MSc in Data Science

Data Visualization & Communication

Final Project

Team Members:

- Agiopoulos Kaptsikas
- Despoina Angelonidi
- Spyridon Mastrodimitris - Gounaropoulos

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Introduction

In recent decades, Asia has witnessed a significant outflow of migrants to other countries, making it a major source region for global migration. Economic disparities, political instability, and armed conflicts have been key drivers behind this migratory movement. This phenomenon has far-reaching consequences, shaping societies, economies, and policies in both the sending and receiving countries.

The aim of this report is to communicate the story behind migration from Asia and uncover its challenges and risks through some visually engaging plots. The data used for the analysis are sourced from a website that records migration-related deaths, regardless of legal status, and missing migrants. While the data reflect a specific timeframe (2014 to 2022), the findings will contribute to a deeper understanding of the issue.

For the preprocessing of the data Microsoft Excel and R were used. The static plots were constructed using R whereas the interactive plots were created using Tableau.

Additional information about the data (e.g. the meaning of each variable) can be found here.

Region of Incident

To begin with, we examine the matter from a more general scope, focusing on a continent level. As the subsequent plot demonstrates, there is an increasing trend regarding the number of incidents over the years for the continent of Asia, especially after the announcement and then the execution of US withdrawal from Afghanistan, whereas the line corresponding to other regions exhibits also an increasing trend but with some fluctuations. The year with the most incidents for Asia appears to be 2022 while for the other regions appears to be 2019.

Number of Incidents per Year
2014 - 2022
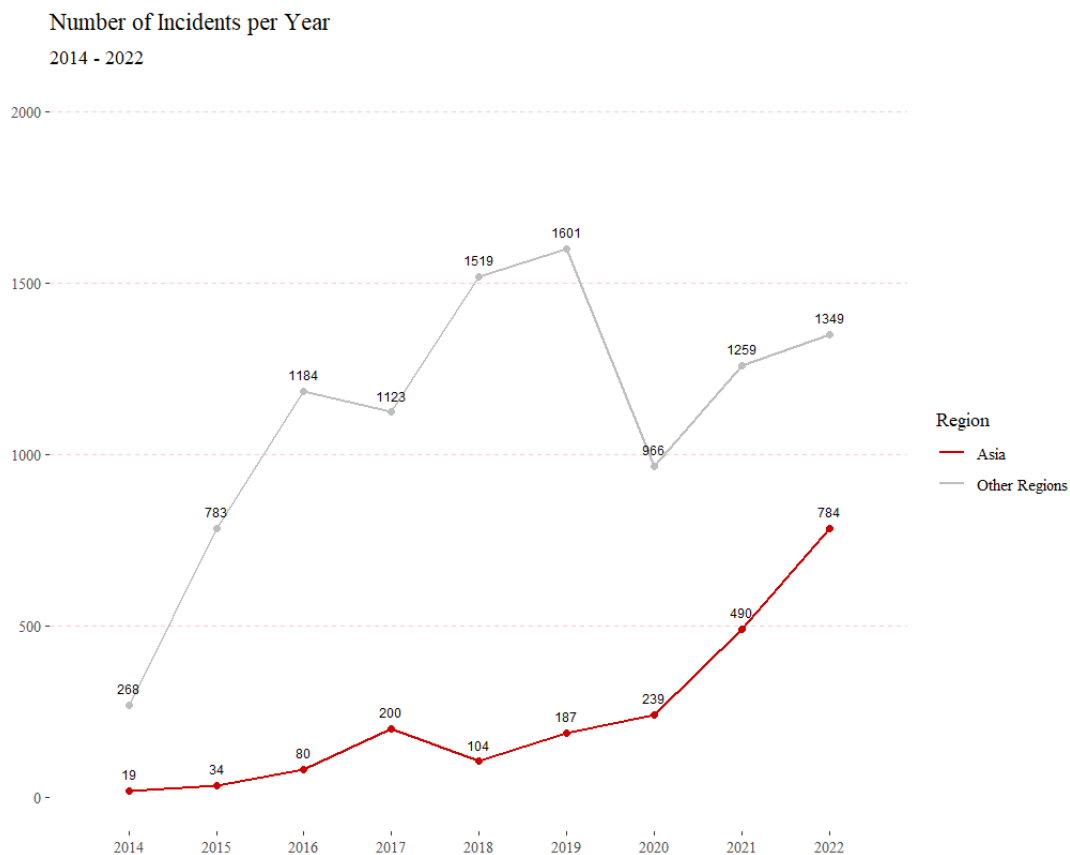
Continuing with the comparison between Asia and other regions, it arises the most incidents regarding Asia occurred during the months of September and November. As far as the other regions are concerned, the majority of incidents occurred between the months of June and October.

