

## Introduction

Deep in the American West, there are certain characters to look out for. There's the grizzled cowboy, the clanging tools of the railroad man, the political outcast. But there is perhaps none as well known as the sickly prospector. Mining and illness go hand in hand, you find one and the other is sure to follow. But why? Through the literature review shown in [Table 1](#) one can see that the presence of certain elements can provoke specific illnesses, which is also supported by the data collected. This study examines exactly that, considering three Utah cities and investigating the causes of death from death certificates for 1904-1940. One town is Springville, where there were no major mining operations and it acts as a control. Next is Price, in Carbon County. It was a prolific mining town that continues to make its money from the coal deposits found within its mountains. The third town is Bingham, Utah where copper and other metals have been mined. It is now home to what is one of the largest mines in the world, Kennecott Copper mine. This town was heavily influenced by the mining industry and was disbanded in 1971 and has since been mined away. Residents essentially lived among mine dust and mine waste. The literature review in [Table 1](#) shows that some health effects are common to all mining activities but others are specific to metal or coal mining. This study aims to determine if significant differences in the rates of death from different causes can be detected between locations. It also aims to identify the least healthy location of the three towns.

**Table 1.** Review of Key literature on the Health effects of Mining and Exposure to Certain Elements

Exposure	Condition	References
Lead	Aggressive and criminal behavior	Mbonane et al. 2021, Hou et al. 2013, Reyes, 2015, Stretesky et al. 2004
Lead, Copper Smelting, coal mining, mining	Respiratory illness, Lung Cancer, TB	Haase et al. 2021, Mbonane et al. 2021, Seixas et al. 1992, Tomaskova et al. 2012, Lubin et al. 2000, Ngosa et al. 2016, Othene et al. 2021
Mining dust	Heart Disease	Landon et al. 2011
Mining	Depression	Hou et al. 2013, Grum et al. 2006
Mining	Alcoholism	Kouame et al. 2017, Reid & Sluis-Cremer 1996, Tynan et al. 2017
Mining	Suicide	Schwartz et al. 2021
Mining heavy metals	Kidney, pancreas, liver damage, Nephritis, unnecessary Appendectomy	Isvoran et al. 2021, Mohammadi et al. 2008, Sabolic, 2006, Carrigan et al. 2007
Coal Mining	Stomach Cancer	Brown et al. 1997, Weinberg et al. 1985, Alif et al. 2021
Coal Mining	Epidemic Meningitis	Smallman-Raynor et al. 2017,
Heavy metals	Mis-carriage, Prematurity, Still birth	Amadi et al. 2017, Sabra et al. 2017

## Methodology

Thousands of Utah death certificates were manually indexed. The chief cause of death was categorized as follows:

- 1) Accidental, 2) Respiratory, 3) Cardiac,
- 4) Cancer, 5) Premature/still birth,
- 6) Involving, Kidney/pancreas/appendix,
- 7) Homicide, 8) Other, 9) Suicide, 10) Alcoholism and 11) Meningitis

