholism, Division of Epidemiology and Prevention Research. National Institute on Alcohol Abuse and Alcoholism.

Lavizzo-Mourey, R. (2017). *Seven Lessions I've Learned About Improving Health in America 2017 Annual Message*. Retrieved from Robert Wood Johnson Foundation: http://www.rwjf.org/en/library/annual-reports/2017-annual-message.html

Lê Cook, B., Doksum, T., Chen, C., Carle, A., & Alegría, M. (2013). The Role of Provider Supply and Organization in Reducing Racial/Ethnic Disparities in Mental Health Care in the U.S. *Social Science & Medicine, 84*, 102-109.

Levine, D. (2012, January). Why are dentists opposing expanded dental care? *Governing: States and Localities*.

Lutfiyya, M. M. (2011). Adequacy of Diabetes Care for Older U.S. Rural Adults: A Cross-Sectional Population Based Study Using 2009 BRFSS Data. *BMC Public Health, 11*(940).

Macinko, J., Starfield, B., & Shi, L. (2007). Quantifying the Health Benefits of Primary Care Physician Supply in the United States. *International Journal of Health Services*, *37*(1), 111-126.

Maqbool, N., & Viverios, J. A. (2015). *The Impacts of Affordable Housing on Health: A Research Summary*. National Housing Conference, Housing Policy Research. Washington DC: Center for Housing Policy.

Marks, R. (2011). Physical Activity and Hip Fracture Disability: A Review. *Journal of Aging Research*.

Martin, P. P., & Murphy, J. L. (2014, January). *African Americans: Description of Social Security and Supplemental Security Income Participation and Benefit Levels Using the American Community Survey*. Retrieved from Research and Statistics Note No. 2014-01: https://www.ssa.gov/policy/docs/rsnotes/rsn2014-01.html

Martino, S., Elliott, M., Kanouse, D., Farley, D., Burkhard, Q., & Hays, R. (2012). Depression and the Health Care Expenditures of Medicare Beneficiaries. *National Institute of Health*, 1883-1904.

Marty, L., Dubois, C., Gaubard, M., Maidon, A., Lesturgeon, A., Gaigi, H., & Darmon, N. (2015). Higher nutritional quality at no additional cost among low-income households: insight from food purchases of "positive deviants". *American Journal of Clinical Nutrition*, 1-9.

Matteson, W., D., Burra, J. A., & Marshall, J. R. (1998). Infant mortality: A multi-level analysis of individual and community risk factors. *Social Science and Medicine, 47*(11), 1841-1854.

McCormick, M. C. (1985, Jan 10). The Contribution of Low Birth Weight to Infant Mortality and Childhood Morbidity. *New England Journal of Medicine*.

McEwen, L., Kim, & Haan, M. e. (2006, Feb). Diabetes Reporting as a Cause of Death. *Diabetes Care, 29*(2), 247-253.

McGarvey, E., Leon-Verdin, M., Killos, L., Guterbock, T., & Cohn, W. (2011). Health Disparities Between Appalachian and Non-Appalachian Counties in Virginia USA. *J Community Health*, 348-356.

McLeroy, K., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological persepctive on health promotion programs. *Health Educ, 15*(4), 351-337.

Menke, A., Casagrande, S., Geiss, L., & Cowie, C. (2015). Prevalence of and Trends in Diabetes Among Adults in the United States, 1988-2012. *JAMA*.

Miles, L. (2007). Physical Activity and Health. *Nutrition Bulletin*, 314-363.

Moriarty, D. G., Zack, M. M., & Kobau, R. (2003). The Centers for Disease Control and Prevention's Health Days Measures – Population Tracking of Perceived Physical and Mental Health over Time. *Health Qual Life Outcomes*, *1*, 37.

Mozaffarian, D. B. (2016). Executive Summary: Heart Disease and Stroke Statistics—2016 Update:. *A Report from the American Heart Association*.

Nathan, D. M. (2009). International Expert Committee Report on the Role of the A1C Assay in the Diagnosis of Diabetes. *American Diabetes Association*, 1327-1334.

National Cancer Institute. (2016, August 31). *Cancer Statistics: Statistical Summaries*. Retrieved from Surveillance, Epidemiology, and End Results Program.: http://seer.cancer.gov/statfacts/html/all.html

National Cancer Institute. (2017). *Cancer Stat Facts: Female Breast Cancer*. Retrieved from National Cancer Institute: https://seer.cancer.gov/statfacts/html/breast.html

National Center for Health Statistics. (2017, March 17). *Leading Causes of Death*. Retrieved from Centers for Disease Control and Prevention : https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

National Center for Health Statistics, HbA1c Test: Diabetic Medicare Beneficiaries. (2016, Aug 31). Retrieved from Health Indicators Warehouse.: http://www.healthindicators.gov/Indicators/HbA1c-test-diabetic-Medicare-beneficiaries-65-75-years-percent_29/Profile.

National Council on Aging. (2016, Aug 31). *Falls Prevention Programs*. Retrieved from http://www.ncoa.org/health-aging/falls-prevention/falls-preventon-programs-for-older-adults/

National Institute of Diabetes and Digestive and Kidney Diseases. (2016, November). *What is Diabetes?* Retrieved from National Institute of Diabetes and Digestive and Kidney Diseases: https://www.niddk.nih.gov/health-information/diabetes/overview/what-is-diabetes

National Institute of Mental Health. (2016, October). *Depression*. Retrieved from National Institute of Mental Health: https://www.nimh.nih.gov/health/topics/depression/index.shtml

National Institutes of Health, Office of Behavioral and Social Sciences Research. (2015, Nov 10). *The link between early education policy and health outcomes.* Retrieved from https://obssr.od.nih.gov/the-link-between-early-education-policy-and-health-outcomes/

National Opinion Research Center (NORC) at the University of Chicago, and East Tennessee State University. (2008). *An Analysis of Mental Health and Substance Abuse Disparities & Access to Treatment Services in the Appalachian Region.* Appalachian Regional Commission.