Number of Incidents per Month
2014 - 2022
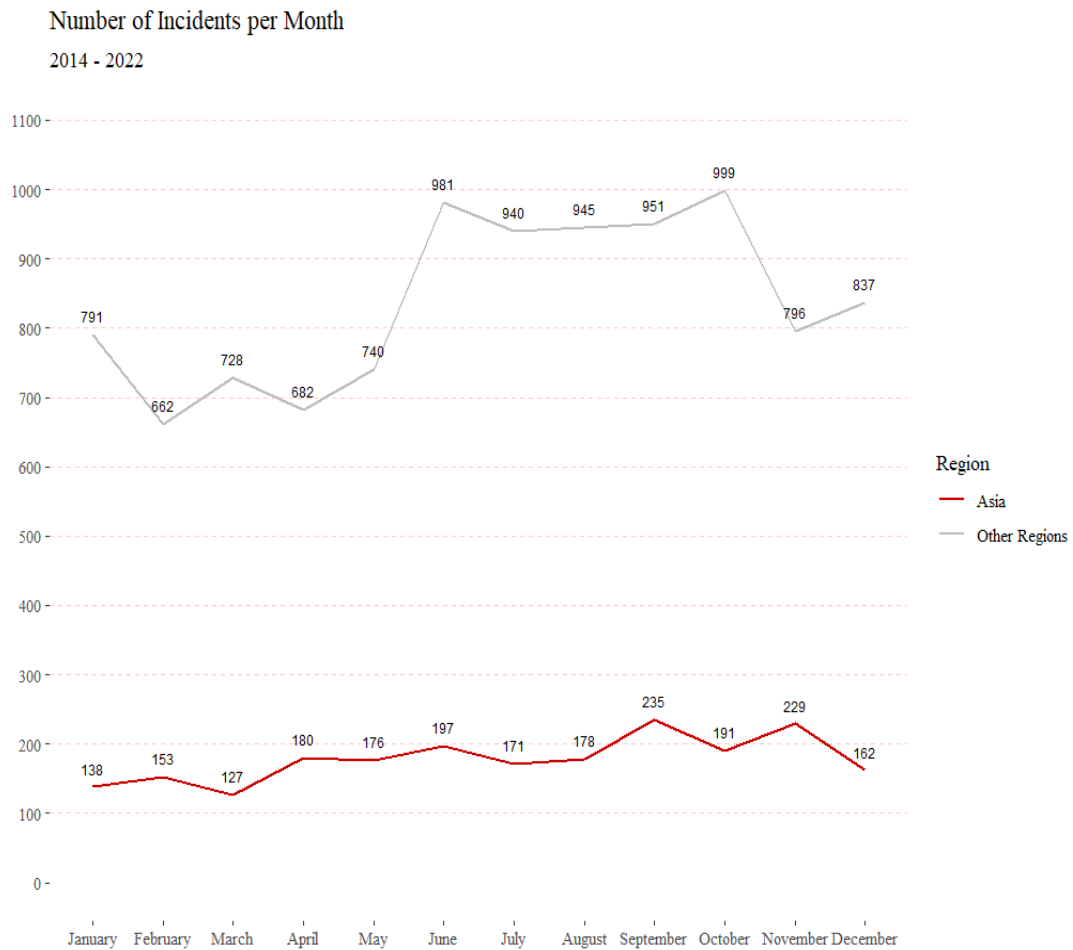
The following plot concerns the average number of deceased per incident, comparing Asia with the other regions. From this simple line plot the reader may notice the peak that the line of Asia creates in 2015 as well as the decreasing trend that the line corresponding to the other continents exhibit. A result of the ongoing Syrian Civil war and the persecution of the Rohingya people in Myanmar.

