WTN Youth Science Contest Health Science Group Division Paper

The Health Divide: Exploring the Impact of Economic Inequality on Public Health in Washington State

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<u>Thesis</u>: Low economic levels across Washington State are correlated with various adverse health effects and environments.

Introduction:

Many studies have identified a poorer socioeconomic status as being related to poor health outcomes. This paper will reinforce and discuss this association by examining three specific health measures, namely cardiovascular-disease related deaths, drinking water contamination due to lead, and rates of hospitalization. These three measures have been selected because they are relatively common and have the potential to largely impact the health of the public all across the United States, including Washington. For instance, heart disease is still the number one killer in the United States today [1]. Furthermore, an astonishing 56% of Americans from 2018 to 2020 had water supplied from systems with detectable levels of lead [2].

Data:



Figure 1: CVD mortality (age adjusted rate per 100,000) over 2018-2022 [3].



Figure 2: Population living in poverty by county (%) from 2015-2019 [3].



Figure 3: All hospitalizations by county (age adjusted rate per 100,000) from 2015-2019 [3].

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Clallam	Cape Flattery	Clallam Bay High and Elementary School	Null	2	
			BottleFiller	1	
			Bubbler	8	
			PotFiller	1	
			Тар	10 7 13	
		Neah Bay Elementary	Null	1	
		School	BottleFiller	1	
			Bubbler	12	
			Тар	13 9 13	
		Neah Bay Junior/ Senior High School	Null	2	
			BottleFiller	1	Greater than 15ppb 6-15ppb 5ppb or less
			Bubbler	5	
			Тар	10 4	
	Crescent	Crescent School	Bubbler	6	
			Тар	5	

Figure 4: Number of fixtures from schools in Clallam County with classifications of lead in water (ppb). [4]



Figure 5: Children (<18) living in poverty by county (%) from 2015-2019. [3]



Figure 6: Median household income (USD) by Washington county from 2015-2019. [3]



Figure 7: Estimated level of Lead Hazard (%) of units in Adams County [3]



Figure 8: Hospital and Health Systems by Washington State Legislative District [6]



Figure 9: Smoking across income levels over time



Figure 10: Best Fit Line of ratio of smoking rates (Income <\$25K vs. Income > \$75K) Over Time

Data Analysis:

The data we took from the WTN consisted of data from the dashboards, which have detailed statistics on specific topics (e.g. lead in schools), and county data from the WTN map tool. This allowed us to compare two different metrics, such as poverty percentage and hospitalizations. We split the data into counties, which allows us to analyze regions in depth and find patterns that we could attempt to explain. However, we want to emphasize that simply finding a correlation does not equate to causation. In the field of public health, many factors influence the wellness, environment, and data that a certain region provides. We measured a lower economic level through two measures: poverty levels & median income. Focusing on poverty levels showed us how the bottom 25th percentile of Washingtonians were impacted. However, we included median income to account for anomaly counties as well. For example, Whatcom County, a county with over 14% of its inhabitants living under the poverty line, has a median income of \$62,984, ranking as the 11th richest county in Washington. Conversely,

Wahkiakum County, boasting a mere 7.3% poverty rate, has a median income of \$53,227, ranking as the 9th poorest county in Washington. To avoid these discrepancies, we used both measures in our analysis, thus ensuring that any outlier counties wouldn't directly invalidate our analysis.

The first adverse health effect we chose to analyze was lead levels. We chose to focus on Clallam County, which has a median income of \$52,192, which is much lower than the Washington median income. Figure 4 displays the data for lead in Clallam County schools. Clallam County schools had 37 counts of water fixtures with over 15ppb, which is the EPA limit at which a water fixture should be shut off immediately [4]. In Figure 5, we can see tha Clallam County has an extremely high rate of <18 persons living in poverty at 23.2%. Many of the children in this group go to the schools mentioned in Figure 4, making the correlation stronger and suggesting a possible link between lower socioeconomic status and lead levels. Furthermore, this pattern is not isolated to Clallam County. If we look at Figure 7, we can see that Adams County has an extremely high average percentage (32.14%) of units with a lead hazard. Similarly, Adams County also has a high percentage of individuals living below the poverty level, at 25.6%. While our data analysis was conducted among a limited number of counties, the data does reveal a pattern. Lower economic levels are correlating with an increased risk of lead hazard prevalence, and this pattern is not applicable solely to adults. Individuals <18 are also at an increased risk of lead hazard if they live in a low economical environment.