National Safety Council. (2016, Aug 31). *Painkillers at Root of Prescription Drug Abuse Epidemic.* Retrieved from http://www.nsc.org/learn/NSC-Initiatives/Pages/prescription-painkiller-epidemic.aspx?var=mnd

NHRA. (2014). HIV/AIDS in Rural America: Disproportionate Impact on Minority and Multicultural Populations. *Policy Brief*, 1-6.

Nicholson Jr., N. R. (2005, June). *The Relationship Between Injurious Falls, Fear of Falling, Social Isolation and Depression.* Retrieved from University of Connecticut Health Center Graduate School: http://digitalcommons.uconn.edu/cgi/viewcontent.cgi?article=1080&context=uchcgs_masters

Nietert, P. J., Wessell, A. M., Jenkins, R. G., Feifer, C., Nemeth, L. S., & Ornstein, S. M. (2007). Using a summary measure for multiple quality indicators in primary care: the Summary QUality InDex (SQUID). *Implementation Science, 2*(11).

O'Malley, A., Pham, H., Schrag, D., Wu, B., & Bach, P. (2007). Potentially Avoidable Hospitalizations for COPD and Pneumonia: The Role of Physician and Practice Characteristics. *Medical Care, 45*(6), 562-570.

O'Connor, A., & Wellenius, G. (2012). Rural–Urban Disparities in the Prevalence of Diabetes and Coronary Heart Disease. *Public Health*, *126*(10), 813-820.

Office of Adolescent Health. (2016). *Trends in Teen Pregnancy and Childbearing.* U.S. Department of Health and Human Services.

Office of Disease Prevention and Health Promotion. (2016, August 22). *General Health Status*. Retrieved from Healthy People 2020: https://www.healthypeople.gov/2020/about/foundation-health-measures/General-Health-Status

Office of Disease Prevention and Health Promotion, Gonorrhea and Chlamydia: Screening – Women. (2016, August 31). Retrieved from HealthyPeople.gov: https://www.healthypeople.gov/2020/tools-resources/evidence-based-resource/gonorrhea-and-chlamydia-screening-%E2%80%93-women

Office of National Statistics. (2013). *Personal Well-being across the UK, 2012/13.* ONS Measuring National Well-being Programme.

Ogden, C., MD, C., CD, F., & Flegal, K. (2015). *Prevalence of obesity among adults and youth: United States, 2011–2014*. Retrieved from National Center for Health Statistscs, NCHS data brief, no 219: https://www.cdc.gov/nchs/data/databriefs/db219.pdf

Olfson, M., Blanco, C., & Marcus, S. C. (2016). Treatment of Adult Depression in the United States. *JAMA Internal Medicine*, 1482-1491.

Pallardy, C. (2016). *Becker's Hospital Review.* Retrieved from http://www.beckershospitalreview.com/healthcare-information-technology/25-things-to-know-about-e-prescribing.html

Papas, M., Alberg, A., Ewing, R., & Helzlsouer, K. (2007). The Built Environment and Obesity. *Epidemiologic Reviews*, 129-143.

Park, H., & Bloch, M. (2016, Jan 19). How the Epidemic of Drug Overdose Deaths Ripples Across America. *New York Times*, pp. https://www.nytimes.com/interactive/2016/01/07/us/drug-overdose-deaths-in-the-us.html.

Park, M., Katon, W., & Wolf, F. (2013, May-June). Depression and risk of mortality in individuals with diabetes: a meta-analysis and systematic review. *General Hospital Psychiatry*, 217-225.

PDA, V. F. (2016). CON Application for Demonstration Dental Only Single Specialty Ambulatory Surgery Centers . North Carolina: North Carolina Division of Health Services Regulation.

Pelicer, F., Nagamine, K., & Faria, M. (2016). Health-Related Physical Fitness in School Children and Adolescents. *International Journal of Sports Science*, 19-24.

Plough, A. L. (2015, November 11). *Measuring What Matters: Introducing a New Action Framework*. Retrieved from Robert Wood Johnson Foundation Culture of Health Blog: http://www.rwjf.org/en/culture-of-health/2015/11/measuring_what_matte.html

Pohl, J. S. (2017). *Falls and the Social Isolation of Older Adults in the National Health and Aging Trends Study*. Retrieved from https://digital.lib.washington.edu/researchworks/handle/1773/37198

Pompili, M., Serafini, G., Innamorati, M., Dominici, G., Ferracuti, S., Kotzalidis, G. D., & Lester, D. (2010). Suicidal Behavior and Alcohol Abuse. *International Journal of Environmental Research and Public Health, 7*(4), 1392-1432.

Pope, C., Burnett, R., Krewski, D., & Jerrett, M. (2009). Cardiovasculare Mortality and Exposure to Airborne Fine Particulate Matter and Cigarette Smoke. *Cardiovascular*, 941-948.

Powell, D., Pacula, R., & Taylor, E. (2016). *How Increasing Medical Access to Opioids Constributes to the Opioid Epidemic: Evidence from Medicare Part D*. Retrieved from Rand Corporation: https://poseidon01.ssrn.com/delivery.php?ID=352021002125000091003025122113014107036024008001019007007071124100021025097082103069121058118006041127001088108091095095079071030007004001088006095113084098113103084000084096028004125105101008121024125010119106 0

Preventing Chronic Disease. (2006, September 15). Retrieved from Centers for Disease Control and Prevention: https://www.cdc.gov/pcd/issues/2006/oct/toc.htm

Radnofsky, L. (2015, Feb 16). Where Are the Mental-Health Providers? . *Wall Street Journal*.

Rehm, J., Mathers, C., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., & Patra, J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*, 2223-2233.

Reif, S., Pence, B., Hall, I., Hu, X., Whetten, K., & Wilson, E. (2015). HIV Diagnoses, Prevalence, and Outcomes in Nine Southern States. *J Community Health*, 642-651.