Average Deaths per Incident by Region: Asia VS Other Regions
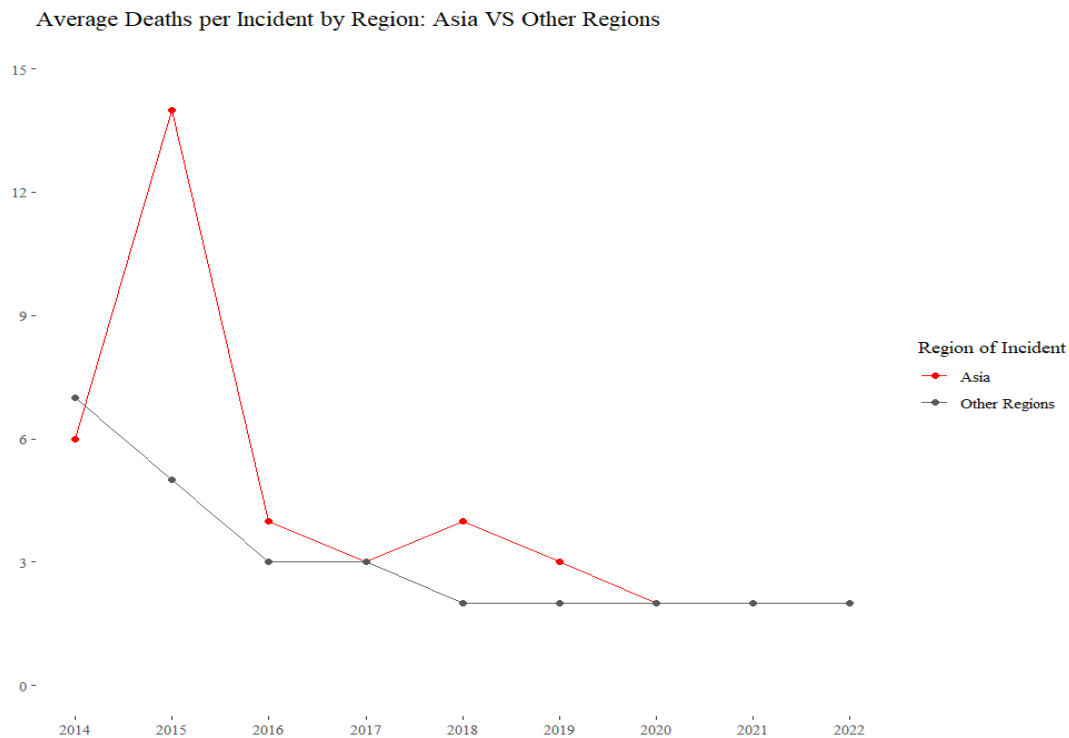
It is evident that on average Asia displays more fatalities per incident in comparison to other regions even though the number of occurrences is not as high.

The next diagram presents the number of occurrences during the time period under study for each continent included in the dataset. As one may notice there is an increasing trend prominent in the subplots of America and Asia with the second displaying a rapid increase especially for the time span of 2020 to 2022. Europe also showcases a slight increase, especially for the aforementioned time period. The subplot of Africa is characterized by some fluctuations with the highest value emerging in 2019. However, a subsequent downward trend becomes apparent from the year 2020 onwards, leading to a period of relative stability.

