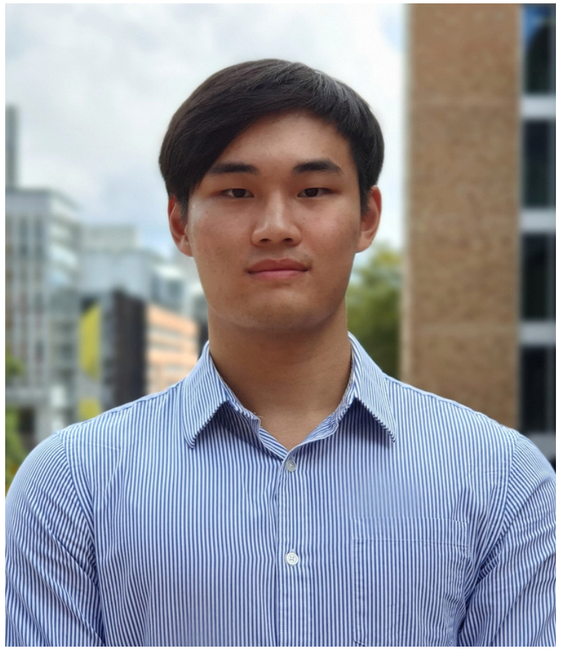
DECONSTRUCTING

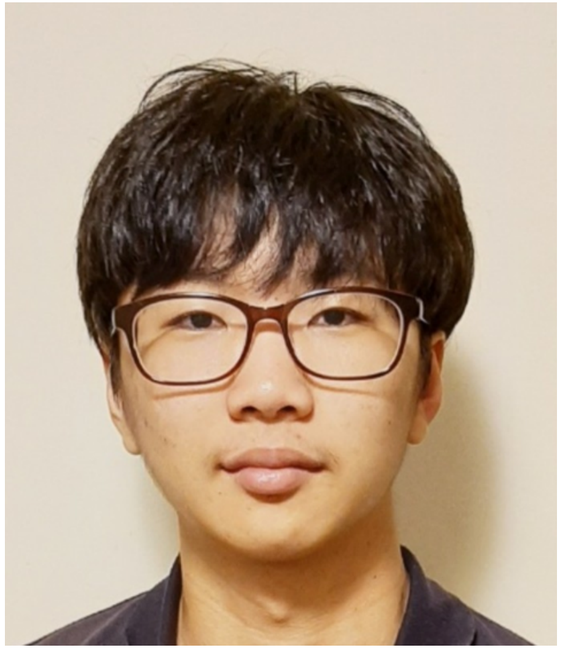
DISASTROUS

DATA

THE TITANS TECH TEAM

Titans Tech





ALEX KIM

STEVE JANG

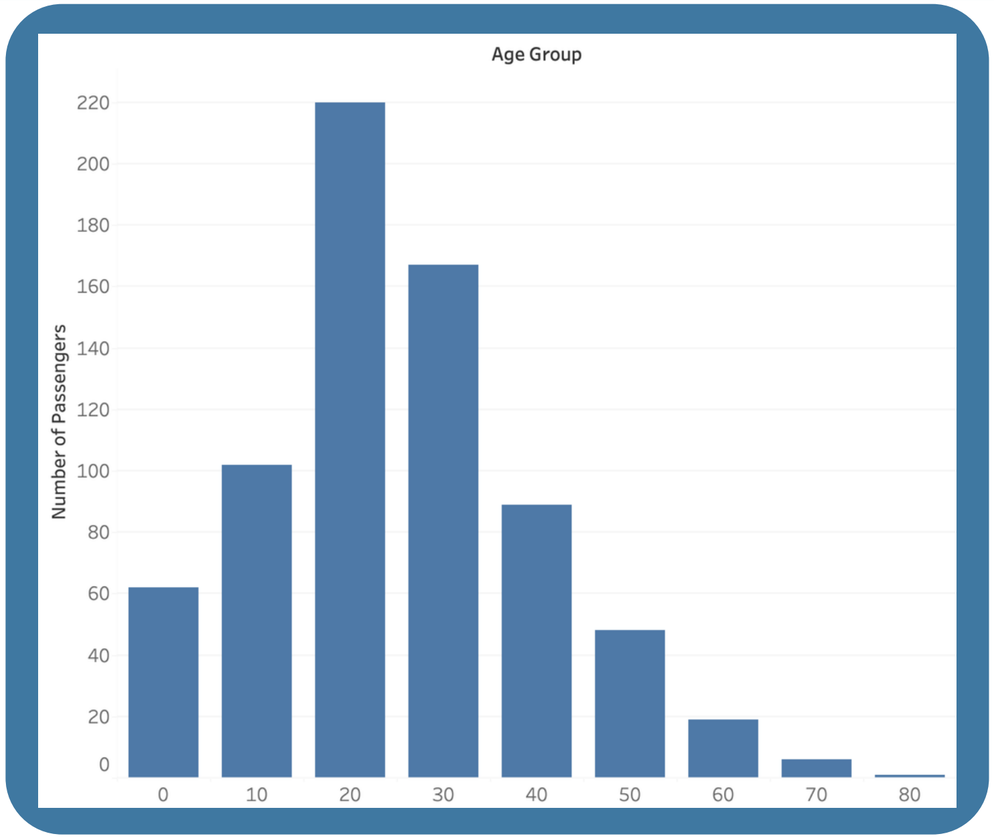
KLAUS LEUNG

DATA CLEANING

Null Values present in the fields: **Age**, **Cabin** and **Embarked**

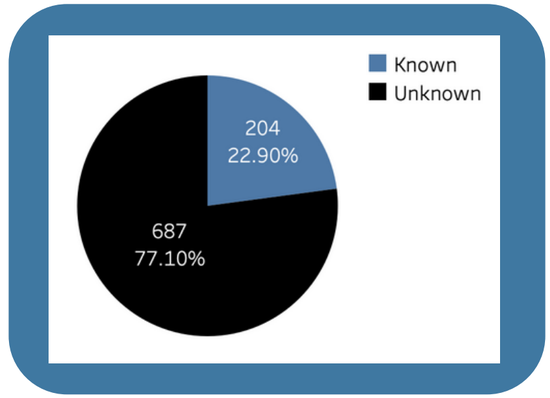
Age

- Backfill the **177** nulls with the **mean** of the ages**,** as it follows the **Normal Distribution**
  - Normality test used to confirm the appropriateness of fit
  - Backfilling with mean is preferred over median or mode, if normally distributed



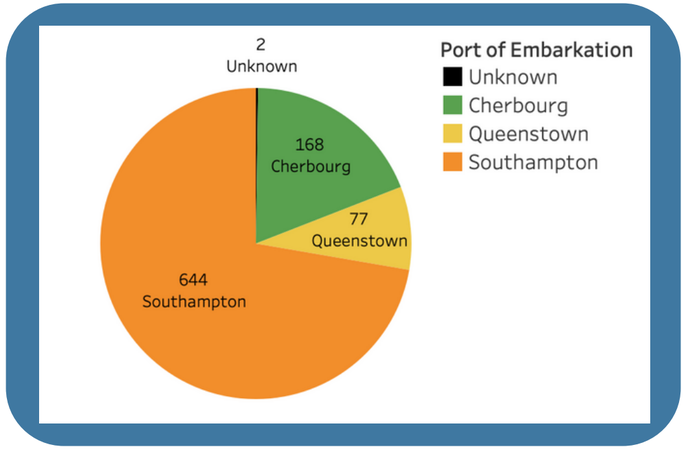
Cabins

- **687 of 891** values are **null**. Replace nulls with a new category, "**Unknown**"
  - Majority of the field is null
  - Cannot backfill with statistical measures as it distorts data



Embarked

- **2 null** values - Backfill nulls with the highest occurring embarkation port, due to the negligible amount



POPULATION OVERVIEW

AGE/SEX DISTRIBUTION

Significantly more males present in the ship, with over 25% of passengers being males in their 20s

Age Group

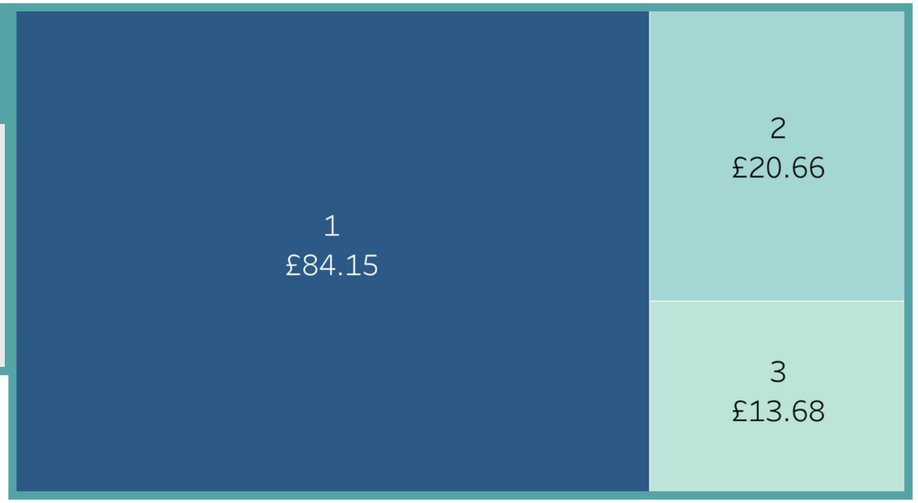
Sex	0	10	20	30	40	50	60	70	80
Female	30	45	125	60	32	18	4		
Male	32	57	272	107	57	30	15	6	1