Reynolds, C. (2016, November 30). *Appalachian Studies Final Project: Drug Abuse in Appalachia.* Retrieved from Blogs@VT Sites site: https://blogs.lt.vt.edu/appalachianiswhatshappenin/2016/11/30/final-project-drug-abuse-in-appalachia/

Richard Pascale, J.S. (2010). *The Power of Positive Deviance.* Boston: Harvard Business Press.

Ricketts, T., & Holmes, M. (2007). Mortality and physician supply: does region hold the key to the paradox? *Health Services Research, 42*(6), 2233-2251.

Riumallo-Herl, C., Kawachi, I., & Avendano, M. (2014). Social capital, mental health and biomarkers in Chile: assessing the effects of social capital in a middle-income country. *National Institute of Health*, 47-58.

Robert Wood Johnson Foundation. (2008, September). *Where We Live Matters for Our Health: Neighborhoods and Health.* Retrieved from Commission Health: http://www.commissiononhealth.org/PDF/888f4a18-eb90-45be-a2f8-159e84a55a4c/Issue%20Brief%203%20Sept%2008%20-%20Neighborhoods%20and%20Health.pdf

Robert Wood Johnson Foundation. (2012, December). *Why Does Education Matter So Much to Health?* Retrieved from http://www.rwjf.org/en/library/research/2012/12/why-does-education-matter-so-much-to-health-.html

Robert Wood Johnson Foundation. (2016). The State of Obesity. Better Policies for a Healthier America. http://stateofobesity.org/physical-inactivity/.

Robert Wood Johnson Foundation. (2017, March 15). *About a Culture of Health*. Retrieved from Building a Culture of Health: http://www.cultureofhealth.org/about/

Roland, S. (2002). The effects of obesity, smoking, and drinking on medical problems and costs. *Health Affairs*, 245-253.

Roux, A., Merkin, S., Arnett, D., Chambless, L., Massing, M., & Nieto, J. (2001). Neighborhood of Residence and Incidence and of Coronary Heart Disease. *The New England Journal of Medicine*, 99-106.

Rubin, P. R. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41-55. Retrieved from https://oup.silverchair-cdn.com/oup/backfile/Content_public/Journal/biomet/70/1/10.1093/biomet/70.1.41/2/70-1-41.pdf?Expires=1488584930&Signature=LoZP4uTuVqlcq3GL5p9gWzzPdcx04rglNIsOm-w~HTDofm0JqS7wO1Anq08LM4c97FmZ1BkiOoBiW985mW1adxTdIBuvHZi6OQZE57eMJq3d5

Rural Health Information Hub. (2017, February 15). *Oral Health in Rural Communities*. Retrieved from Rural Health Information Hub: https://www.ruralhealthinfo.org/topics/oral-health

Rutledge, R., Messick, J., Baker, C., Rhyne, S., Butts, J., Meyer, A., & Ricketts, T. (1992, Jul). Multivariate population-based analysis of the association of county trauma centerrs with per capita county trauma death rates. *J Trauma, 33*(1), 29-37.

Saab, H., & Klinger, D. (2010). School differences in adolescent health and wellbeing: Findings from the Canadian Health Behaviour in School-aged Children Study. *Social Science and Medicine, 70*, 850-858.

Samuel, C. (2014, Nov). Area-level factors associated with electronic health record adoption and meaningful use in the Regional Extension Center Program. *21*(6), 976-983.

Santo Tomas, L. (2011, Mar). Emphysema and chronic obstructive pulmonary disease in coal miners. *Curr Opin Pulm Med.*, *17*(2), 123-125.

Sarti, C., Rastenyte, D., Cepaitis, Z., & Tuomilehto, J. (2003). International Trends in Mortality from Stroke, 1968-1994. *Stroke*, 1588-1602.

Sauer, R., Huttner, H., Breuer, L., Engelhorn, T., Schellinger, P., Schwab, S., & Kohrmann, M. (2010). Repeated Thombolysis for Chronologically Separated Ischemic Strokes. *Stroke*, 1829-1833.

Saydah, S., Eberhardt, M., Loria, C., & FL, B. (2002). Age and the Burden of Death Attributable to Diabetes in the United States. *Am. J. Epidemiol.*, *156*(8), 714-719.

Schane, R., Ling, P., & Glantz, S. (2010). Health Effects of Light and Intermittent Smoking. *Circulation*, 1518-1523.

Schedlbauer, A., Prasad, V., Mulvaney, C., Phansalkar, S., Stanton, W., Bates, D., & Avery, A. (2009). What Evidence Supports the Use of Computerized Alerts and Prompts to Improve Clinicians' Prescribing Behavior. *Journal of American Medical Informatics Association*, 531-538.

Sheiham, A. (2005, Sep). Oral health, general health and quality of life. *Bull World Health Organ.* , *83*(9), 644.

Shortridge, E., & Moore, J. (2010). *Use of Emergency Departments for Conditions Related to Poor Oral Health Care.* Retrieved from http://www.norc.org/PDFs/publications/OralHealthFinal2.pdf

Siegel, R. L., Miller, K. D., & Jemal, A. (2017). Cancer statistics, 2017. *CA Cancer J Clin*, 7-30.

Smith, C., & Barnett, E. (2005). Diabetes-related mortality among Mexian Americans, Puerto Ricans, and Cuban Americans in the United States. *Rev Panam Salud Publica*, 381-387.

Social Security Administration, Annual Statistical Report on the Social Security Disability Insurance Program. (2014). Retrieved from https://www.ssa.gov/policy/docs/statcomps/di_asr/2014/index.html

Starfield, B., Shi, L., & Macinko, J. (2005). Contribution of Primary Care to Health Systems and Health. *The Millbank Quarterly*, 457-502.

Starfield, B., Shi, L., Grover, A., & Macinko, J. (2005). The Effects of Specialist Supply on Populations' Health: Assessing the Evidence. *Health Affairs*, *24*, 97-107.