The second adverse health effect we chose to analyze was hospitalizations. The total number of hospitalizations in a certain region may indicate a higher prevalence of diseases or injuries in a population. Our first county we analyzed was Ferry County. As shown in **Figure 6**, the median household income in Ferry County is in the lowest median income category, with the county reporting a mere \$41,939 median income. This is also correlated with the data in **Figure**

3, which displays the age adjusted hospitalization rate per 100,000 people for counties across Washington State. Ferry County's age adjusted hospitalization rate is 8.9445%. To ensure accurate analysis, we chose another low median income county, Gray's Harbor County. **Figure 6** shows us that the median household income in Gray's Harbor County is \$51,240, which is in the lower income categories, similar to Ferry County. Another similarity is the county's hospitalization rate, which is 8.908%. When we follow the data, the correlations start becoming more evident. A lower median income is correlated heavily with higher hospitalization rates. This provides more grounded evidence supporting our thesis. A possible explanation is that lower economic prosperity impairs the ability of an individual to access proactive care such as regular checkups and personal health planning. These causes will be further assessed in the Equity section.

The third and final adverse health effect we investigated was cardiovascular-disease related deaths. Cardiovascular diseases are the leading cause of death in the United States and in Washington. Hence, cardiovascular deaths are an accurate measure of overall health quality. To explore the relation between poverty and deaths due to cardiovascular disease, we focused on three counties: King County, Yakima County, and Whitman County. As shown by **Figure 2**, King County has a low poverty level with only 8.9% of its population living in poverty. Accordingly, King County has the highest median income of all counties in Washington: \$56,955. King County also has one of the lowest rates of deaths due to cardiovascular disease. **Figure 1** shows King County having 165.59 deaths per 100,000 residents, putting it in the lowest range for deaths caused by cardiovascular disease. On the other hand, Yakima and Whitman county both have high levels of poverty and high rates of deaths caused by cardiovascular disease. **Figure 1** shows that Yakima's population and 26.5% of Whitman's population living in poverty.

per 100,000 residents, and similarly, Whitman has 226.32 deaths caused by cardiovascular disease per 100,000 residents. These three counties support the correlation between poverty levels and deaths due to cardiovascular disease.

Equity:

After our data analysis, we wanted to prove that this relation between poverty and adverse health effects wasn't just a coincidence, but rather a causation/correlation. Hence, we explored various factors that could be intermediaries in the relation between economic status and overall health.

A notable correlation we noticed was that lower numbers of medical centers were recorded in counties with high levels of hospitalizations. For example, Ferry County, which we found to have high hospitalization rates (8.9445%), only has one health center, Ferry County Memorial Hospital [6]. Another notable example is Gray's Harbor, another county with high hospitalization rates (8.908%), with only one medical center, Capital Medical Center [6]. One reason fewer facilities may contribute to an increase in hospitalization rates is due to the decrease in preventive care and timely treatment provided. If there are fewer clinics or urgent care centers available, people may avoid seeking medical attention for small ailments and chronic conditions. The delay in treatment ultimately worsens their condition, eventually leading to the need for hospitalization. Furthermore, fewer centers imply longer traveling distances, heavier loads of patients, and strained resources in existing facilities, thus scaring away people from going early for care. The result would be a bottleneck effect that could heighten the risks for severe complications, hence raising hospitalization rates.