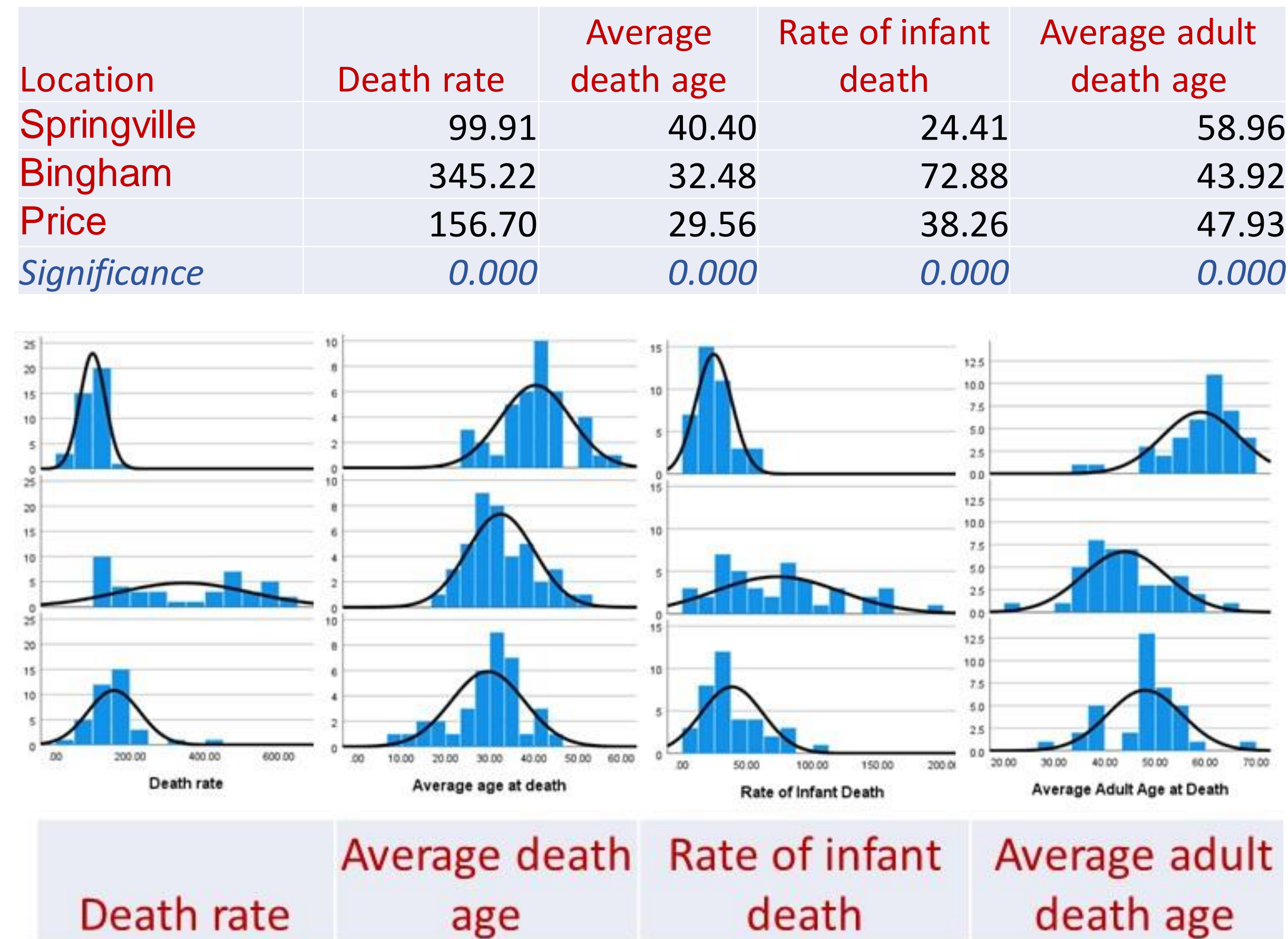
The rates of each cause of death per 10,000 for 1904-1940 were calculated for each city by dividing the count of a certain cause of death by the population of the city in that year and multiplying the result by 10,000. Rates for several variables were highly skewed so non-parametric Kruskal Wallis H comparison tests were used to compare rates between towns.

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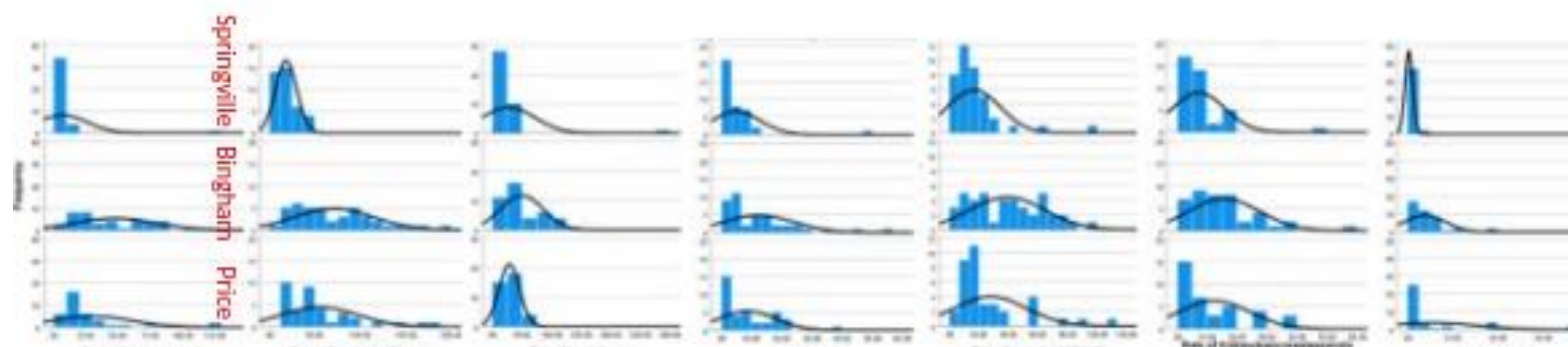