Stat Trek. (2017). *Statistics and Probability Dictionary*. Retrieved from Stat Trek: http://stattrek.com/statistics/dictionary.aspx?definition=z%20score

Stewart, N., & Kaye, K. (2013). *Why it Matters: Teen Childbearing and Child Welfare*. Retrieved from The National Campaign: https://thenationalcampaign.org/resource/why-it-matters-teen-childbearing-and-child-welfare

Substance Abuse and Mental Health Services Administration. (2013). Retrieved from Report to Congress on the Nation's Substance Abuse and Mental Health Workforce Issues: http://store.samhsa.gov/shin/content//PEP13-RTC-BHWORK/PEP13-RTC-BHWORK.pdf

Substance Abuse and Mental Health Services Administration. (2013). *Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings.* NSDUH Series H-46, HHS Publication No. (SMA) 13-4795. Washington: Substance Abuse and Mental Health Services Administration.

Susan G. Komen. (2017, January 15). *Comparing Breast Cancer Screening Rates Among Different Groups*. Retrieved from Susan G. Komen: http://ww5.komen.org/BreastCancer/DisparitiesInBreastCancerScreening.html

Szreter, S., & Woolcock, M. (2004). Health by Association? Social Capital, Social Theory, and the Political Economy of Public Health. *International Journey of Epidemiology*, 650-667.

The Pew Charitable Trust. (2013, June). *In Search of Dental Care: Two Types of Dentist Shortages Limit Children's Access to Care*. Retrieved from Children Dental: http://www.pewtrusts.org/~/media/legacy/uploadedfiles/pcs_assets/2013/insearchofdentalcarepdf.pdf

Thomas, K., Ellis, A., Konrad, T., Holzer, C., & Morrissey, J. (2009). County-Level Estimates of Mental Health Professional Shortage in the United States. *Psychiatric Services*, 1323-1328.

Thorpe, K., Florence, C., & Joski, P. (2004). Which Medical Conditions Account for the Rise in Helath Care Spending? *Health Affairs*, 437-445.

Topmiller, M. (2016, March). *Geospatial Research Brief*. Retrieved from healthlandscape.org: https://www.healthlandscape.org/Brigh_Spots_Approrpriate_Diabetes_Preventive_Care.pdf

Torrone, E., Papp, J., & Weinstock, H. (2014). Prevalence of Chlamydia Trachomatic Genital Infection Among Persons Aged 14-29 Years-- United States, 2007-2012. *MMWR*, 830-845.

Toth, M., Holmes, G., Van Houtven, C., Toles, M., Weinberger, M., & PC, S. (2015). Rural Medicare Beneficiaries Have Fewer Follow-up Visits and Greater Emergency Department Use Postdischarge. *Medical Care, 53*(9), 800-8.

Treuhaft, S., & Karpyn, A. (2010). *The Grocery Gap: Who Has Access to Healthy Food and Why It Matters.* PolicyLink. Retrieved from http://thefoodtrust.org/uploads/media_items/grocerygap.original.pdf

Tukey, J. W. (1977). *Exploratory Data Analysis.* Reading, MA: Addison–Wesley.

U.S. Census Bureau. (2015). *Income, Poverty, and Health Insurance Coverage in the United States: 2014.* Washington: U.S. Census Bureau.

U.S. Department of Health and Human Services, Prevention Quality Indicators Overview. (2017, May 18). Retrieved from Agency for Healthcare Research and Quality: https://www.qualityindicators.ahrq.gov/modules/pqi_resources.aspx

U.S. Department of Health and Human Services, The Opioid Epidemic: By the Numbers. (2016, Jue). Retrieved from Factsheet-opoids - 061516: http://www.hhs.gov/sites/default/files/Factsheet-opioids-061516.pdf

U.S. Preventive Services Task Force, Final Recommendation Statement: Breast Cancer: Screening. (2016, January). Retrieved from U.S. Preventive Services Task Force: https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/breast-cancer-screening1

Umeå University. (2011, May 25). Long-distance commuters get divorced more often, Swedish study finds. *ScienceDaily*.

United Health Foundation. (2016). *American's Health Rankings: Poor Physical Health Days.* http://www.americashealthrankings.org/ALL/PhysicalHealth.

United Health Foundation. (2016). *Poor Mental Health Days.* Retrieved from http://www.americashealthrankings.org/ALL/MentalHealth

United States Department of Health and Human Services. (2012). *HHS Action Plan to Reduce Racial and Ethnic Health Disparities*. Retrieved from Minority Health: http://minorityhealth.hhs.gov/npa/files/plans/hhs/hhs_plan_complete.pdf

United States Drug Enforcement Administration. (2015). *2015 Drug Threat Assessment Summary.* Washington, DC.

Urban Institute. (2015). *How Are Income and Wealth Linked to Health and Longevity?*

U.S. DHHS Office of Disease Prevention and Promotion. (2016, November 17). *HealthyPeople.gov Topic Area Cancer*. Retrieved from www.healthypeople.gov: https://www.healthypeople.gov/2020/data-search/Search-the-Data#srch=cancer;

U.S. Preventive Services Task Force. (2016). Screening for Chronic Obstructive Pulmonary Disease US Preventive Services Task Force Recommendation Statement . *JAMA, 315*(13), 1372-77.

USDHHS Agency for Healthcare Research and Quality. (2016, December 3). *Understanding Quality Measurement*. Retrieved from Agency for Healthcare Research and Quality: http://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/chtoolbx/understand/index.html

Vyavaharkar, M., Glover, S., Leonhirth, D., & Probst, J. (2013). *HIV/AIDS in Rural America: Prevalence and Service.* SC Rural Health Research Center. .

Wagstaff, A. (2002). Poverty and Health Sector Inequalities. *Bulletin of the World Health Organization*, 80(2):97-105.

Weinstock H, e. a. (2004). Sexually transmitted diseases among America's youth: incidence and prevalence estimates, 2000. *Perspectives on Sexual and Reproductive Health, 36*(1), 6-10.