Count of Age

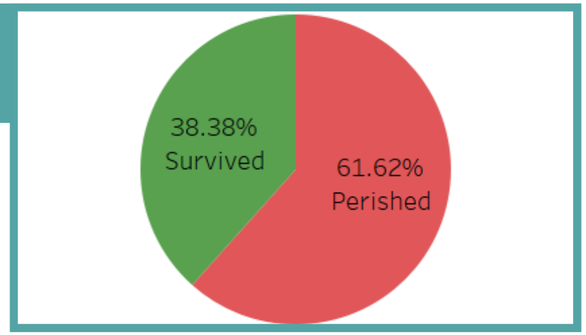
1 272

AVERAGE FARE COST BY CLASS

Today's Cost (USD)
Class 1 - $420.75
Class 2 - $103.3
Class 3 - $68.4

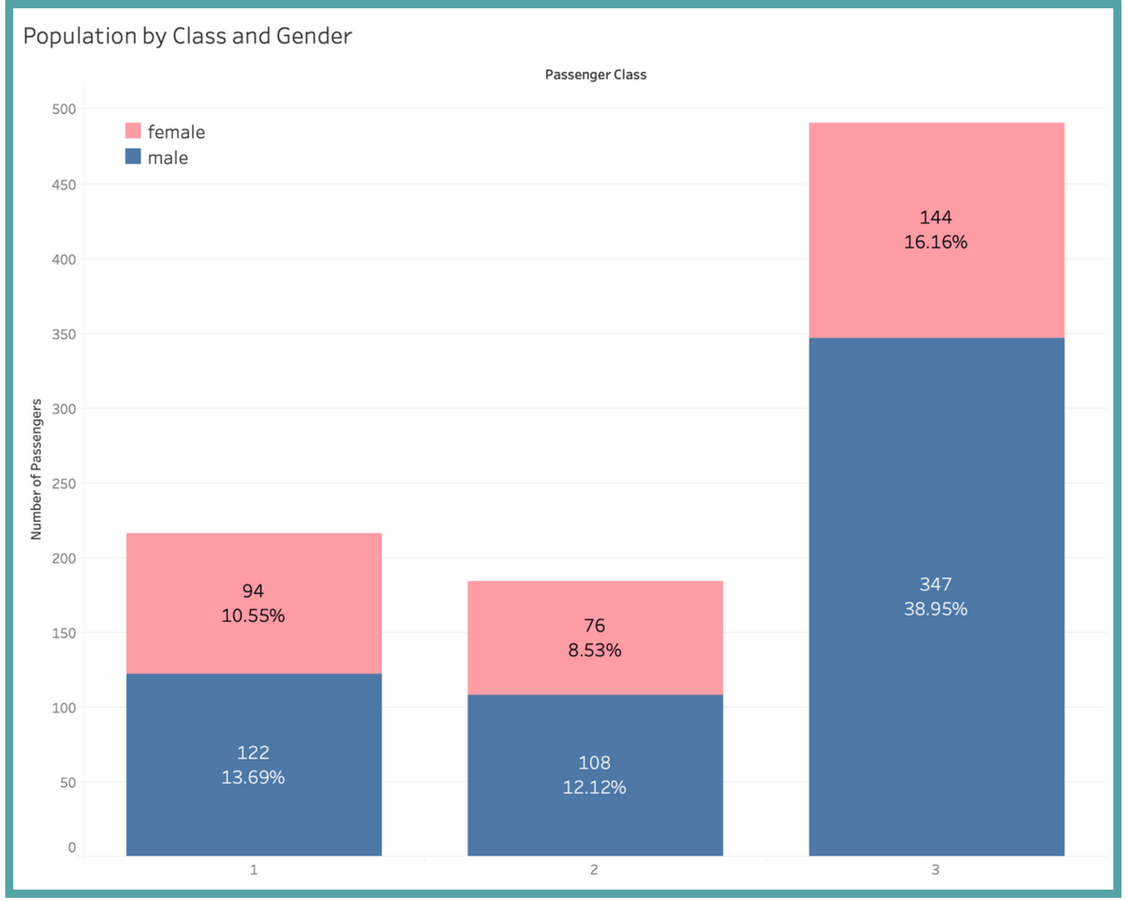


OVERALL SURVIVAL RATE



SEX/CLASS DISTRIBUTION

Most passengers travelled in the 3rd class, which was the cheapest

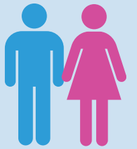


KEY QUESTIONS

WHAT ARE THE MOST IMPORTANT FACTORS AFFECTING SURVIVAL?

