Is there a growing demand for non-traditional burial in the UK?

Born out of the curiosity for numbers of COVID-19 related-deaths and concern for burial space in the UK, our goal here is to analyze trends in end-of-life disposition, predict prices for traditional and non-traditional burial, and ultimately provide insight for most reasonable solution to the problem of declining burial space.

According to the combined sources of Wikipedia, The New York Times, JHU CSSE COVID-19 Data, and Our World in Data, there have been 219 million COVID-19 cases and approximately 4.55 million deaths globally. In the UK, there have been 6.86 million cases and 133,178 deaths.

Burials as well as cemetery upkeep are very costly, both fiscally and environmentally. According to Thinkwillow.com, average funeral costs vary depending on the region in the UK. In South West of England funeral costs are around *£4,500* while in London it's roughly *£6,000*. Cremations on average cost around *£3,000-£4,000*. Traditional burial, which includes basic coffin, hearse, collection and care of loved one, and a funeral director comes at about £5,000. The funeral director alone covers 50-60% of total cost of a funeral - so approximately £2,500. Other amenities and services have additional costs. It's important to remember these figures as we go on.

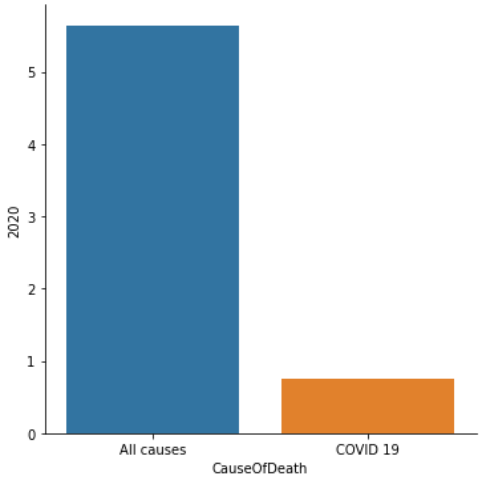
Take into account the environmental costs as well. An average cremation uses 92 cubic metres of natural gas - about 400 kg of CO_2, equivalent to a 500 miles car trip. Cremations also release toxic gases like dioxins, PCDFs, and mercury. Most coffins used in the UK for cremations are made from chipboard or MDF that release harmful nitric oxide and nitrogen dioxide when burned. Materials used for burials cannot be reused and most items won't decompose for decades. Lastly, it is unlikely or at least difficult to convert cemeteries to woodland or pasture and cities are running out of space for cemeteries (a quarter of England's cemeteries are expected to be full by 2023).

Sources

1. Office for National Statistics
2. Calderdale Metropolitan Borough Council
3. Wikipedia
4. Google maps
5. BBC News
6. Individual borough's websites (for burial fees)
7. Cemetery websites

Data

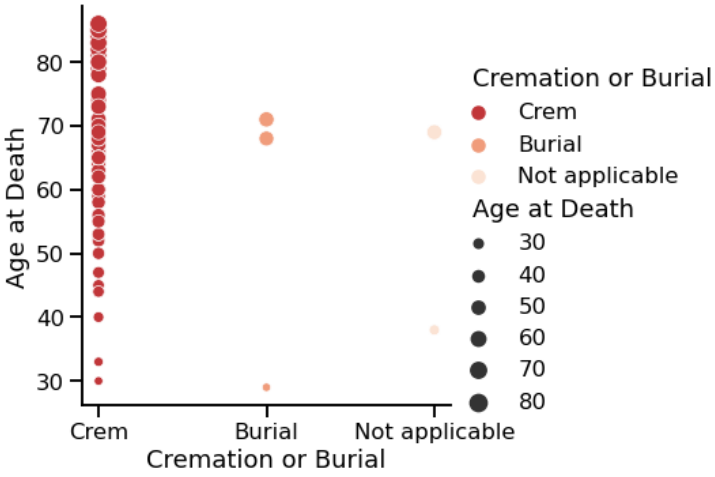
One of main goals of this capstone is to investigate how the covid-19 pandemic has affected funeral services and end-of-life body disposition in the UK, so we are looking at data from 2019 to 2021 (present) specifically. Data for full body burials or cemetery burials are from 2016-2021. The first data presented here is from 2020 from the Office for National Statistics, which includes number of deaths from districts across England, and cause of death recorded as either from Covid-19 or other causes simplified into a bar graph:

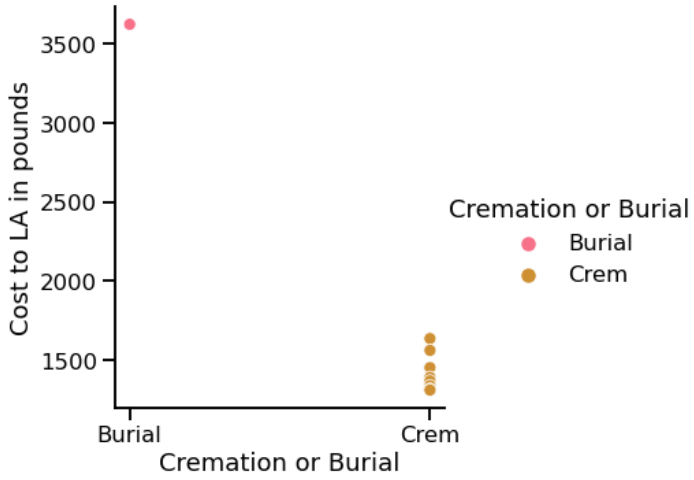


This dataset has 419,309 records, so it does not represent the entire population of UK. In 2020, according to BBC News and other sources, there were around 5.3 million recorded cases of Covid-19, with a total of 128,642 deaths.