Weir, H. A. (2016). Heart Disease and Cancer Deaths - Trends and Projections in the United States, 1969-2020. *Prev Chron Dis*, 13:16021.

West P, S. H. (2004). School effects on pupils' health behaviours: evidence in support of the health promoting school. *Research Papers in Education*, 19(3), pp. 261–291.

Wier, L., Elixhauser, A., Pfunter, A., & Au, D. (2011). *Overview of Hospitalizations among Patients with COPD.* Retrieved from Healthcare Cost and Utilization Project, Statistical Brief #106.: http://www.hcup-us.ahrq.gov/reports/statbriefs/sb106.pdf

Wilper, A. P., Lasser, K. E., McCormick, D., Bor, D. H., & Himmelstein, D. U. (2009). Health Insurance and Mortality in US Adults. *American Journal of Public Health*, 2289-2295.

Woloshin, S., Schwartz, L., & Welch, G. (2008). The Risk of Death by Age, Sex, and Smoking Status in the United States: Putting Health Risks in Context. *JNCI Journal of the National Cancer Institute*, 845-853.

Woolf, S. H., Aron, L., Dubay, L., Simon, S. M., Zimmerman, E., & Luk, K. X. (2015, April). *How Are Income and Wealth LInked to Health and LongevIty?* Retrieved from Urban Institute: http://www.urban.org/sites/default/files/alfresco/publication-pdfs/2000178-How-are-Income-and-Wealth-Linked-to-Health-and-Longevity.pdf

WR Best, D.C. (1994, April). The ratio of observed to expected mortality as a quality of care indicator in non-surgical VA patients. *Medical Care, 32(4)*, 390-400.

Young, A. M., DiClemente, R. J., Halgin, D. S., Sterk, C. E., & Havens, J. R. (2014). HIV vaccine acceptability among high-risk drug users in Appalachia: a cross-sectional study. *BMC Public Health, 14*(537).

Zeiders, K., & Roosa, M. a. (2011, Marcy). Family Structure and Family Processes in Mexican American Families. *Fam Process*, *50*(1), 77-91.

Zhang, Z., Infante, A., Meit, M., English, N., Dunn, M., & Bowers, K. (2008). *An Analysis of Mental Health and Substance Abuse Disparities & Access to Treatment Services in the Appalachian Region.* Appalachian Regional Commission and National Opinion Research Center.

Zizzi, S., Goodrich, D., Wu, Y., Parker, L., Rye, S., Pawar, V., . . . Tessaro, I. (2006). Correlates of Physical Activity in a Community Sample of Older Adults in Appalachia. *ournal of Aging and Physical Activity, 14*, 423-438.

B. METHODOLOGICAL AND TECHNICAL NOTES

Definition of a County

The data in this report come from more than 15 secondary data sources. Different institutions organize their data into a particular universe of spatial units based on their analytical needs. The county-level data files provided by these sources—or sub-county data aggregated from source files—were organized to meet the Appalachian Regional Commission's standard representation of the United States as consisting of 3,113 counties, which adheres to the Bureau of Economic Analysis's county-level delineation of the nation. However, many of the data sources disaggregate the country into 3,143 "county units" (with some slight variation around this number). The data from many of these secondary data sources thus have to be converted into the 3,113-county universe, and this is done by combining several county-level units. The most frequent example of this takes place in Virginia, where independent cities are combined with surrounding counties in order to meet the ARC/BEA organizational structure. If source data provided numerators and denominators, these values were used to compute figures such as rates and percentages for each indicator. When only computed figures were provided, a weighting variable from another source (such as the 2014 American Community Survey (ACS) population figures) was used to create a weighted average of values. In rare cases, data from source counties were distributed to more than one of the 3,113 counties. This was most often necessary for five Alaska boroughs/county-equivalents, which were recently reallocated from three county-equivalents. In these cases, values from the three county-equivalents were directly assigned to the new areas based on predominate geographic overlap.

Mapping Procedures

The measures included in this report are examined at the county level, with national and regional maps for each indicator displaying its variation across counties. For ease of interpretation, the maps for each variable were designed to have darker colors represent values indicating poor health status, or values for social or behavioral factors that contribute to poor health status.

The value groupings used to determine the color categories in both the national and regional maps are determined by the *national* quintiles of each respective indicator: five groupings with equal numbers of constituent counties in each category (with some variation due to rounding, clustering, and suppressed data values). The quintiles are determined by using the breaks at the 20^{th}, 40^{th}, 60^{th}, and 80^{th} percentiles of the national distribution. Since both the national and regional maps use these national groupings, the national maps will have the same number of counties in each category.[8] The maps for the Appalachian Region, however, will not necessarily have an equal distribution among categories and colors, as the quintiles are based on the *national* data. For example, if the Appalachian Region as a whole performs worse than the national average for any particular measure, it is likely that more than 20 percent of the Region's counties will be shaded in the darkest color on the map.

[8] The number of counties may vary by one between groups. For example, there are 3,113 counties analyzed, which does not divide equally into groups of five, meaning for indicators with complete data, three groups will have 623 and two will have 622.

Age Adjusting Mortality Rates

Age adjusting mortality rates allows for comparisons among counties with different age distributions. Counties with greater numbers of elderly residents can generally expect higher mortality rates than counties with less elderly residents. Thus, a county with higher unadjusted (crude) mortality rates, which suggest poor health, may actually be relatively healthy but simply have a larger number of older residents (and thus a higher overall baseline risk of death). Using data from the Compressed Mortality Files from CDC, we compared the distributions of county populations by age cohort to the standard population distribution for the country as a whole. Using these population distributions by age cohort as a base, the mortality rates in this report are age adjusted and standardized based on the Year 2000 Standard Million Population (see Table 71). This provides the reader with the ability to accurately compare mortality across counties with different age distributions. Only infant mortality is not age adjusted in this report, because the age distribution of a population is not relevant to the measure. The YPLL indicator is obtained directly from County Health Rankings & Roadmaps, which age-adjusted YPLL prior to publishing.