1. Does a higher **passenger class** lead to more safety (lower mortality rates)?

2. Did a specific **sex** have a higher survival rate?

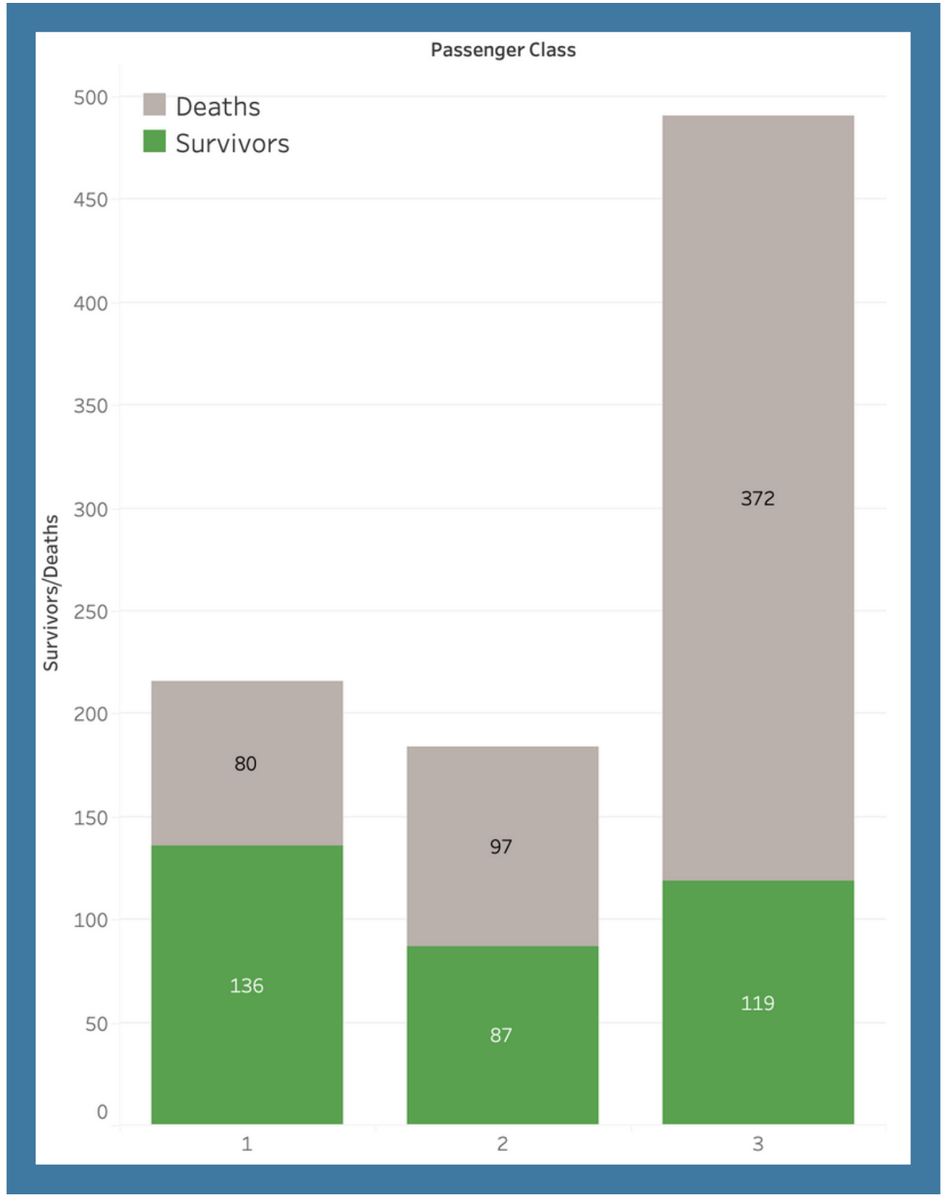


3. How does the survival rate vary between the **ages** (**young and old**)?

4. Did having **family members** lead to a higher survival rate?

PASSENGER CLASS

PASSENGER CLASS



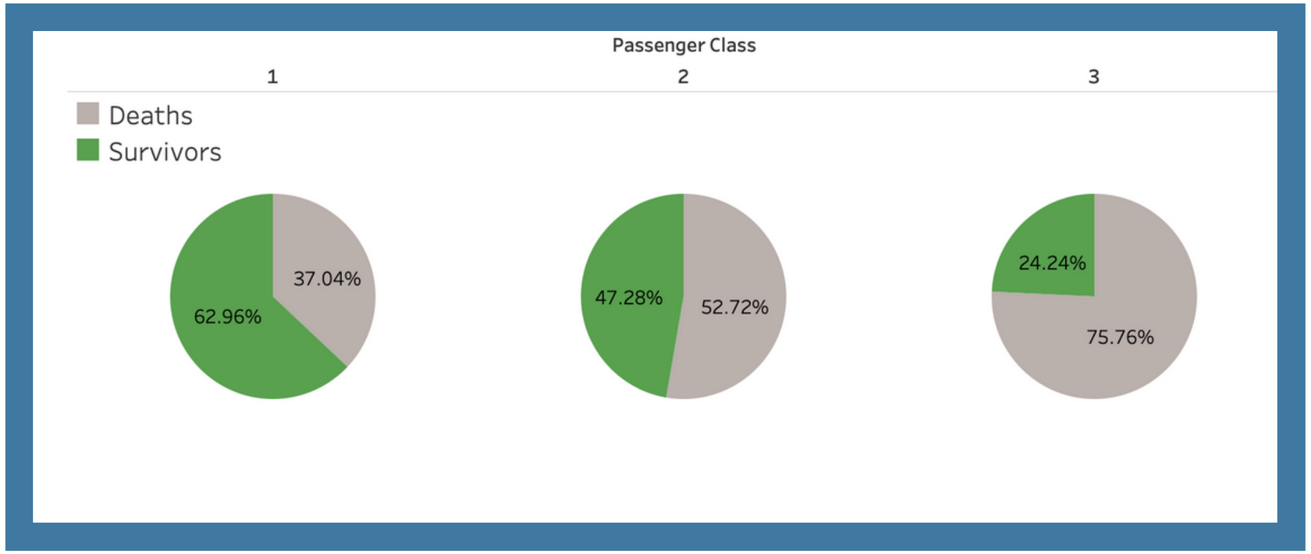
Insights

Higher classes linked to a greater survival rate

1st class passengers **15% more likely** to survive than 2nd class
2nd class passengers **2 times more** likely to survive than 3rd class

Disparity in survival chances occurred although there were more 3rd class passengers than **1st and 2nd combined**

This disparity + population difference meant that more than **two thirds** of deaths were from the **3rd class**



PASSENGER CLASS: FARE PRICES

Greater survival rate with higher fares paid

Higher fare prices is directly related with higher passenger class

Rich passengers survived more than commoners

*This is despite the total number of 1st class passengers being only **44%** of the number of 3rd class passengers.*

Disparity due to the disadvantageous cabin positions of the 3rd class on the Titanic

***66%** of those who spent **£50 or less** died*

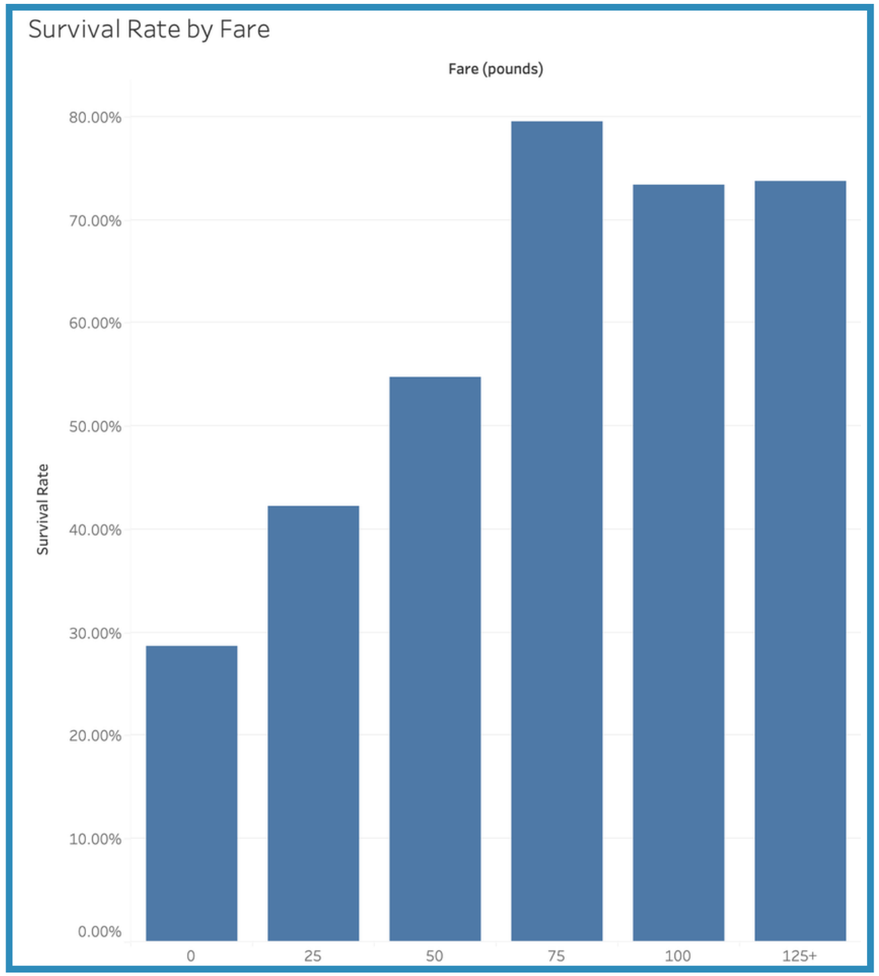
***24%** of those who spent **£75 or more** died*

.....

*An **increased 42% chance** of survival!*

Survivors/Deaths by Fare

	Fare (pounds)					
	0	25	50	75	100	125+
Survived	160	73	35	35	11	28
Died	397	100	29	9	4	10



PASSENGER CLASS: CABINS

The Illustrations show that the higher passenger class cabins were more spacious, meaning that passenger density was lower, allowing for **faster evacuation**

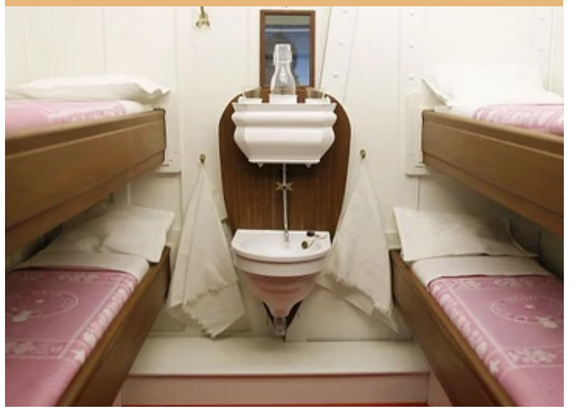
The **staircases** would have gotten heavily clogged during the scramble, especially for the **third class**, where the majority of people belonged

*The Titanic had a total of **17 stories***

FIRST CLASS

SECOND CLASS

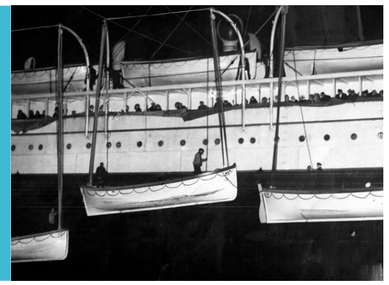
THIRD CLASS



PASSENGER CLASS: CABINS

The lifeboats were designed to hold only **65 people** each

The lifeboats were stored at the **top & middle** of the Ship, nearest to 1st class



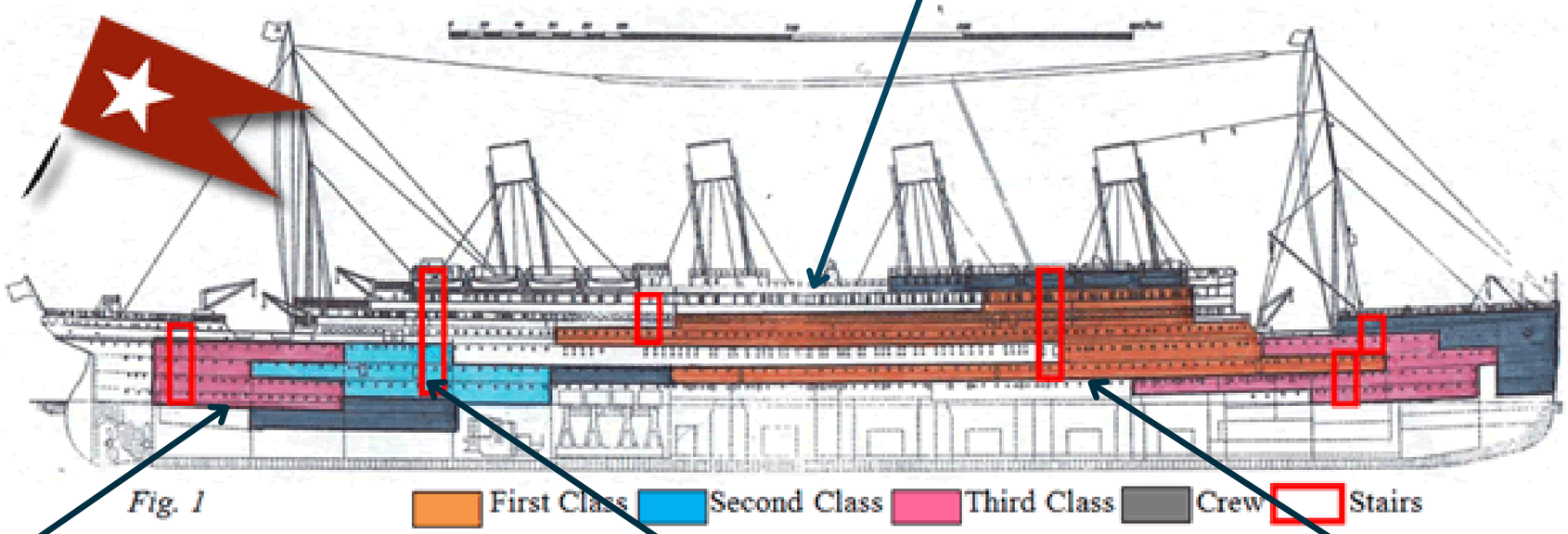


Fig. 1

The third class cabins were on each **end** of the Ship, being the **most distant** from the exits and lifeboats