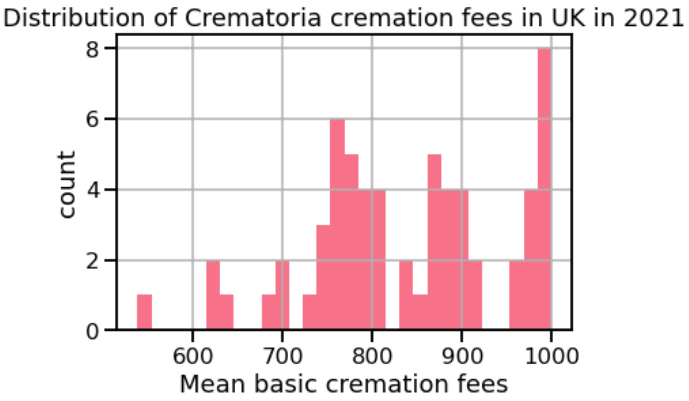
Exploratory Data Analysis

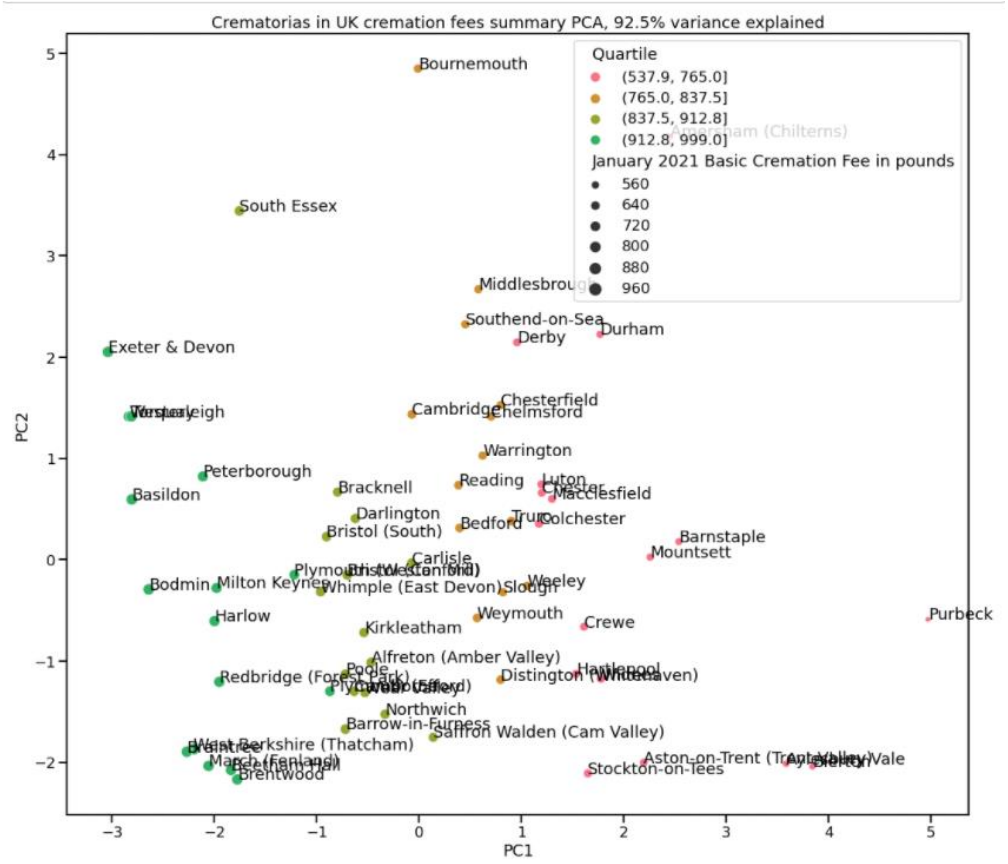
Cremation vs Burial





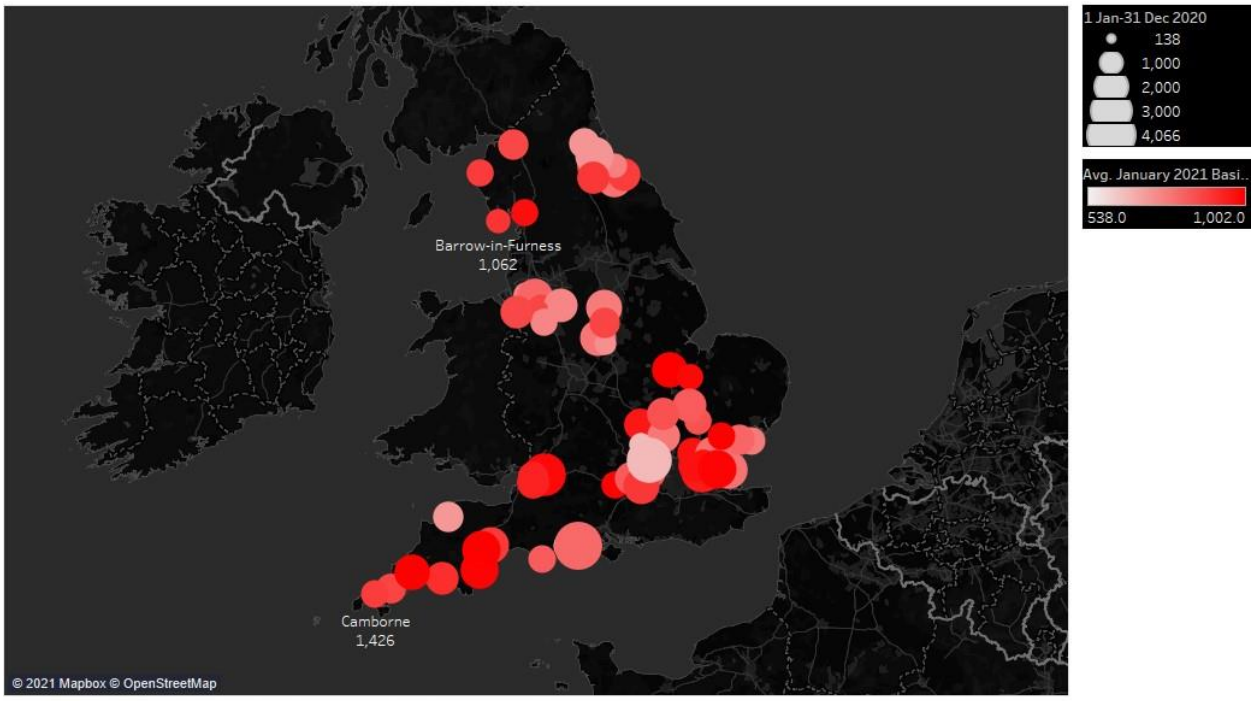
Crematoriums in UK





Crematoriums – Mapping and Analysis utilizing Tableau

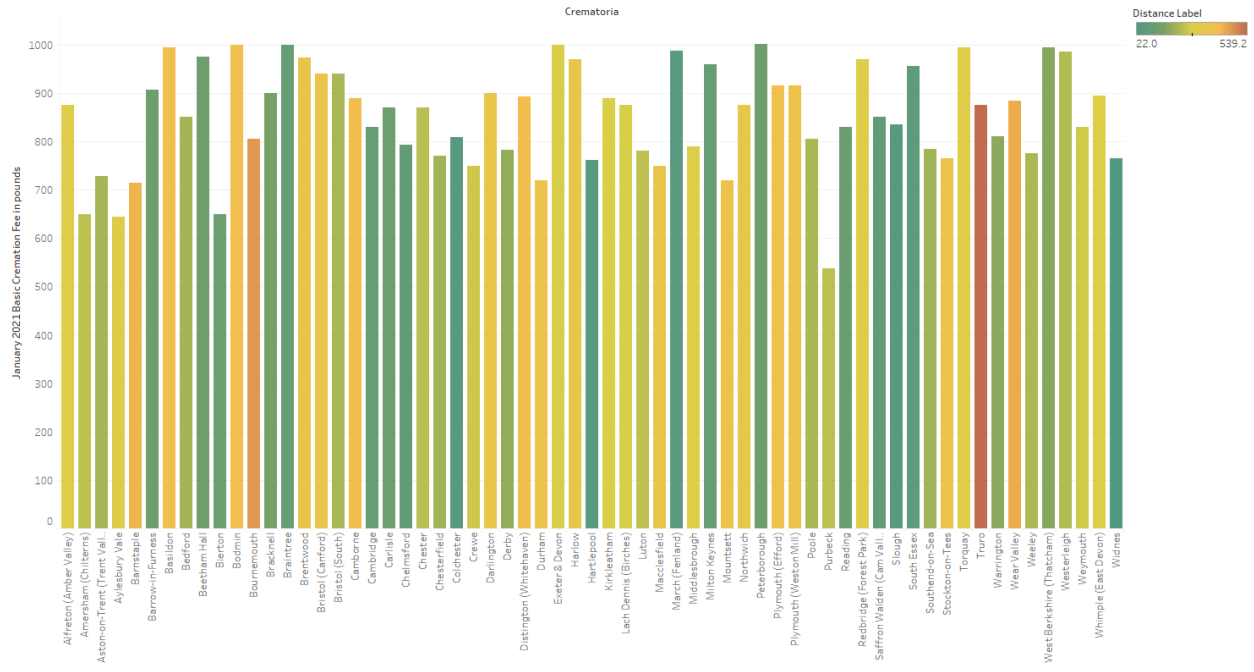
Sheet 1



Map based on average of Longtitude and average of Latitude. Color shows average of January 2021 Basic Cremation Fee in pounds. Size shows sum of 1 Jan-31 Dec 2020. The marks are labeled by Crematoria and sum of 1 Jan-31 Dec 2020. The view is filtered on Crematoria, which keeps 63 of 63 members.