Economic levels also impact the number of medical facilities. Counties with low median income levels have fewer medical centers, further reinforcing the hypothesis that lower

economic levels are correlated with adverse health effects and environments. As shown in Figure 6, Adams County, with a median income of \$48,294, has one of the lowest economic levels across Washington. Notably, it has only 2 medical centers (Figure 8). Skamania County, another low median income county as shown in Figure 6, has a median income of \$65,181, placing it well below average. Skamania County has no medical centers (Figure 8), which reflects a serious and dangerous lack of medical care. Pend Oreille County, with a median income of \$50,591 [3], follows the trend, with only one medical center. The correlation between the low-level economic counties and fewer medical centers is driven by several factors, which include economic, social, and logistical challenges. These counties usually have a lack of financial resources to construct and maintain healthcare facilities, purchase medical equipment, and hire qualified staff. Most of these areas are rural with dispersed populations, making it economically less viable for healthcare providers to set up centers where patient numbers are low. In addition, medical professionals are hardly attracted to or retained in low-income regions due to low wages, limited career growth opportunities, and few resources compared to wealthier areas. Private healthcare investors also focus on more affluent regions where higher returns are expected, further exacerbating the disparity. In addition, the lack of adequate transportation and infrastructure in these counties contributes to making access to healthcare difficult, thus discouraging the development of new facilities. In conclusion, the effect that lower economic levels have on the number of available medical facilities, and the correlation between a low number of medical facilities and high rates of hospitalization prove that there is causation between lower economic levels and higher hospitalization rates.

Another inequitable factor that affects low income communities disproportionately is the rate of smoking. Using the percentages taken from **Figure 9**, we calculated that in 2021, individuals with a household income under \$25,000 were ~4.7 times more likely to smoke than individuals with a household income above \$75,000. Similarly, in 2015, this ratio was ~3.2, and

in 2012, this ratio was ~2.6. This correlation between smoking rates and income levels is concerning as smoking has been proven to be a major factor in cardiovascular disease development. In fact, according to the CDC, "smoking is a major cause of cardiovascular disease (CVD) and is responsible for one in every four deaths from CVD [7].

Figure 10 (our best fit line) reveals that by 2030, individuals with a household income under \$25,000 will be 590% more likely to smoke than individuals with a household income above \$75,000. Hence, by 2030, individuals with a household income under \$25,000 will be 72% more likely to die due to a cardiovascular disease related death than individuals with a household income above \$75,000. As the disparity between upper income levels and lower income levels widens, the ratio of smoking between those in poverty and those not is also increasing. Therefore, we can conclude that income levels do directly impact rates of cardiovascular-related deaths.

Overall, decreasing economic inequality could be the solution ending a state-wide public health crisis and should be a priority for policymakers in coming years.

Reflection:

Summary of Our Process:

In this project, we reviewed data from the Washington Tracking Network (WTN). We accessed the relevant data through the WTN Comparison Portal and analyzed it to identify the thesis for our paper. Afterwards, we identified specific graphs and trends directly related to our thesis: how economic levels relate to public health in regions and counties across Washington. However, we faced challenges primarily in translating our findings into an understandable, comprehensible paper. We worked on this by showing our paper to our teacher, who didn't have any background knowledge. We used our teacher's feedback to revise our draft of our paper.

Reasons for picking these problems:

Various issues that we had exposure to in our PE/Health class led us to analyze the problem of economic inequality in health. Specifically, we learnt about how lower income levels lead to food deserts, which have adverse health effects on lower-income populations. Hence, we wanted to explore other adverse health effects that can be caused by poverty. We researched negative health effects like lead levels and cardiovascular related deaths, and seeing how these issues negatively impact communities drove us to further analyze the relation between lower economic levels and adverse health effects.

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Our teacher, Ms. Simmons, was a crucial part of our success. Her guidance, encouragement, and belief in our abilities kept us motivated and focused throughout the project. We're very grateful for her support and feedback.

Lessons:

This project not only improved our research and data analysis skills but also taught us the impact of how huge the difference in health was for different economic levels. After completing the project, it was clear to us that low socioeconomic levels are dangerous for a multitude of reasons, and further steps must be taken by policymakers to address this gap and ensure a healthy future for all Washingtonians. Furthermore, this project taught us how to read different types of graphs: bar, lines, and pie.

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