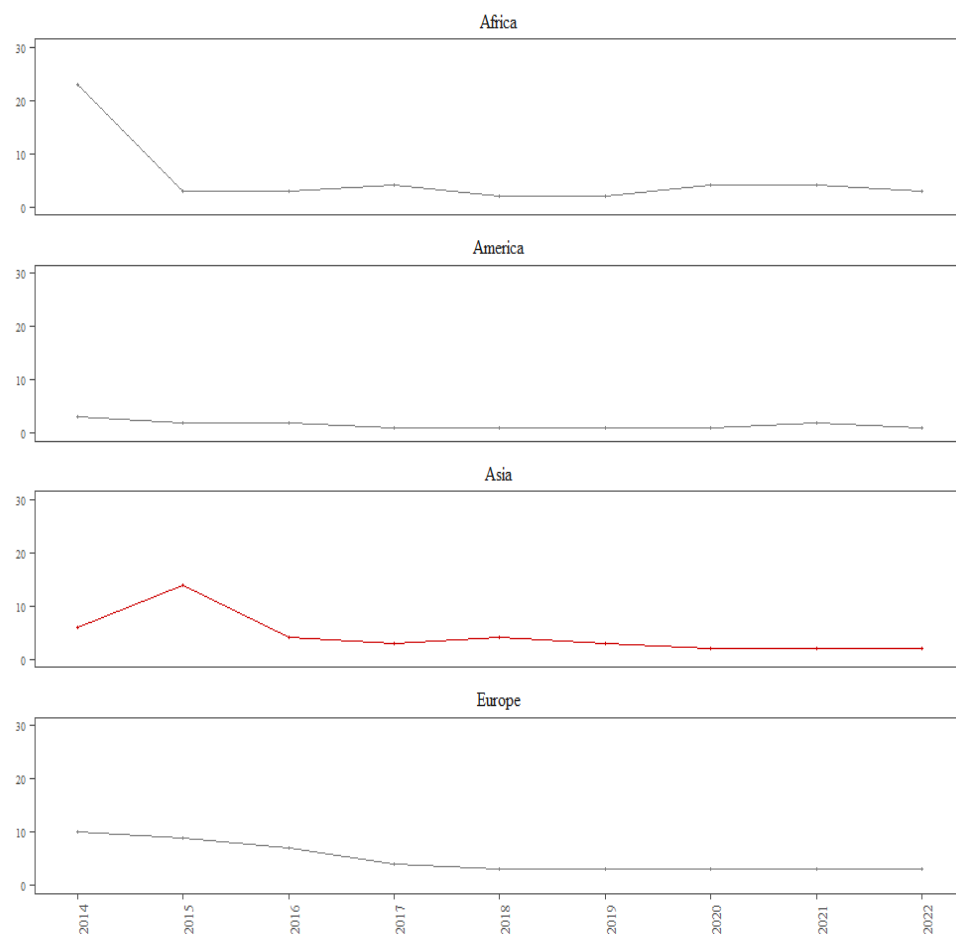Number of Incidents per Year & Continent
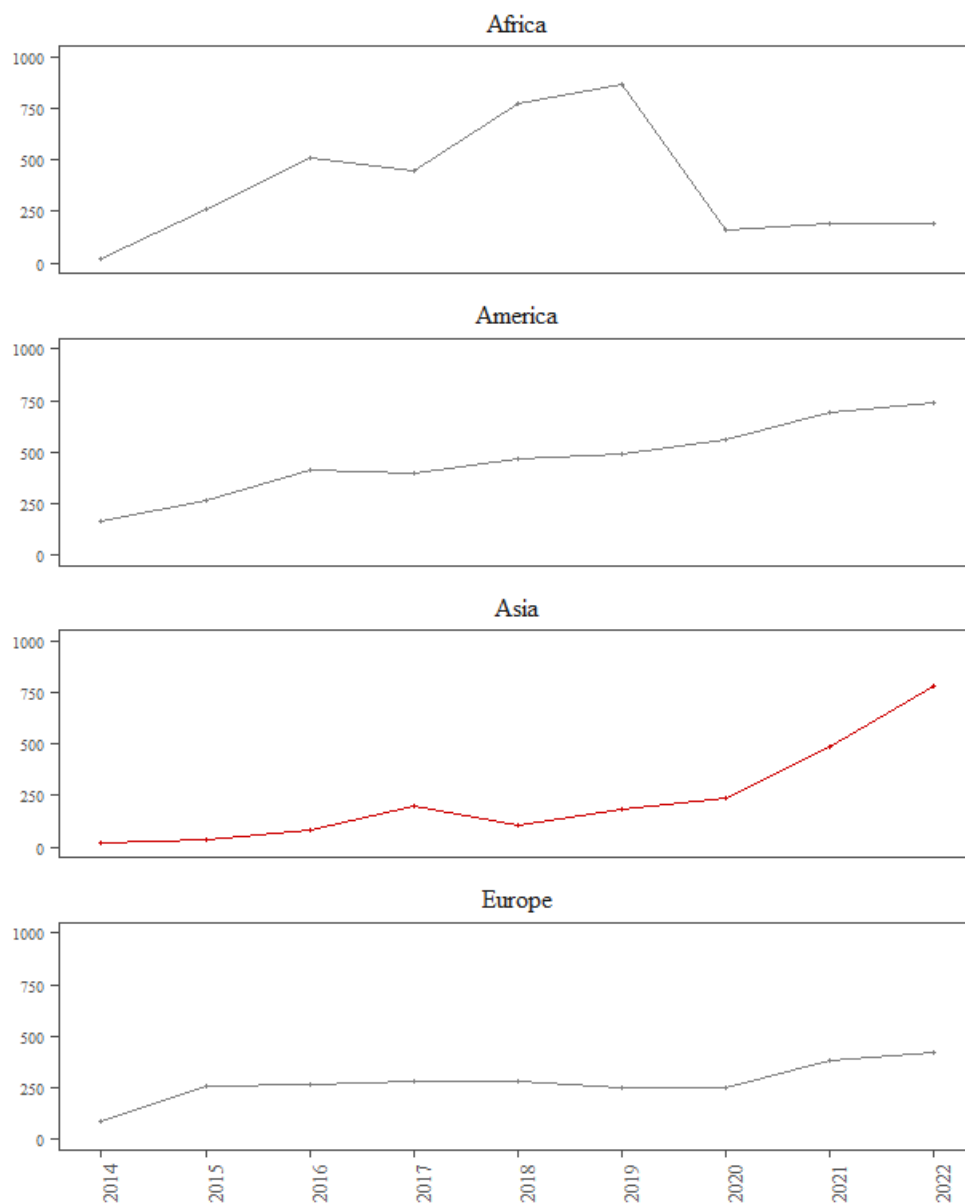
To continue, we create a plot that portrays the average number of deceased per incident for each year for the continents of Africa, America, Asia and Europe.