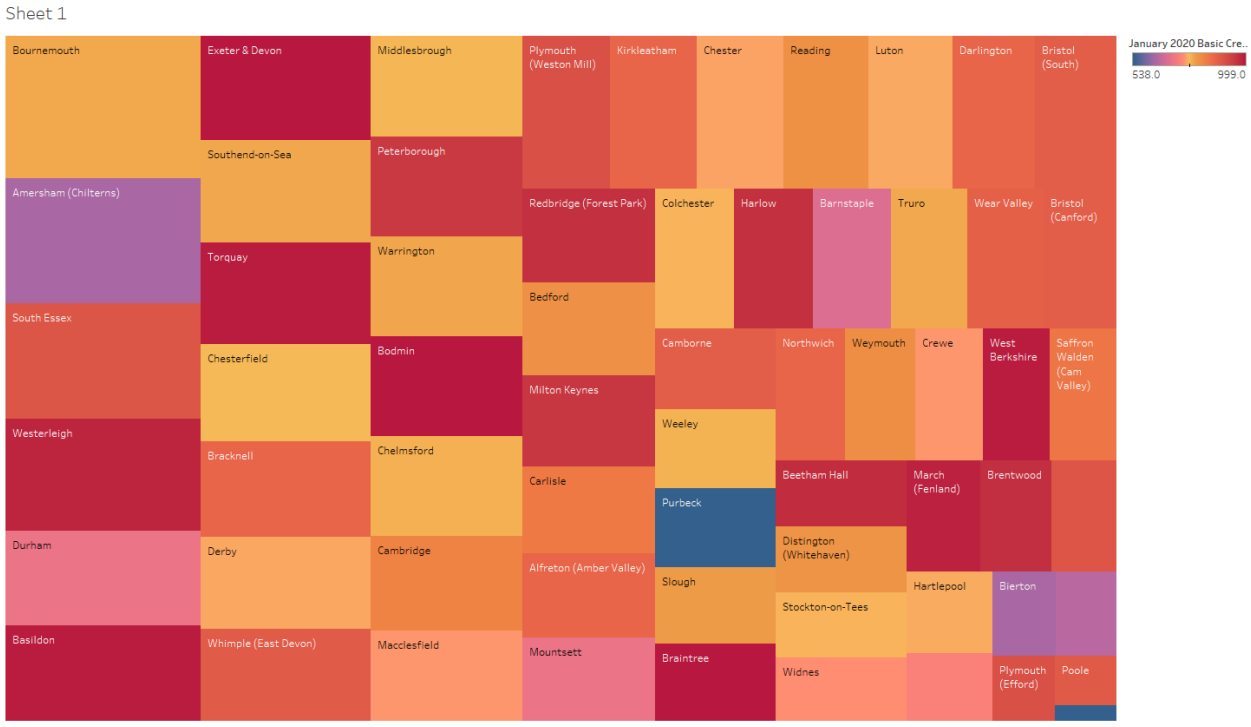
The above figure shows relationship between number of cremations in 2020 and Average Jan 2021 basic cremation fees. The size of the circle shows number of cremations, with larger being more. The color indicates range of cremation fees, with white being less expensive and red more expensive.

Sheet 2



Sum of January 2021 Basic Cremation Fee in pounds for each Crematoria. Color shows sum of Distance Label.

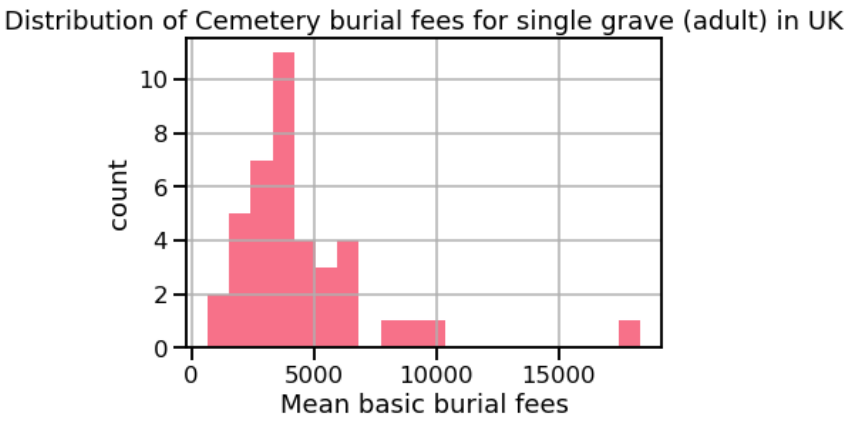
Bar chart of Crematoria, January 2021 basic cremation fees and relative distances between crematoria is shown here. Truro, Bournemouth, and Wear Valley stand out.