**Figure 1:** Table and Histograms showing the results of Kruskal Wallis H tests comparing death rate, average age at Death, rate of infant death and average adult age at death



**Figure 2:** Pie Charts showing the proportions of Death Age Classes for Springville, Bingham and Price, Utah

Location	Rate Accidental	Rate Respiratory	Rate Cardiac	Rate Cancer	Rate premature or still born	Rate kidney pancreas appendix	Rate Homicide	Rate other	Rate Suicide	Rate Alcoholism	Rate Meningitis
Springville	6.83	18.64	27.40	4.98	16.66	7.20	0.31	33.83	0.35	0.40	1.11
Bingham	47.75	71.11	49.46	12.41	39.29	15.64	3.84	105.36	1.44	2.07	4.25
Price	29.97	55.24	28.59	8.61	27.87	12.34	5.32	91.57	3.53	1.84	2.72
Sig.	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.023	0.003	0.065



**Figure 3:** Table and Histograms showing the results of Kruskal Wallis H tests comparing rates of death from different causes

## Discussion

For all causes of death, there are statistically significant differences between the three towns. Bingham, a copper mining town, had the highest general rate of death out of the three cities with the lowest overall age at death ([Figure 1](#)). Not only is mining in and of itself extremely hazardous, it was especially dangerous during the years analyzed (1904-1940). Exposure to heavy metals (like copper and lead) can result in higher rates of respiratory cancer, aggression and severe organ failure ([Figure 3](#)). Price had the highest rates of homicide and suicide, but Bingham had the highest rates of death from all other conditions ([Figure 3](#)). Research shows that coal and metal miners are known to often have chronic lung issues, as well as being prone to fits of aggression and depression which can lead to homicide, suicide and alcoholism. Springville, the control, had rates of death much lower than the other two towns in general for all conditions and had a significantly higher age at death. For Springville, the two age groups with the largest proportions of death are 0-1 and >60 whereas for Bingham and Price the >60 age group has a smaller proportion of deaths ([Figure 2](#)). This is showing how more people die in old age in Springville's healthier living and working conditions. For Bingham, the 0-1 and the 18-40 age groups dominate deaths. The high infant mortality rate and accidental death rates for Bingham are probably the reasons why the 0-1 and 18-40 age groups dominate deaths in Bingham ([Figure 2](#)). For Price, there are almost equal proportions of deaths for the 0-1, 18-40, 40-60 and >60 age groups and small proportions of deaths for the 1-5 and 5-18 age groups.



**Figure 4 a)** Picture of Miner, **b)** Picture of Dusty and Smoky Environment in Bingham, Utah, 1916

## Conclusions

This study shows that an individual is likely to die at an earlier age and in a more unnatural way in a mining town than a non-mining town. From these data, it seems that metal mining is generally more harmful to health than coal mining, but this may also be associated with the compact valley and living among the mine waste in a dusty and smokey environment in Bingham ([Figure 4b](#)). Other analysis (not shown) looked at occupational exposures and it seems that there is more risk from being a miner ([Figure 4a](#)) than just living in a mining town as there is not constant occupational exposure for mere residents of a town. Even within mining towns, however, there are significant differences between rates of certain illnesses. Through data collection and statistical analysis it is concluded that even just between mining of heavy metals and coal there are specific illnesses that accompany each type of mining.

Full Reference list available from first author upon request: awellin3@student.byu.edu