The subplot corresponding to Africa includes the highest value which is observed in 2014. This year, numerous countries in this region were experiencing armed conflicts, political instability, and civil unrest. Ongoing conflicts in countries such as Libya, South Sudan, Somalia, and the Central African Republic led to displacement and forced many individuals to seek safer environments elsewhere. Unfortunately, many of them did not survive.

The next highest value appears on the subplot of Asia for the year of 2015. This peak was caused by the large numbers of muslim refugees from Myanmar attempting to flee the country in the face of the soon to come 2016-2017 Rohyngya genocide. According to some sources the number of people who left the country rose to 700.000 and the number of dead to 25.000. Overall, a mild decreasing trend is observed with some fluctuations in some cases. There is a hypothesis to be made from this findings, that forced displacement leads to higher casualties.


Average Deaths per Incident by Year & Continent

The next plot allows a comparison between the number of incidents and the number of dead and missing individuals from 2014 to 2022 as time progresses.

The highest numbers overall regarding the dead and missing appear in the continent of Europe followed by the continent of Asia. The highest value is around 1500 and it appears in Europe during April of 2015 with the number of instances not surpassing 25. Focusing on Asia, the highest value emerges in December of 2014 with the number of instances being under 10. Again a result of desperate people fleeing from armed conflict either Syria or Myanmar.

