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Data 512

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Final report

**Exploring the impact of wildfire smoke on the health care industry of Leavenworth, Kansas**

**Introduction:**

In this work, the author was tasked with conducting a human-centered data analysis project concerned with measuring a specific impact that wildfire smoke has on a particular city, and from there creating a policy recommendation for said city. Specifically, the author was assigned to consider the city of Leavenworth, Kansas and chose to measure the impacts on the healthcare industry. As expected, the main motivation behind this work is to save Leavenworth money and resources through education. To answer the question of why this analysis is important, research [INSERT REF] shows that wildfire smoke is dangerous to inhale over both the short and long term. This means that if the city of Leavenworth is not aware of current smoke exposure trends, they will likely be unable to mitigate incurring extra avoidable health and economic repercussions due to wildfire smoke. Tangentially, this work may be considered interesting from a technical standpoint because it served as an exercise that demonstrates the difficulty in solving real world problems due to reasons such as: Suboptimal datasets, operating on multiple assumptions, and combining datasets for analysis. The rest of this report will go into details about related work, methods used, findings, limitations, and finally the proposed policy recommendation.

**Background/Related work:**

In this work, the first main research question that was asked was a hard requirement by the course staff for the first portion of work named “common analysis”. Specifically, the question was “What are the estimated smoke impacts on your assigned city for the last 60 years?” In this case, the assigned city was Leavenworth, Kansas. After the first smoke estimates were determined through the work done for the “common analysis”, new research questions were chosen by the author to be answered in the second portion of work called the “extended analysis”. The research questions regarding the extended analysis are: “What impacts does wildfire smoke have on the healthcare industry in Leavenworth, Kansas”, “How do specific health conditions relate to emergency department visits”, and “What are the increased risks of emergency department visits for chosen health conditions when wildfire smoke is involved”. Given the research questions, the next paragraphs mention and discuss the use of various different research sources, data sources, and algorithms used to attempt to answer the proposed questions.

In this section, each research or information source used will be discussed. First, in the creation of an annual smoke estimate, we utilized [1] to determine the volume of smoke produced by burning one kilogram of wood, which according to the source was 87.5 meters squared per kilogram. Second, sources [2], [3], and [4] were used as justification to why specific health conditions such as asthma, cardiovascular disease (CVD), chronic obstructive pulmonary disease (COPD), myocardial infarctions (MI), and strokes were considered in this analysis. Next, the results from [5] were used to estimate that 7.7 percent of people in Leavenworth, Kansas have asthma regardless of the year, the results from [6] were used to estimate that 7.53411 percent of people in Leavenworth, Kansas have CVD regardless of the year, the results from [7] were used to estimate that 6.4 percent of the people in Leavenworth, Kansas have COPD regardless of the year, the results from [8] and [9] were used to estimate that 0.241 percent of the people in Leavenworth, Kansas have experienced a heart attack each year, and the results from [9] and [10] were used to estimate that 0.237 percent of the people in Leavenworth, Kansas have experience a stroke each year. After that, sources [11], [12], [13], [14] were used to determine that asthma, CVD, COPD, heart attacks, and strokes account for 1.32 percent, 11.4 percent, 12.44 percent, 0.6 percent, and 0.6 percent of all emergency department (ED) visits in Leavenworth, Kansas regardless of the year. Similarly, the number of ED visits per year was estimated to be equivalent to 40 percent of the population of that year due to [15]. Next, sources [16], [17], [16], [18], and [17] were used to determine that the number of ED visits for asthma, CVD, COPD, heart attacks, and strokes could increase by up to 2.2, 5, 1.39, 42, and 11 percent respectively depending on how severe the annual smoke estimate was. Finally, [19] was used to estimate that each ED visit cost 530 dollars.

This work utilized three different sources of data. First, we used a dataset titled “Combined wildland fire datasets for the United States and certain territories, 1800s-Present”. This dataset was published [here](https://www.sciencebase.gov/catalog/item/61aa537dd34eb622f699df81) on 12/08/2021. In short, the dataset is a combination of many smaller or incomplete United States fire datasets and stores various metadata for historical fires such as: Area, location, date, polygon coordinate geometry, etc. The second source of data utilized the [Air Quality System (AQS) API](https://aqs.epa.gov/aqsweb/documents/data_api.html), which contained “ambient air sample data collected by state, local, tribal and federal air pollution control agencies”. The contents of data called by the API include recorded station data such as: Particulate type, particulate amount measured, date of collection, location of the station, etc. Third, this work utilized United States census data, which can be found [here](https://data.census.gov/). United States census data is quite vast and can include many different schemas which cannot be fully described here. For this work specifically, population estimates, age estimates, healthcare coverage estimates, and employment by industry estimates were used.