The second class cabins had a **direct** but long staircase leading to the lifeboats

First class passengers were situated **closest** to the 20 lifeboats' storage

Passenger Class | Sex | Age | Family

PASSENGER CLASS: 3RD CLASS ETHNICITIES

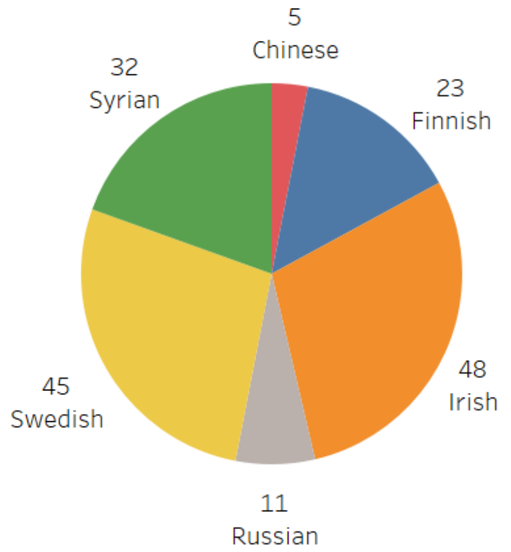
Last names of passengers were analysed with a data warehouse of names to predict possible **ethnic backgrounds**

Majority of the 1st and 2nd class passengers were **native Europeans**

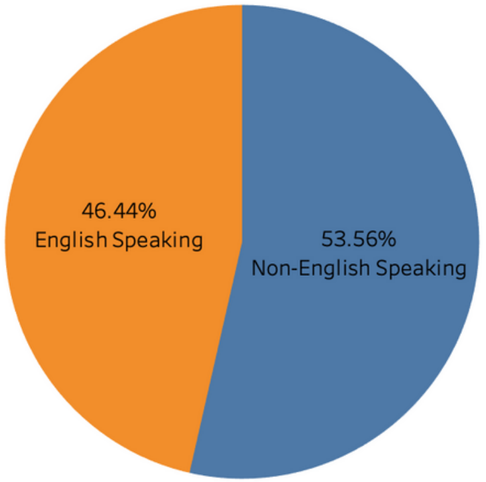
1st class: upper class (businessmen, politicians)
2nd class: tourists, authors
3rd class: immigrants moving to US / Canada

Highly likely that third-class emigrants died due to **poor English skills**, hindering **communication** and lowering their likelihood of survival

Immigrant Ethnicities



3rd Class Passengers by Language



SEX

SEX: ANALYSIS

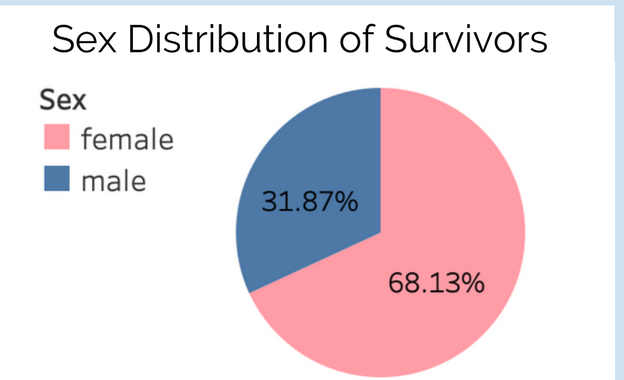
- Males had a **19%** survival rate
- Females had a **74%** survival rate

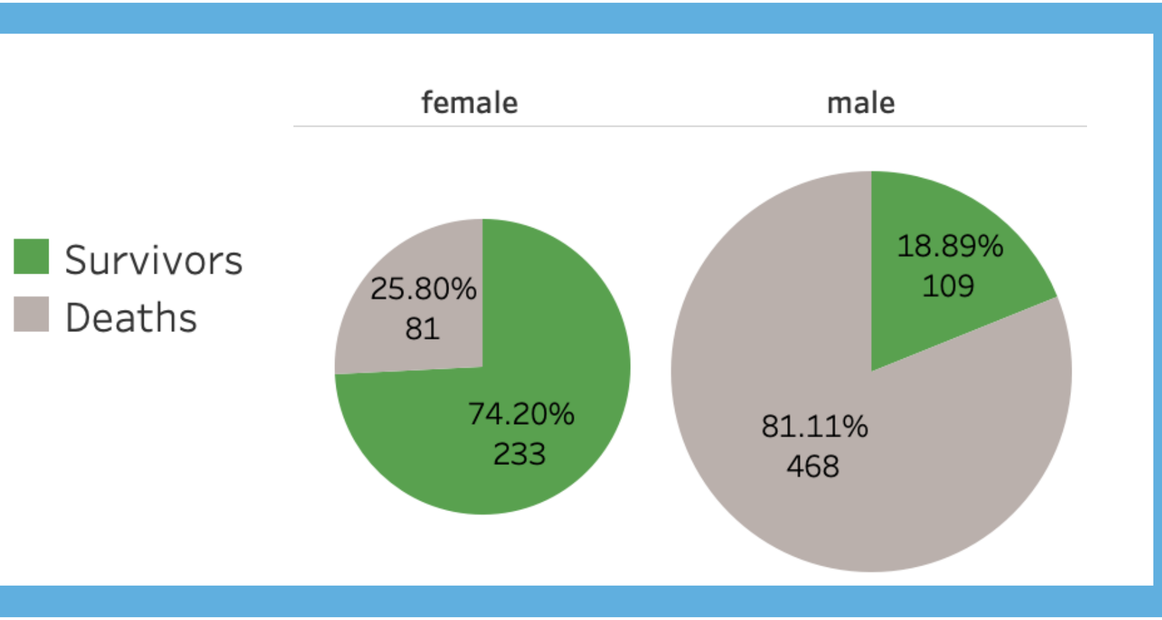
Huge disparity caused by:

- "Women and children first" mentality
- Men most fit to help others

Interesting Facts:

- **97%** of crew members were male
- The number of males who died **exceeds** total females onboard





SEX: HISTORICAL CONTEXT

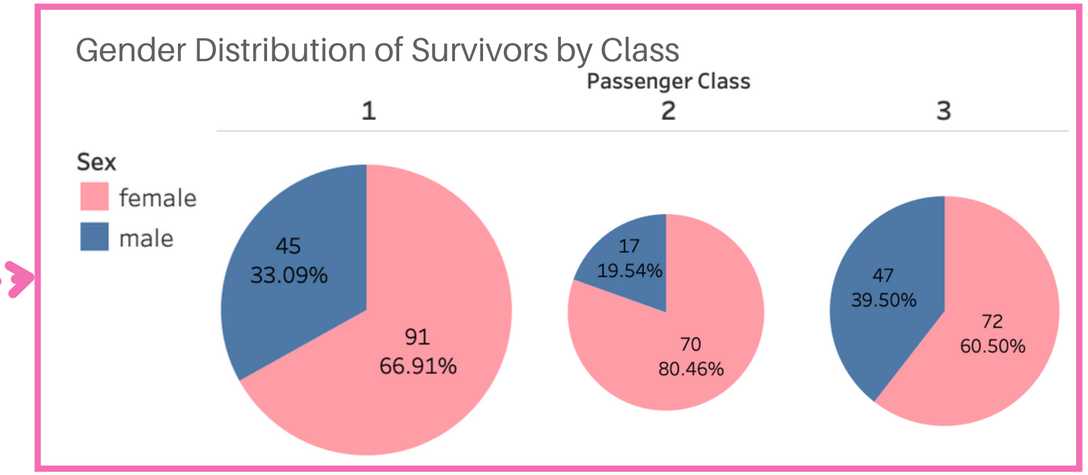
Women in society	Edwardian Era
Increased societal interest towards women's rights	Chivalry common, with a **"Ladies first"** European etiquette
Women had increased employment opportunities	Deemed correct behaviour for men to give women **precedence over themselves**
Although excluded from leadership roles, women gained a wider access to knowledge sources	Large disparity between rich and poor, with great change (political + social)

These contextual factors likely influenced the prioritising of women's survival in the Titanic evacuation

SEX: PASSENGER CLASS & AGE

Further Insights

- For every passenger class, at least **60%** of survivors were women
- No women aged 60+ died, likely due to others (men) prioritising their evacuation
- Female survivors aged 50+ are displayed on the right:
  - **14 of 20** from First Class
  - **17 of 20** were native English speakers
- Reinforces that **First Class** Passengers, and **native English speakers** were more likely survive