The month with the most occurrences, as the diagram suggests, is November of 2022 pertaining to the continent of Asia. Fortunately, the number of casualties or disappearances was small. As far as the behavior of the curves for each region is concerned, Africa exhibits an increase from the August of 2015 to February of 2020, America and Asia display an increase and Europe seems quite stable, with all curves fluctuating.
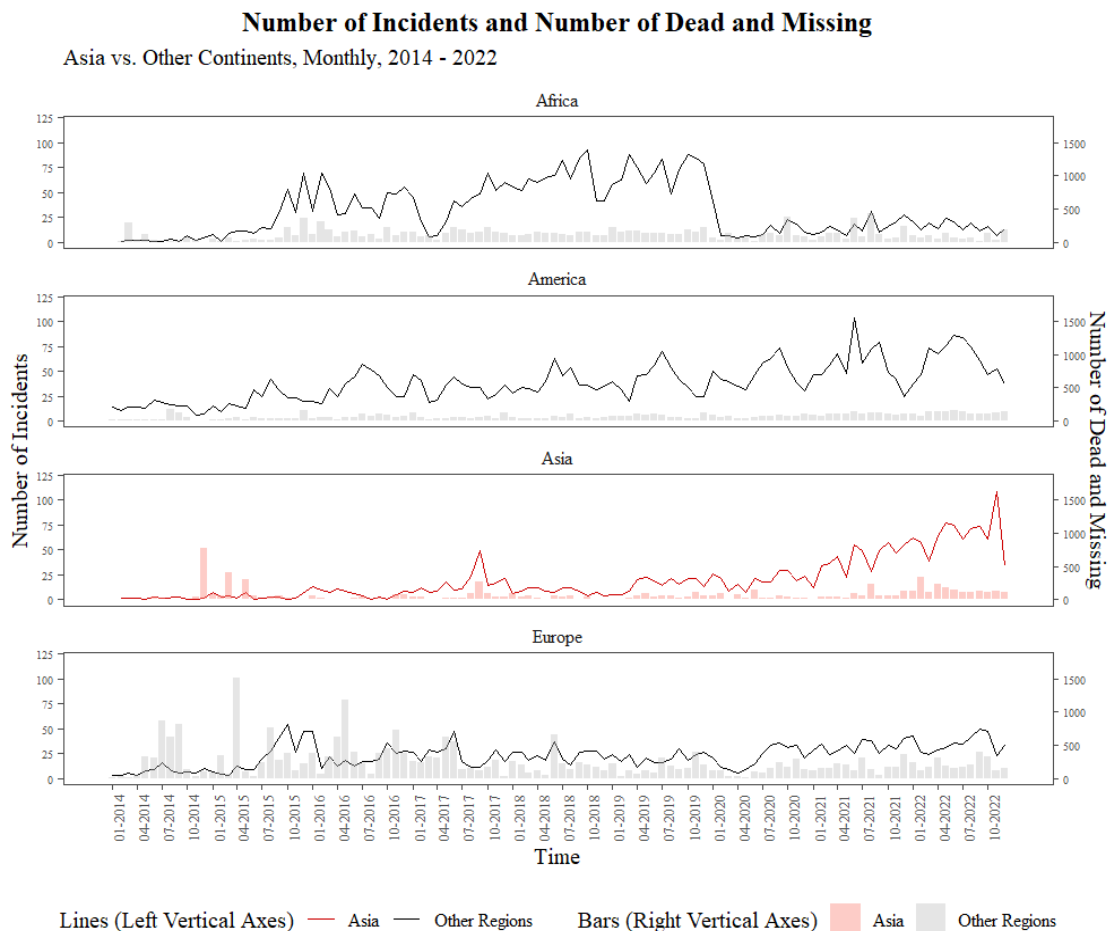
Number of Incidents and Number of Dead and Missing

Asia vs. Other Continents, Monthly, 2014 - 2022

Moving from a broader perspective that encompasses entire continents to a more focused examination at a subregional level, we construct a plot that illustrates the number of occurrences per region of incident. At a first glance, it emerges that North America has the highest number of incidents. In terms of Asian regions, Southern Asia ranks fourth, Western Asia stands at the tenth position, while Southeastern Asia comes in eleventh place. Eastern and Central Asia have the fewest incidents, occupying the last two positions.

Total Number of Incidents per Region of Incident
2014 - 2022

Region	Incidents
North America	2573
Northern Africa	1918
Mediterranean	1901
Southern Asia	1490
Central America	1272
Western Africa	954
Europe	568
Eastern Africa	440
Western Asia	404
South-eastern Asia	233
South America	194
Caribbean	142
Middle Africa	74
Southern Africa	16
Eastern Asia	9
Central Asia	1

The following plot showcases the total number of deaths per region of incident. It becomes evident that the Mediterranean region has experienced the highest number of deaths throughout the given timeframe. As far as the regions of Asia are concerned, one may notice that Southern Asia and Western Asia rank among the top regions with significant fatalities

Total Number of Deaths per Region of Incident
2014 - 2022

Region	Deaths
Mediterranean	8788
Northern Africa	5458
North America	3539
Western Africa	2122
Southern Asia	2079
Western Asia	1915
Central America	1806
Eastern Africa	1508
South-eastern Asia	1317
Europe	887
South America	373
Caribbean	369
Middle Africa	205
Southern Africa	113
Central Asia	52
Eastern Asia	12

To gain a better understanding, it is important to know the number of incidents across the time span under study. It appears that in Central Asia there is only one incident in 2018. Eastern Asia showcases a steady, low number of incidents over time whereas South-eastern Asia exhibits a small peak in 2019. Regarding Southern Asia, a rapid increase is observed, especially during the time period of 2018 to 2022. The subplot of Western Asia demonstrates some fluctuations but the number of incidents over the years do not exceed 150.