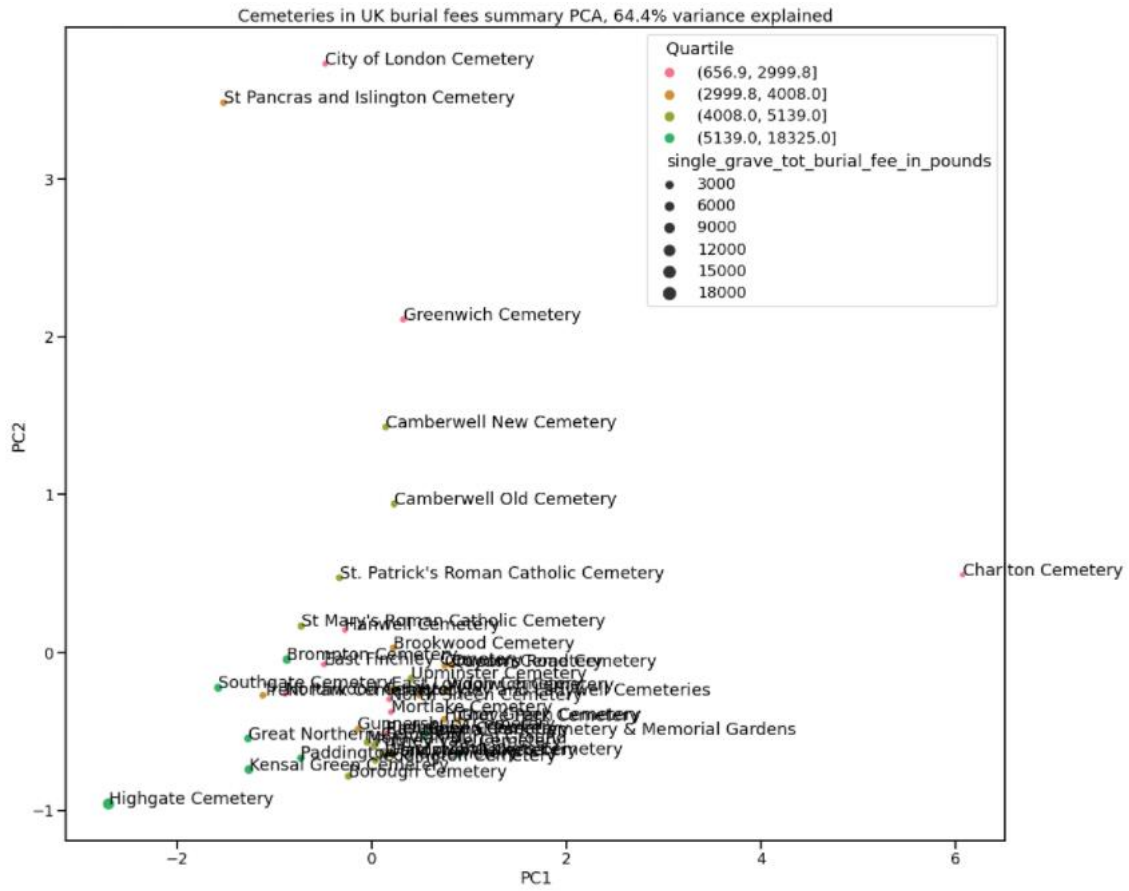


Crematoria. Color shows sum of January 2020 Basic Cremation Fee in pounds. Size shows sum of 1 Jan-31 Dec 2020. The marks are labeled by Crematoria. The view is filtered on Crematoria, which keeps 63 of 63 members.

Using Tableau's treemap, we are able to now which Crematoria in which district in the UK had the highest basic (average) cremation fees in January 2021 and the most cremations in 2020. The larger the square, the more cremations, and the color bar at the top shows that blue or purple indicates less expensive basic cremation fees and red is more expensive. According to this, Bournemouth had the most cremations in 2020 and Lach Dennis (Birches Remembrance Park & Crematorium) had the least. Based on the scale at the top right, Exter & Devon, Torquay, Bodmin, West Berkshire, March (Fenland), Westerleigh, Basildon, and Braintree have the highest cremation fees in January 2021. Vice versa, Purbeck, Lach Dennis, Amersham (Chilterns), Bierton, and Aylesbury Vale had the lowest cremation fees.

Cemeteries in UK – Burial data





Cemeteries – Mapping and Analysis utilizing Tableau

Sheet 1

Map based on average of Longtitude and average of Latitude. Color shows sum of Single Grave Tot Burial Fee In Pounds. Size shows Tot Num Bodies Or Graves as an attribute. The marks are labeled by Burial site.

The figure above shows a relationship between number of burials/graves and single grave total burial fees (for adult). Highgate Cemetery shows to be the most expensive, although not the most in terms of bodies buried. It seems St. Pancras and Islington Cemetery has the most bodies buried and/or most graves.