Survival Rates by Age and Gender

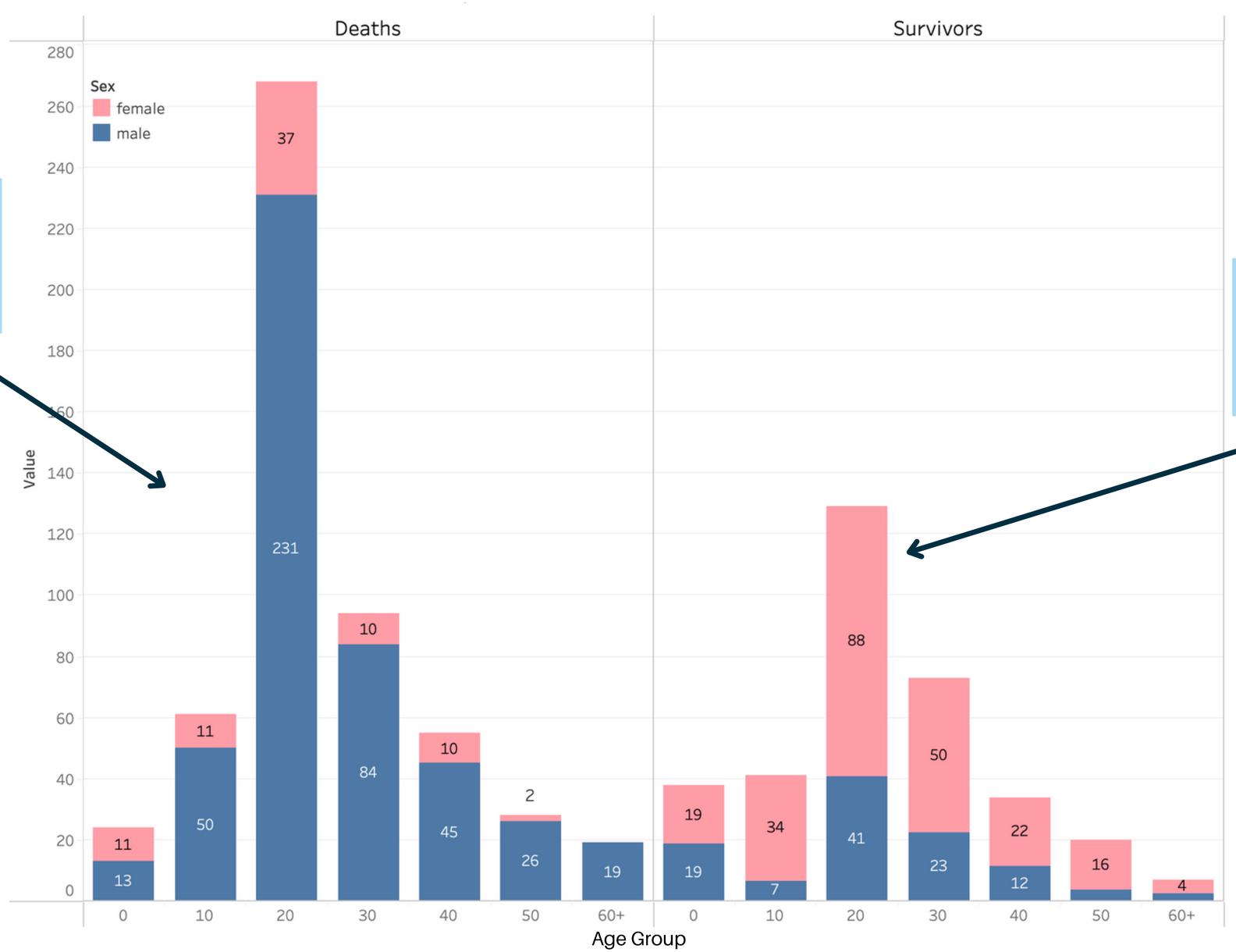
Sex	Age Group 0	10	20	30	40	50	60+
female	63.33%	75.56%	70.40%	83.33%	68.75%	88.89%	100.00%
male	59.38%	12.28%	15.07%	21.50%	21.05%	13.33%	13.64%

Background, Age and Class of 50+ Female Survivors

Name	Passenger Class	Age	English Background
Andrews, Miss. Kornelia Theodosia	1	63	Yes
Appleton, Mrs. Edward Dale (Charlotte Lamson)	1	53	Yes
Baxter, Mrs. James (Helene DeLaudeniere Chaput)	1	50	Yes
Bonnell, Miss. Elizabeth	1	58	Yes
Eustis, Miss. Elizabeth Mussey	1	54	Yes
Graham, Mrs. William Thompson (Edith Junkins)	1	58	Yes
Hays, Mrs. Charles Melville (Clara Jennings Gregg)	1	52	Yes
Hogeboom, Mrs. John C (Anna Andrews)	1	51	Yes
Lurette, Miss. Elise	1	58	No
Potter, Mrs. Thomas Jr (Lily Alexenia Wilson)	1	56	Yes
Rothschild, Mrs. Martin (Elizabeth L. Barrett)	1	54	No
Stephenson, Mrs. Walter Bertram (Martha Eustis)	1	52	Yes
Stone, Mrs. George Nelson (Martha Evelyn)	1	62	Yes
Warren, Mrs. Frank Manley (Anna Sophia Atkinson)	1	60	Yes
Hewlett, Mrs. (Mary D Kingcome)	2	55	Yes
Hocking, Mrs. Elizabeth (Eliza Needs)	2	54	Yes
Parrish, Mrs. (Lutie Davis)	2	50	Yes
Ridsdale, Miss. Lucy	2	50	Yes
Toomey, Miss. Ellen	2	50	Yes
Turkula, Mrs. (Hedwig)	3	63	No

SEX: AGE DISTRIBUTION BY OUTCOME

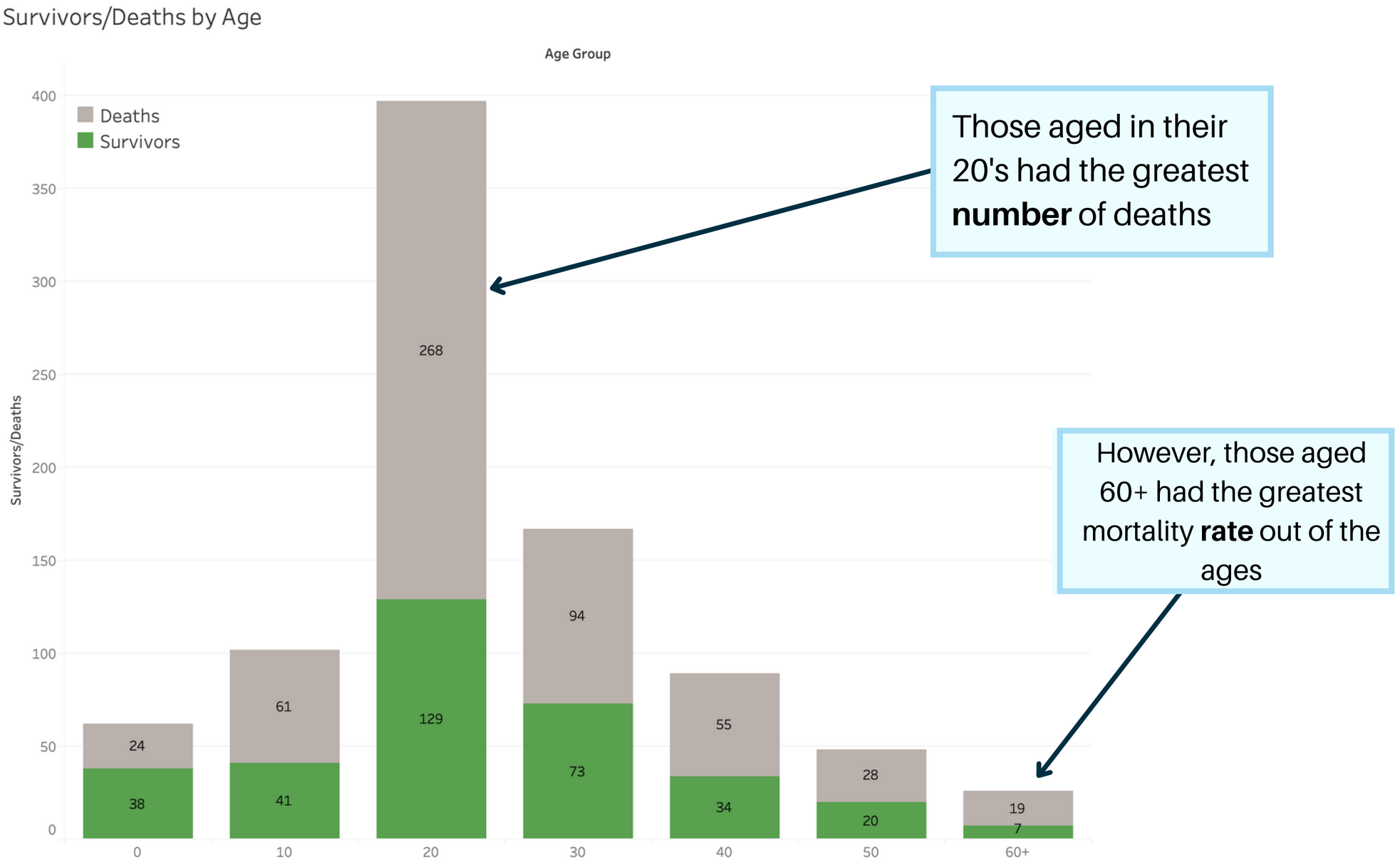
A majority of people who perished were young men, especially those in their 20s