Number of Incidents per Region of Incident: **Asia**
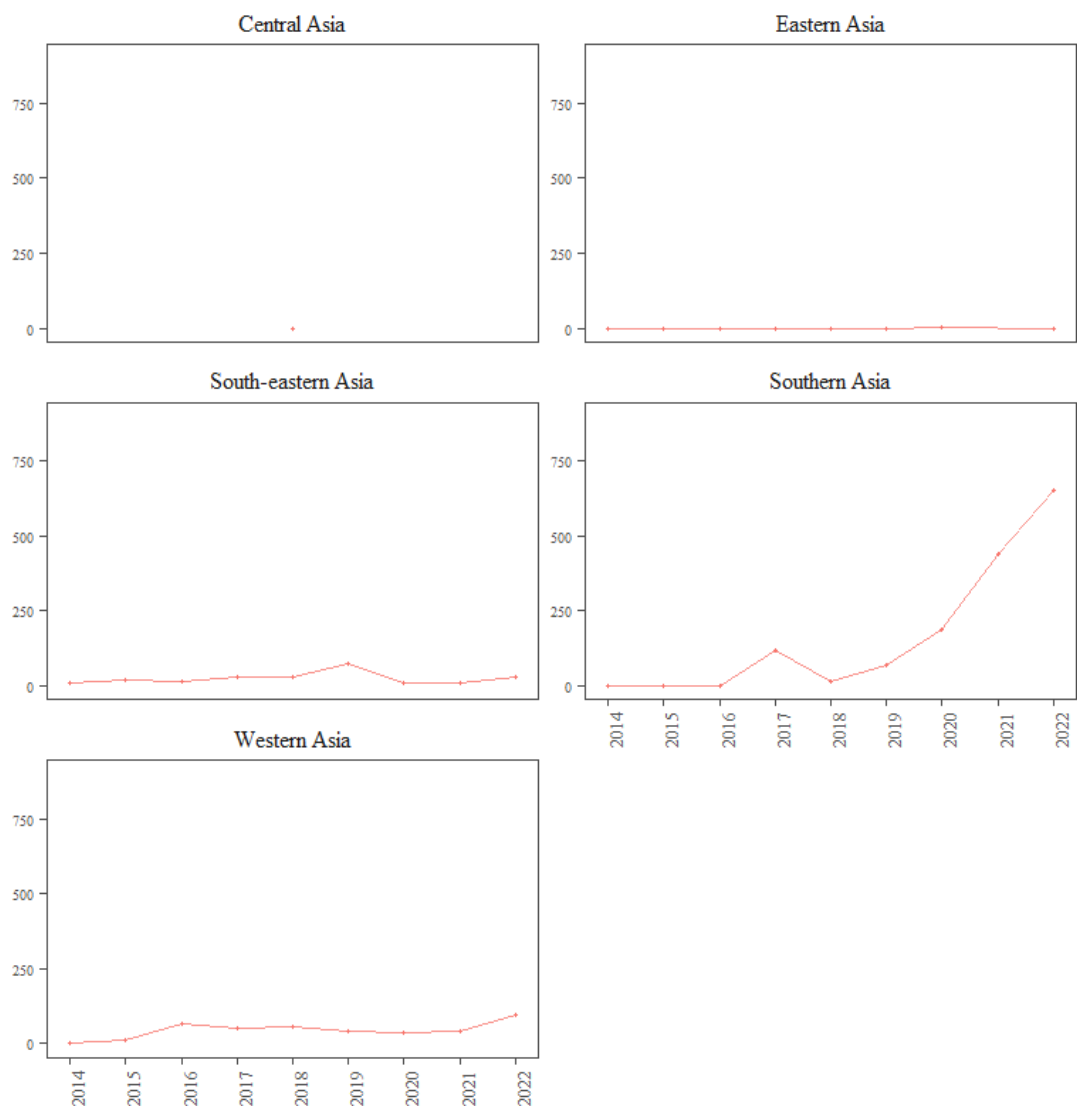
After gaining the insight of the absolute frequency of the occurrences during the time span of interest, the total number of deaths per region of incident will be, now, examined. Regarding Central Asia, according to the previous diagram, there is only **one recorded incident** that occurred in 2018 in which 52 people died as the current plot denotes. Moving on to Eastern Asia, there seems to be a constant low number of deaths during the given time period. The subplot of South-eastern Asia demonstrates some fluctuations whereas the one of Southern Asia showcases an increasing trend from 2018 until 2022. Finally, the plot that immediately captures the gaze is the one of Western Asia due to the rapidly increasing number of deaths observed from 2021 to 2022.