Sheet 1

Map based on average of Longtitude and average of Latitude. Color shows sum of Tot Num Bodies Or Graves. The marks are labeled by Burial site.

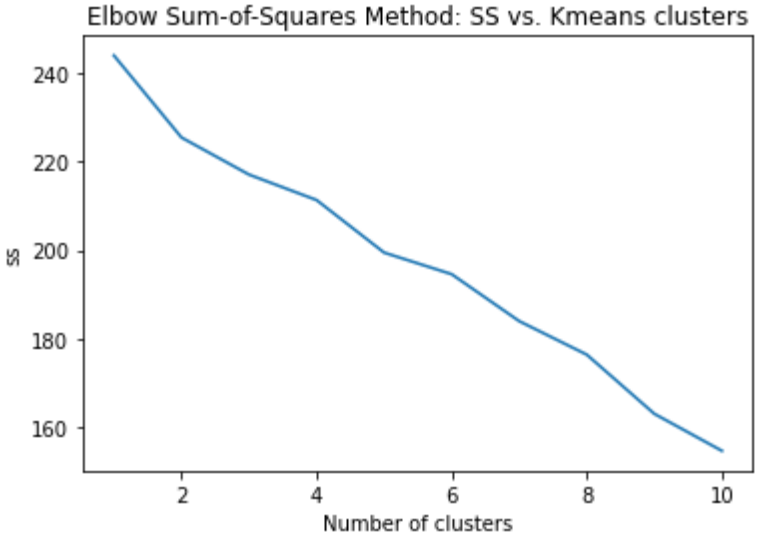
A density map is shown here, where an intense orange color signifies more burials.

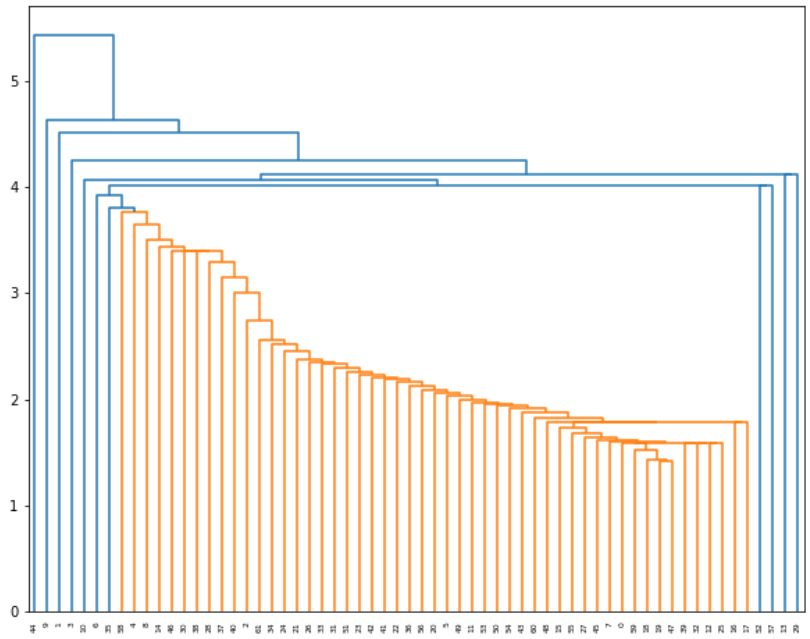
Modeling

After feature engineering dataset for cremation vs. burial and crematoriums, a point-biserial correlation was performed for cremation vs. burial dataset. Point-biserial correlation is the same as the Pearson correlation coefficient used in linear regression, with the difference being dichotomous data is being compared to continuous data instead of continuous data to continuous data. From this point on we assume that our dichotomous data is composed of items from two groups (group 0 and group 1) and the continuous data as “y”. Our results were:

PointbiserialResult(correlation = 0.291, p-value=0.06)

K-means, agglomerative/hierarchical clustering were ran on crematorium dataset.


Elbow Sum-of-Squares Method: SS vs. Kmeans clusters
SS
240
220
200
180
160
2
4
6
8
10
Number of clusters


5
4
3
2
1
0