Table 71: Year 2000 Standard Million Population for the United States

Age	2000 Standard Population Distribution
Under 1 year	13,818
1-4 years	55,317
5-9 years	72,533
10-14 years	73,032
15-19 years	72,169
20-24 years	66,478
25-34 years	135,573
35-44 years	162,613
45-54 years	134,834
55-64 years	87,247
65-74 years	66,037
75-84 years	44,841
85 years and over	15,508
All Years	1,000,000

Source: https://wonder.cdc.gov/wonder/help/cmf.html

The formulas to convert crude rates to weighted rates by age cohort and total population age-adjusted are:

(Deaths / pop) x 100,000 = CRUDE RATE

CRUDE RATE x (standard pop in each age cohort / 1,000,000) = WEIGHTED RATE

Sum (WEIGHTED RATES) all cohorts = AGE-ADJUSTED RATE for total population

In this example, the crude data are reported in increments of 100,000 residents.

For example, consider the crude and age-adjusted mortality rates in two states: Utah and Maine, the former of which has a relatively younger population. Table 72 displays the crude and age adjusted rates using two sources: CDC Wonder, an interactive web tool that allows users to calculate mortality rates for specific queries, and then also the age adjustment process used in this report. The slight differences in the mortality rates between these two sources are due to rounding and the inclusion of deaths with unknown ages. Table 72 also shows the process of converting from crude mortality rates to age-adjusted mortality rates. While Maine has nearly double the crude rate of Utah, once the data are age adjusted, the rates become quite similar in all age cohorts.

Table 72: Comparison of Crude and Age-Adjusted Mortality Rates for Utah and Maine

Age Cohort in Years	Standard Million Population	Utah (Younger Population State)				Maine (Older Population State)			
		Deaths	Population	Crude Rate	Wtd Rate	Deaths	Population	Crude Rate	Wtd Rate
Under 1	13,818	4,383	840,336	522	7.2	1,345	229,045	587	8.1
1–4	55,317	886	3,256,680	27	1.5	227	947,922	24	1.3
5–9	72,533	501	3,862,337	13	0.9	170	1,291,131	13	1.0
10–14	73,032	600	3,669,490	16	1.2	206	1,427,186	14	1.1
15–19	72,169	1,972	3,698,192	53	3.8	843	1,520,896	55	4.0
20–24	66,478	3,047	4,021,230	76	5.0	1,166	1,314,897	89	5.9
25–34	135,573	6,974	6,764,886	103	14.0	2,568	2,537,252	101	13.7
35–44	162,613	9,417	5,545,348	170	27.6	5,060	3,157,287	160	26.1
45–54	134,834	16,789	4,839,035	347	46.8	12,660	3,540,842	358	48.2
55–64	87,247	25,609	3,575,069	716	62.5	23,653	2,888,520	819	71.4
65–74	66,037	36,825	2,198,826	1,675	110.6	37,485	1,868,337	2,006	132.5
75–84	44,841	62,962	1,308,643	4,811	215.7	61,595	1,160,897	5,306	237.9
85 and over	15,508	72,608	475,018	15,285	237.0	70,676	462,785	15,272	236.8
All Years	1,000,000	242,573	44,055,090	550.6	733.8	217,654	22,346,997	974.0	788.0

Table 73: Comparison of Calculated Age-Adjusted Rates with CDC Wonder Reported Rates

State	Utah		Maine	
Data Type	Crude	Age-Adjusted	Crude	Age-Adjusted
Calculated Rates	550.6	733.8	974.0	788.0
CDC Wonder	550.7	734.1	974.0	788.0

Data Suppression and Smoothing

Accommodations for Suppressed Values

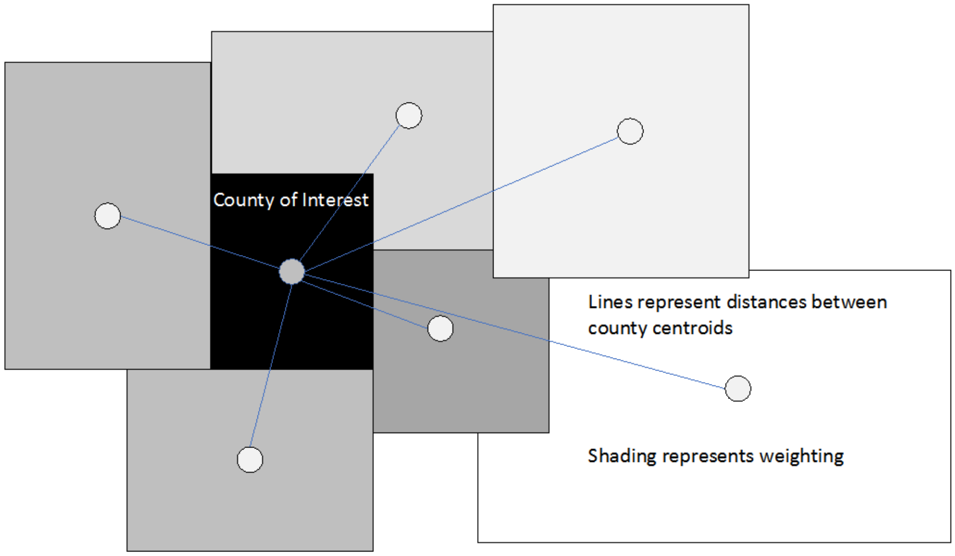
The National Center for Health Statistics of the Centers for Disease Control and Prevention prohibits the reporting of death counts and death rates when the unit is fewer than ten cases. This results in rates that are suppressed for many counties in the Appalachian Region, as well as elsewhere in the United States. To account for this issue, data for counties with deaths below this threshold were augmented by incorporating data from nearby counties. To calculate the augmented rate for any particular county, a proportion of deaths (numerator) and population (denominator) from nearby counties were added to the base numbers for the target county. The proportion of a nearby county's information that was added to the target's decreases with increasing distance between the two.