Talk about models/algos ---------------as-das-ddsa-dsa—dsa-dsa-sad

**Methodology:**

Talk about common analysis pipeline

Talk about extended analysis pipeline

Talk about human-centered components to the work

**Findings:**

Asd

**Discussion/Implications:**

Asd

**Limitations/assumptions:**

Asd

**Conclusion:**

Asd

**References:**

1. <http://virtual.vtt.fi/virtual/innofirewood/stateoftheart/database/burning/burning.html> – smoke produced by wood
2. <https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm> - why asthma
3. <https://www.cdc.gov/air/wildfire-smoke/default.htm> - why cvd, copd
4. <https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke> - why MI, stroke
5. <https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm> - 7.7% asthma
6. <https://professional.heart.org/-/media/PHD-Files-2/Science-News/2/2022-Heart-and-Stroke-Stat-Update/2022-Stat-Update-factsheet-GIobal-Burden-of-Disease.pdf> - 7.5341% CVD
7. <https://www.cdc.gov/copd/basics-about.html> - 6.4% COPD
8. <https://www.cdc.gov/heartdisease/facts.htm> - 0.241% heart attack
9. <https://www.census.gov/library/stories/2022/12/happy-new-year-2023.html> - 2023 pop
10. <https://www.cdc.gov/stroke/facts.htm> - 0.237 stroke
11. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8862306/> - 1.32% ED from asthma
12. <https://www.cdc.gov/nchs/data/nhsr/nhsr174.pdf> 11.4% ed from CVD
13. <https://journal.copdfoundation.org/jcopdf/id/1103/Characteristics-of-COPD-Patients-Using-United-States-Emergency-Care-or-Hospitalization> - 12.44% all ed from copd
14. <https://hcup-us.ahrq.gov/reports/statbriefs/sb47.pdf> - 0.6% ED from MI and stroke
15. <https://www.cdc.gov/nchs/products/databriefs/db452.htm/> 40% ED visits
16. <https://www.healio.com/news/pulmonology/20231107/wildfire-pollution-linked-to-cardiopulmonary-ed-visits-among-vulnerable-populations> - 2.2% increased ED asthma, 1.39 copd
17. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6015400/> - 5% increase ED CVD, 11% stroke
18. <https://newsroom.heart.org/news/wildfires-may-fuel-heart-health-hazards-smoke-exposure-increases-cardiovascular-risks> - 42% MI ED increase
19. <https://hcup-us.ahrq.gov/reports/statbriefs/sb268-ED-Costs-2017.jsp> 530 per ED visit

Stuff I haven’t used

<https://www.cdc.gov/mmwr/volumes/67/wr/mm6713a1.htm> 9.9% of people with asthma visited ED

<https://usafacts.org/articles/how-many-wildfires-occur-in-the-us/> 119 acres for avg fire  
[https://www.pnas.org/doi/10.1073/pnas.2302409120](https://www.pnas.org/doi/10.1073/pnas.2302409120#:~:text=In%20contrast%2C%20health%20outcomes%20with,increase%20by%2030%20to%20110%25) - 30-110% increase in asthma and COPD visits

**Data sources:**

Combined wildland fire datasets:

[Combined wildland fire datasets for the United States and certain territories, 1800s-Present (combined wildland fire polygons) - ScienceBase-Catalog](https://www.sciencebase.gov/catalog/item/61aa537dd34eb622f699df81)

AQS API:

<https://aqs.epa.gov/aqsweb/documents/data_api.html>

US Census Data:

<https://data.census.gov>

<https://data.census.gov/table/ACSST5Y2021.S2407?q=Leavenworth%20city,%20Kansas&t=Class%20of%20Worker>

<https://data.census.gov/table/ACSSE2022.K201803?q=Leavenworth%20city,%20Kansas&t=Disability> -

<https://data.census.gov/table/ACSSE2022.K201801?q=Leavenworth%20city,%20Kansas&t=Health> -

<https://data.census.gov/table/ACSST5Y2021.S0101?q=Leavenworth%20city,%20Kansas&t=Age%20and%20Sex>

<https://data.census.gov/table/ACSST5Y2022.S2701?q=Leavenworth%20city,%20Kansas&t=Health%20Insurance>