For every age group, 50% or more survivors were women

AGE

AGE: SURVIVORS/DEATHS



Those aged in their 20's had the greatest **number** of deaths

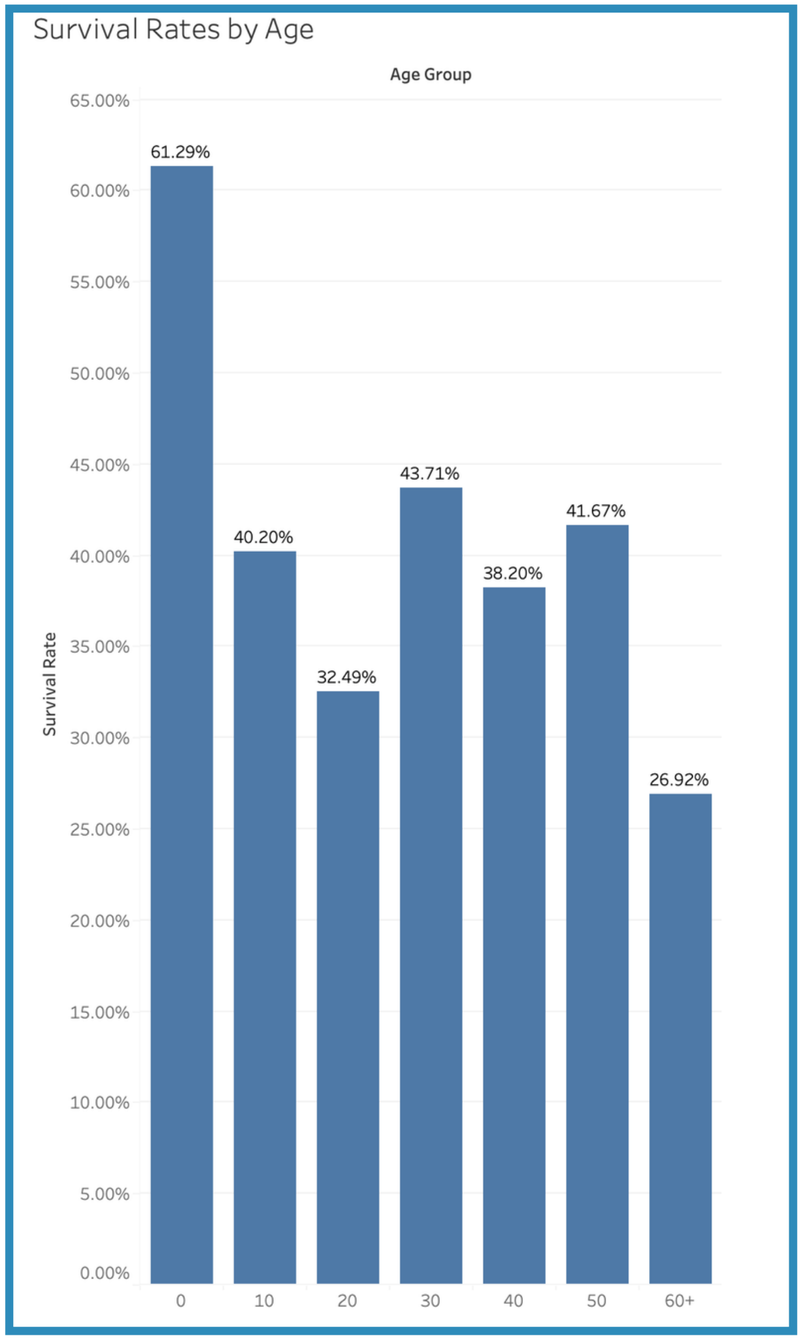
However, those aged 60+ had the greatest mortality **rate** out of the ages

AGE: ANALYSIS

Elderly passengers, especially **ages 60+** had the lowest survival rate - most liable to perish from **hypothermia** in **-2°C waters**

Children aged **0-9** years old had the highest survival rate, likely due to their safety being prioritised by their **parents**

Older children and young men in their **20s** had a surprisingly low survival rate despite their relative fitness - likely due to **confidence** and helping weaker age groups



AGE: PASSENGER CLASS

Those aged in their **20's** died the most, as a majority of them were in 3rd class

- Likely due to inability to afford high class tickets compared to those older

Pclass	Age Group 0	10	20	30	40	50	60	70	80
1	3	18	64	50	37	27	13	3	1
2	17	18	64	48	18	15	3	1	
3	42	66	269	69	34	6	3	2	

Count of Age

1 — 269

Men aged 20+ had highest mortality rate

- Were confident with their ability to help others
- Combination of the 2 factors with worst survival rate: 3rd Class & Male

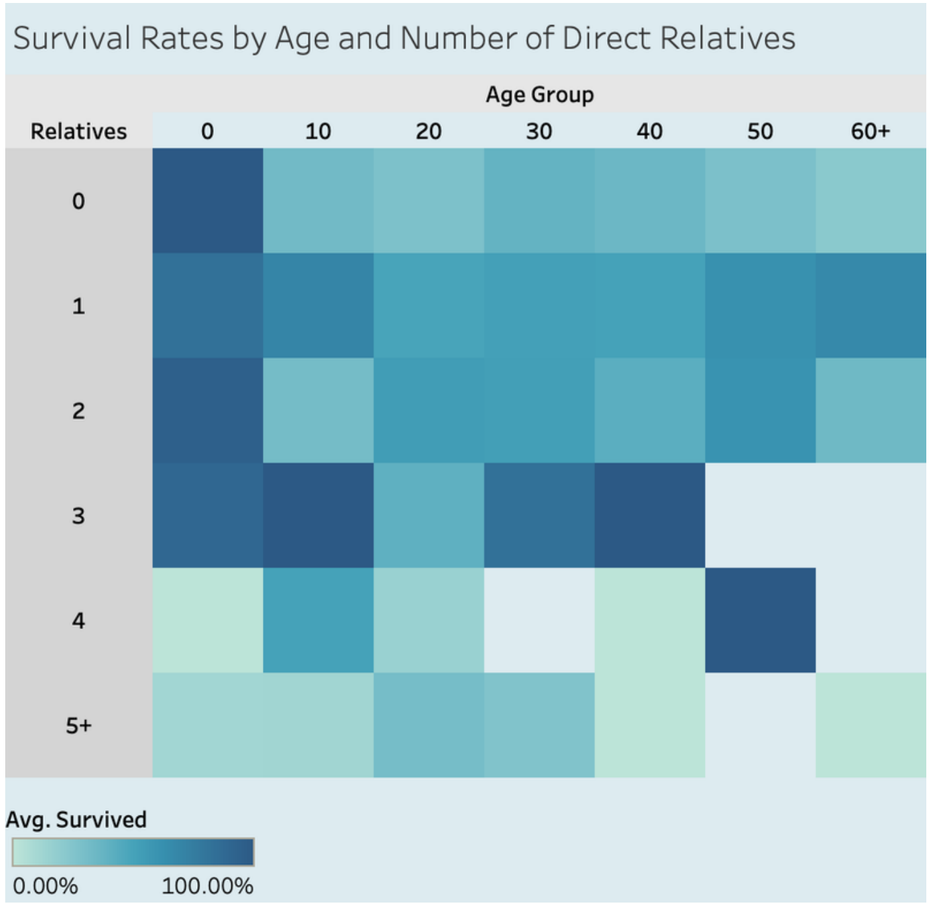
Interestingly , the survival rate of **1st class men** was very similar to that of **3rd class children** (**both about 35%**), despite children being prioritised over men in general

- This affirms that **Passenger Class** was the most important factor for survival

Richard L. Beckwith | 1st Class
Stockbroker

Clarence G.H. Asplund | 3rd Class
Child of 2 boarded parents

AGE: FAMILY MEMBERS



Heatmap Analysis

Higher age linked to lower survival rates

As age group increases, more family members increased survival:

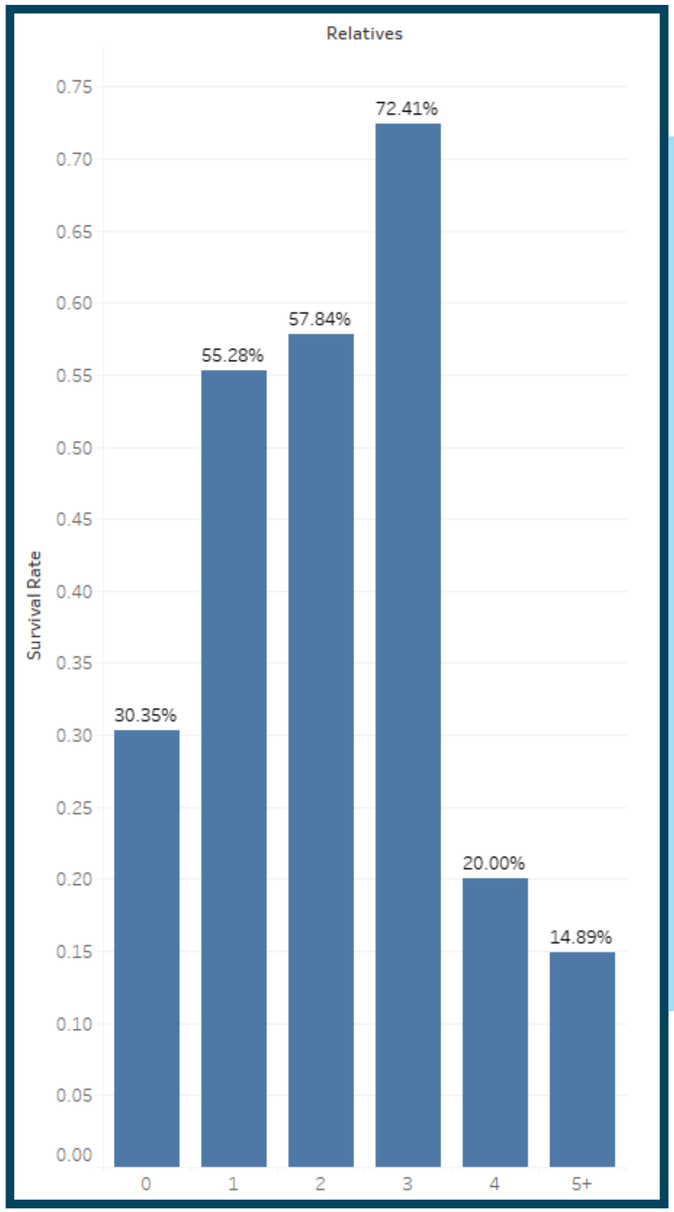
- Children with fewer siblings had more attention from parents
- Older passengers with more supporting relatives were safer

Those in their teens with 3 siblings also stand out with a **higher** survival rate, likely due to them being very active with family responsibilities

As expected, those in their 60+ years had very low survival rates, but had a higher chance of surviving with 1 relative

FAMILY

FAMILY: ANALYSIS



Those with **3 direct relatives** had the highest survival rate of **72.4%**

Most individuals had **0 relatives** on board, yet their survival rate was only **30%**

May be linked to **heroism**, as those with 0 relatives may have had the **most intent** to save others

Individuals with 4+ direct relatives were mostly from the 3rd class, likely explaining their low survival rate

Passenger Count by Class and Direct Relatives

	Relatives					
Passenger Class	0	1	2	3	4	5+
1	109	70	24	7	2	4
2	104	34	31	13	1	1
3	324	57	47	9	12	42

FAMILY: PASSENGER CLASS AND SEX

Survival Rate by Siblings/Spouses & Class

Siblings/Spouses	Passenger Class 1	2	3
0	54.20%	38.18%	21.30%
1	73.85%	47.73%	26.87%
2+	75.00%	42.86%	13.64%

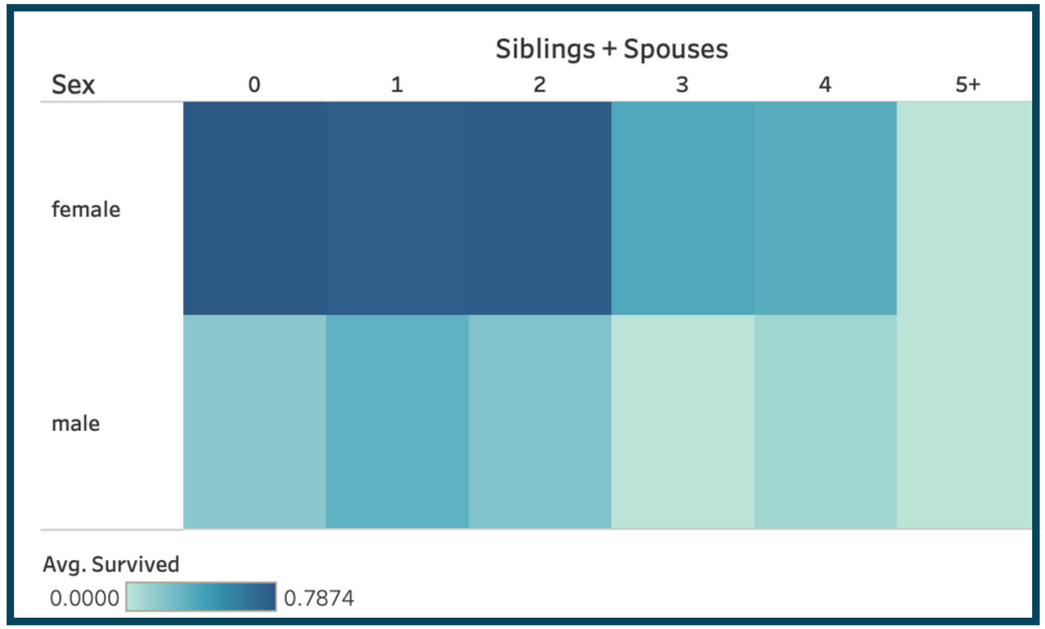
No matter the number of siblings and spouses, being in a higher passenger class led to a **higher** survival rate

Having **more** siblings and spouses on board was **advantageous** in the first class, but this is not clear for lower passenger classes

Survival rates by Siblings/Spouses & Gender

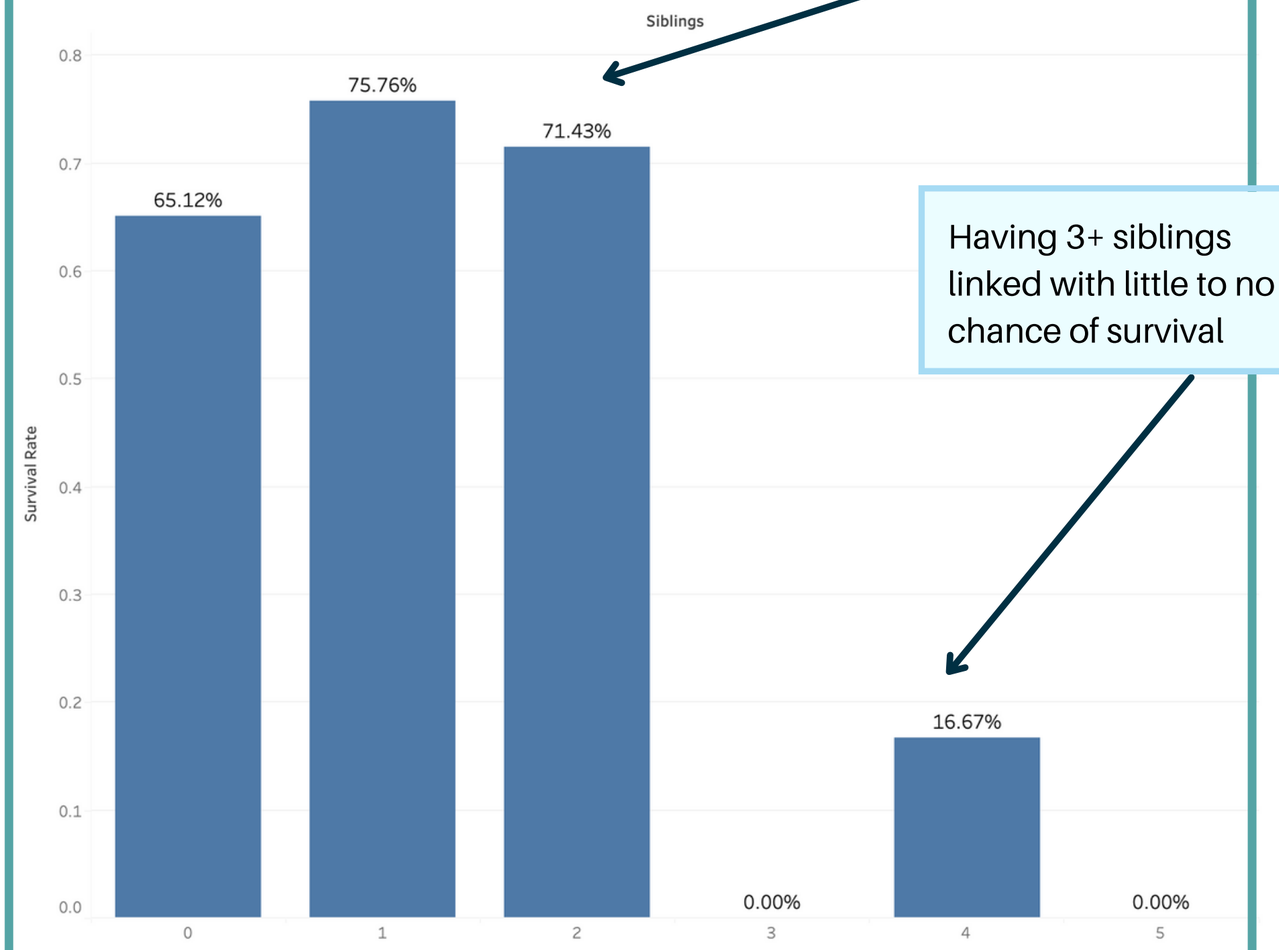
For especially women, having **more** siblings or spouses led to **lower** chances of survival

This **opposite trend** hints that there is **no general relationship** between the number of siblings/spouses & survival rate