This technique is called smoothing. In addition to overcoming suppression issues, it helps correct for unstable measures resulting from small population sizes. When small populations lead to even smaller numerators—such as occurs in counties with fewer than ten poisoning deaths in a given year—rates can be smoothed to eliminate statistical instability. The ten-death criteria for spatial adjustment was applied not only for the total number of deaths for any given mortality measure, but for individual age cohorts, as well.

Overview of Smoothing Process

The smoothing process applies weights to counties surrounding the county with the suppressed value, the "county of interest" in Figure 189 below. The process results in an augmented value resulting from the combination of actual data from the county of interest with weighted values from nearby counties. The degree to which a nearby county contributes to the augmented value depends on the distance from the county of interest to any given nearby county. Figure 189 below demonstrates this principle. The county of interest receives a weight of 1.0 and is fully shaded. Closer counties (e.g., the small, dark gray county directly to the southeast) have darker shading and higher weights than more distant counties (e.g., the large, white county further to the southeast). For each county, the number of deaths and populations in each age category then multiplies the weights. These numbers are then aggregated across counties by age category, and ultimately an age-adjusted rate for the county of interest is calculated.

Figure 189: Example of Weighting Counties for Smoothing Based on Distance



Technical Detail

This approach is one we have used in the past (Ricketts & Holmes, 2007). First, we specified the general form of the weighting function:

WEIGHT = exp (λ * MILES)

where MILES is the straight-line distance between two county centroids. The parameter λ is constrained to be negative, so the weighting function is equal to one if MILES equals zero, is decreasing in MILES, and is bounded from below by zero. Values of λ that are closer to zero lead to a slower decay—for example, a λ of -0.05, will place greater weight on distant counties than a λ of, say, -0.2. In selecting the value of λ, there is a tradeoff between faster decay (averaging over counties that are located closer to the county with the suppressed value) and using more counties (leading to more precise estimates). This approach significantly reduces the number of unreportable area-cause death rates while maximizing local influence on the augmented rate.

We conducted a grid search for the optimal λ using the following approach. First, we randomly chose counties in the Appalachian Region to be labeled as suppressed. We then calculated smoothed rates using the above methods for a variety of potential λ. We repeated this exercise 1,000 times using a different λ each time. After each iteration, we calculated the mean squared error, or the average squared difference between the smoothed rate and the actual rate (the randomly chosen counties labeled as suppressed in this exercise had actual rates and served as the basis for comparison). This method allowed us to identify the λ with the smallest mean squared error. The λ satisfying this condition was **-0.125.** We specified the same λ for all mortality rates.

With λ now in hand, the approach was as follows. For each suppressed county, we calculated the distance (MILES) between that county centroid and the county centroid of all other counties. We then calculated the weight associated with each county using the weighting function noted above.

Any county with a weight of less than 0.01 was dropped from the analysis. This approach has little practical effect on the augmented rate and eases any rounding issues (e.g., a populous county that is very distant may still have more weight than a nearby county of moderate size). We aggregated the deaths and population (numerator and denominator) across nearby counties—incorporating their weights—to create an augmented numerator and denominator for the suppressed county. This augmentation includes any deaths and population reported for the suppressed county, as well. At this point, the suppressed county has a "smoothed" number of deaths and population, with closer counties contributing more to the value. The mortality rate can then be calculated directly from these numbers.

For age-adjusted mortality rates (everything except infant mortality), the augmentation occurs prior to age-adjusting. Table 74 illustrates a simple example in which only two ages are considered: children and adults. Five counties are displayed, along with the number of deaths and population for both age groups. Distance from County A's centroid determines the weight for each county. The final four columns calculate the weighted deaths and population. Note that County E, with a weight of less than 0.01, does not contribute to the aggregation.

Table 74: Sample County Illustration of Augmentation for Suppressed Data

County	Deaths	Population	Age Group	Distance in Miles	Weight	Children		Adults	
						Wtd deaths	Wtd pop	Wtd deaths	Wtd pop
A	2	1,000	Children	0	1.000	2.00	1000		
A	18	10,000	Adults	0	1.000			18.00	10,000.0
B	2	1,200	Children	5	0.535	1.07	642.0		
B	24	11,500	Adults	5	0.535			12.85	6,152.5
C	4	800	Children	10	0.287	1.15	229.6		
C	37	7,900	Adults	10	0.287			10.60	2,267.3
D	3	1,500	Children	20	0.082	0.25	123.0		
D	27	16,000	Adults	20	0.082			2.22	1,312.0
E	7	2,000	Children	40	0.007	weight < .01 => 0			
E	91	18,500	Adults	40	0.007			weight < .01 => 0	
TOTAL						***4.47***	***1,994.6***	***43.7***	***19,731.8***

After the aggregated deaths and population are calculated by age category, age-adjustment occurs using the approach outlined above (see Table 75). For purposes of this example, we specify weights of 0.1 (children) and 0.9 (adults) and thus calculate an age-adjusted rate of 221.7. Note that the example rates here—like the mortality rates in the report—are standardized per 100,000 population.

Table 75: Age-Adjusted Step for Spatial Adjustment

Metric	Children	Adults
Mortality Rate	224.11	221.32
Age-adjusted weights (for example)	0.10	0.90
Weighted rate	22.41	199.32
AUGMENTED AGE-ADJUSTED RATE		***221.73***

Reciprocal Measures

In order to report health professional supply measures consistently, we calculated the reciprocal of values pulled directly from County Health Rankings. For example, 2016 County Health Rankings Data for Bibb County, Alabama shows a Primary Care Physician Ratio of 2,814:1 (persons per physician). We use the reciprocal (1/2,814), converted to primary care physicians per 100,000 people. The calculation is as follows:

1/2,814 * 100,000 = .000355 * 100,000 = 35.5

Similarly, the dentist ratio of 5,627:1 becomes 17.8 dentists per 100,000. The only health professional supply measure that was not calculated in this manner was specialist physicians per 100,000, as County Health Rankings does not report this measure. Instead, the data for this measure come from the HRSA Area Health Resources File (AHRF).