FAMILY: CHILDREN WITH SIBLINGS

CHILD SURVIVAL RATE BY NUMBER OF SIBLINGS



Children with 0-2 siblings had a high survival rate

Having 3+ siblings linked with little to no chance of survival

- Children with **0 to 2** siblings had relatively high survival rates of **over 50%**
- Likely due to them helping each other

- Children with 3 or 5 siblings had a **100%** mortality rate, and those with 4 siblings with **84%**
- Likely due to slower evacuating as more siblings mean each have less attention from parents

Passenger Class | Sex | Age | Family

CONCLUSION

CONCLUSION

WHAT IS THE SINGLE MOST IMPORTANT FACTOR AFFECTING SURVIVAL?	**Passenger Class**

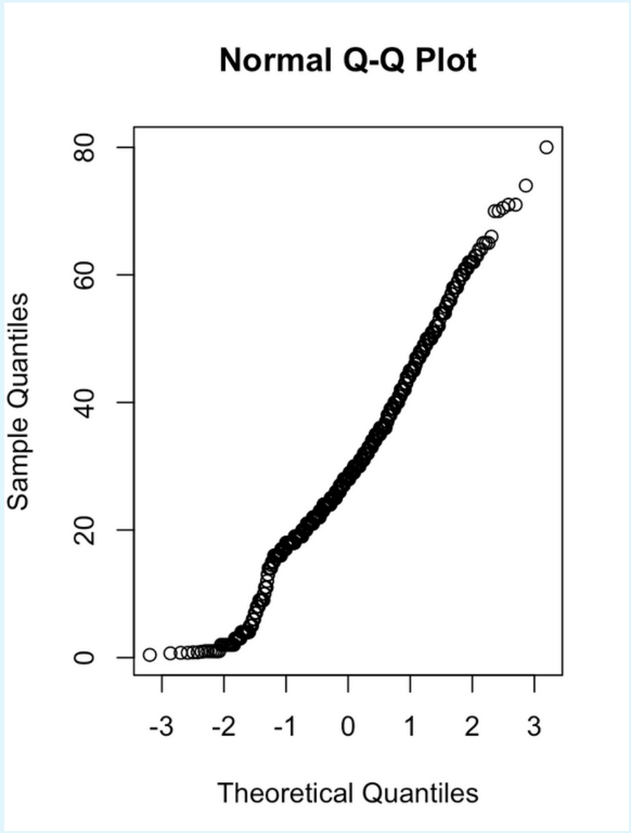
Passenger Class: First class survived more, due to cabins' proximity to lifeboats

Sex: Females survived more, due to the values of the time

Age: Younger people survived more, due to their fitness

Family: Younger people with less relatives survived more, opposite for old

APPENDIX



RATIONALE FOR BACKFILLING NULL VALUES

- Dropping of column is only appropriate if it doesn't affect analysis
- Removing data leads to loss of information, which returns biased data
- Null values are replaced with:
  - **Mean** if dataset is normally distributed
  - **Mode** if there are frequent values & number of nulls is small
  - **Median** if data comprises of significant outliers

```
stats.normaltest(df['Age'])
```

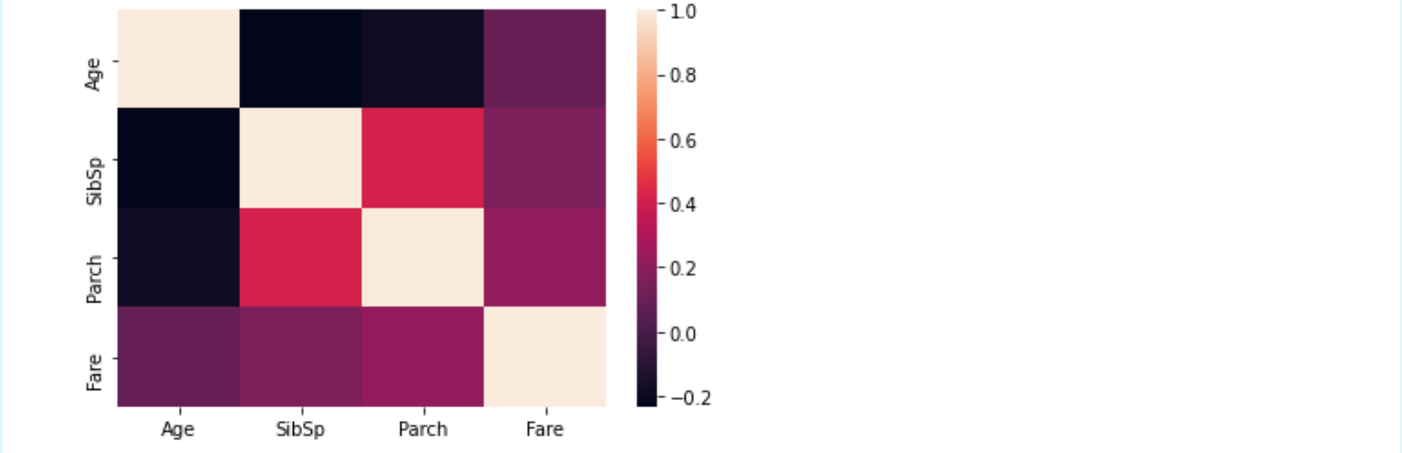
```
NormaltestResult(statistic=43.85896585051567, pvalue=0.299327)
```

Methodology to decide which variables to analyse

1. Chose the most intuitive fields that could influence survival
2. Confirmed hypothesised relationships by computing correlation and testing for independence (Chi-square Test)
3. Concluded that Passenger Class, Sex, Age & No. of Relatives were the most influential

Output from Python code for checking correlation between variables

```
The p-value of the Chi-square test comparing Pclass with Survived is: 4.549251711298793e-23
The p-value of the Chi-square test comparing Sex with Survived is: 1.1973570627755645e-58
The p-value of the Chi-square test comparing Embarked with Survived is: 2.3008626481449577e-06
```



Methodology to answer the 4 main questions

- For each variable of concern (Class, Sex, Age, Siblings/Spouse), subquestions were constructed
- These subquestions involved comparing **Survival Rate** with the chosen variable with other 3 variables
    - e.g. For Sex, Class and Age died the most?

Technologies Used

- Used Python (pandas) to check rough relationships of both categorical & numerical values
    - Also used to export filtered CSV files (e.g. only children data)
- Used R for statistical measures of numerical rows
- Used Shell to derive Passenger Ethnicities from last names
- Visualised with Tableau after data cleaning

Methodology for Mapping Surnames to Backgrounds

1. Used the website www.familysearch.org, which maps surnames to countries based on a **large worldwide database**
2. Compiled a list of surnames appearing in our dataset
3. Wrote a shell script using linux tools including *curl* to automatically map every surname to candidate countries
4. Filtered out all surnames which had the top candidate country as an English speaking country

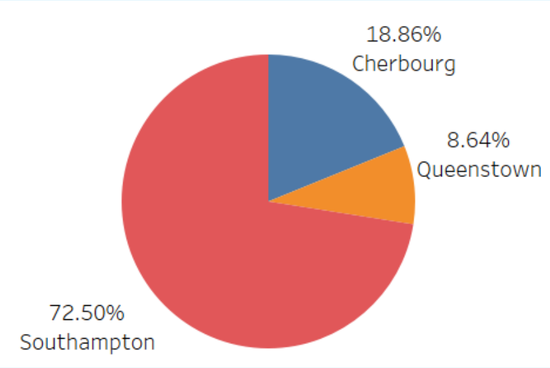
Shell Script Output

```
Abbing,Netherlands,Germany,United States
Abbott,United States,England,Canada
Adahl,Sweden,United States,Finland
Adams,United States,England,Canada
Ahlin,Sweden,United States,Samoa
Aks,United States,England,Austria
```

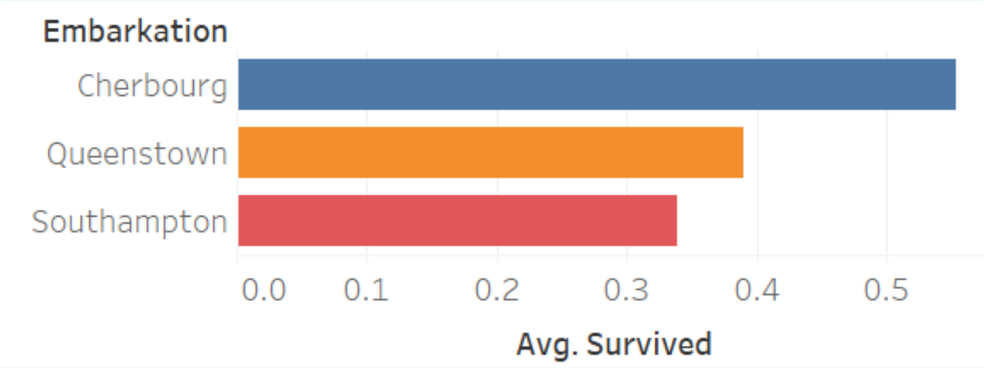
Additional Information: Embarked Field

- Data shows that someone from “Cherbourg” had a higher chance of surviving than those from "Queenstown" and "Southampton"
- Most passengers boarded from Southampton (73%)
- In a real life context, where a passenger came from would have had **no impact on survival rate**, as any region could purchase higher class tickets

Passengers by Embarkation



Survival Rate by Embarkation



Survival Count by Embarkation

Embarkation	
Cherbourg	168
Queenstown	77
Southampton	646