Rurality in Appalachia

ARC, in coordination with staff at USDA's Economic Research Service (ERS), has developed a simplified version of the 2013 Urban Influence Codes (UIC) for their research and analytical work. To create the UICs, the USDA starts with the official listing of metropolitan Core Based Statistical Areas (CBSAs/MSAs) published by the Office of Management and Budget (OMB). The USDA then distinguishes metropolitan counties by the population size of their metro areas, and nonmetropolitan counties by (i) the size of their largest city or town and (ii) proximity to metro areas. ARC simplified the USDA's original 12-part county classification into the five levels described below.

1. **Large Metros:** Metropolitan counties in large metro areas of more than 1 million residents
2. **Small Metros:** Metropolitan counties in small metro areas of less than 1 million residents
3. **Non-metro, Adjacent to Large Metros:** Nonmetropolitan counties adjacent to a large metro area
4. **Non-metro, Adjacent to Small Metros:** Nonmetropolitan counties adjacent to a small metro area
5. **Rural (non-metro, not adj. to a metro):** Nonmetropolitan counties not adjacent to a metro area

Table 76 illustrates the USDA twelve county classification system and the crosswalk from the USDA categories to the simplified five-class scheme.

Table 76: USDA Twelve County Classification System

ARC Crosswalk Category	UIC Code	Description
Metropolitan counties:		
1	1	In large metro area of 1+ million residents
2	2	In small metro area of less than 1 million residents
Nonmetropolitan counties:		
3	3	Micropolitan area adjacent to large metro area
3	4	Noncore adjacent to large metro area
4	5	Micropolitan area adjacent to small metro area
4	6	Noncore adjacent to small metro area and contains a town of at least 2,500 residents
4	7	Noncore adjacent to small metro area and does not contain a town of at least 2,500 residents
5	8	Micropolitan area not adjacent to a metro area
5	9	Noncore adjacent to micro area and contains a town of at least 2,500 residents
5	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents
5	11	Noncore not adjacent to metro or micro area and contains a town of at least 2,500 residents
5	12	Noncore not adjacent to metro or micro area and does not contain a town of at least 2,500 residents

Population-weighted Averages for Large Geographies

To create measures for geographic units larger than the county, we used population-weighted averages. We used the same method of calculating these averages for all large geographies, including the United States, the Appalachian Region, the five Appalachian subregions, and then also the Appalachian, non-Appalachian, and total values for each state. The groupings of counties based on rurality and economic status also used this same methodology. These calculations are necessary because our data sources do not contain values for many of the report's key geographies, such as the Appalachian Region or the Appalachian subregions. We thus needed a methodology to apply to all geographic groups in order to have a valid comparison. The population-weighted average approach provides a valid, consistent method.

The specific calculation used to generate population-weighted values is described here. Consider i counties that are members of an area A. Area A could be a state, a specific economic status (e.g. distressed), or any other geography or grouping described in the report. The population-weighted average for variable x is calculated as the sum of the product of x and the population of each county, divided by the sum of the 2014 ACS populations of the counties in the area.

$$AVERAGE_A = \left(\frac{1}{\sum_{i \in A} POP_i}\right) \sum_{i \in A} [POP_i \cdot x_i]$$

As a result of the population weighting, values in this report for even commonly reported geographies—such as the United States as a whole—may differ slightly from published sources. However, using this population-weighted approach across all geographies ensures an accurate, consistent comparison.

Time Periods of Mortality Measures

For the mortality measures examined in this report, the values for each represent performance over a span of years: 2008–2014. This has the effect of reducing suppressed values in low population counties, as well as helping smooth single year spikes in mortality. These seven-year periods represent the original time period of the data as they are found in the CDC's Compressed Mortality File.

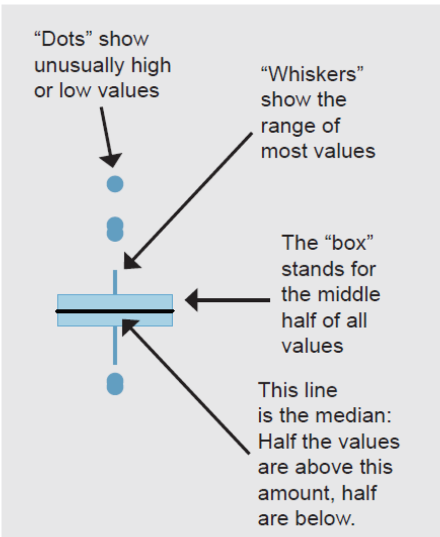
State-level effects of BRFSS Data

Many of the variables derived from the CDC's Behavioral Risk Factor Surveillance System (BRFSS) survey data show sharp state-level border effects. Because the survey is conducted at the state level, statistical modeling is utilized by County Health Rankings to develop these county-level values. Due to low numbers of responses in many counties, even with these statistical techniques, robust estimates for each county are not always possible. As such, county-level numbers oftentimes show little variation in any particular state. For more detailed information, please visit the County Health Rankings website.

Box Plots

A box plot is a type of graph that shows the distribution of data. Comparing box plots among different groups shows how the median of each group compares to the other groups, how much variation exists within each group, and how the variation compares between the groups.

Figure 190: Components of a Box Plot



The edges of the whiskers and the black line represent specific statistics calculated from the data. For example, the black line denotes the median (half of values are greater than this value, half are less than this value). The lower and upper edges of the box represent the 25th and 75th percentiles, respectively. The 25th percentile is the value for which 25 percent of county values are less, and the remainder (75 percent) are greater. The 75th percentile is defined similarly. The caps of the whiskers are defined as "adjacent values" (Tukey, 1977). The upper adjacent value ("top whisker") is the largest observed value that is less than or equal to the 75th percentile plus 3/2 of the difference between the 75th and 25th percentile. The lower adjacent value is defined similarly. Outside values —the dots described as "unusually high or low values"—are those values that lie outside the adjacent values.