Total Deaths per Region of Incident: **Asia**
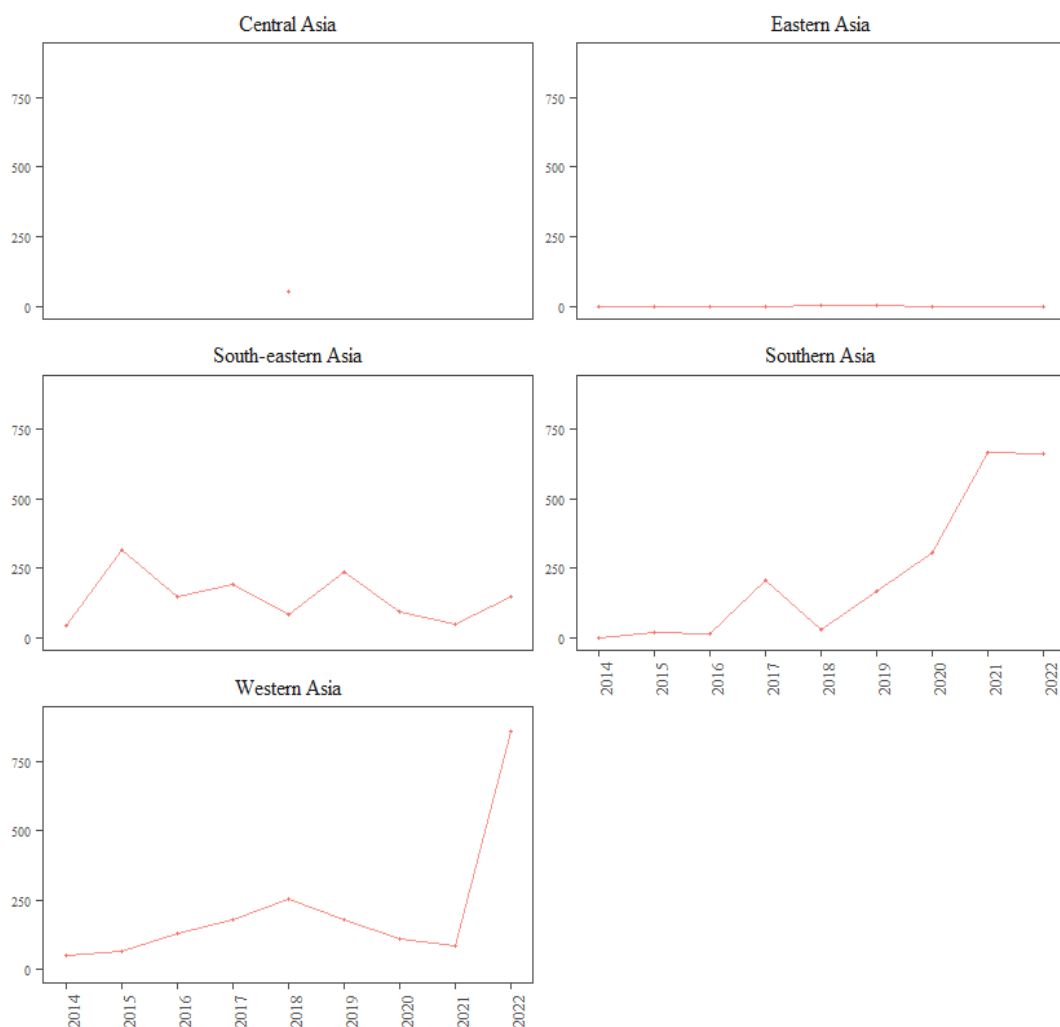
From the plot and table below the reader may gain an insight regarding the **average** number of dead or missing per incident in comparison with the **average** number of people involved in the incident for all occurrences that took place in Asia. It is evident that the majority of people involved in **the** incident that unfolded in Central Asia did not survive. The area that exhibits the most interest is Eastern Asia as, even though the average number of people involved per incident is low, the percentage of dead and missing is almost 50%. This becomes even more intriguing considering the fact that the number of incidents and deaths over time is very low.

Average Number of Dead and Missing vs. **Average** Number of People per Incident: **Asia**
2014 - 2022
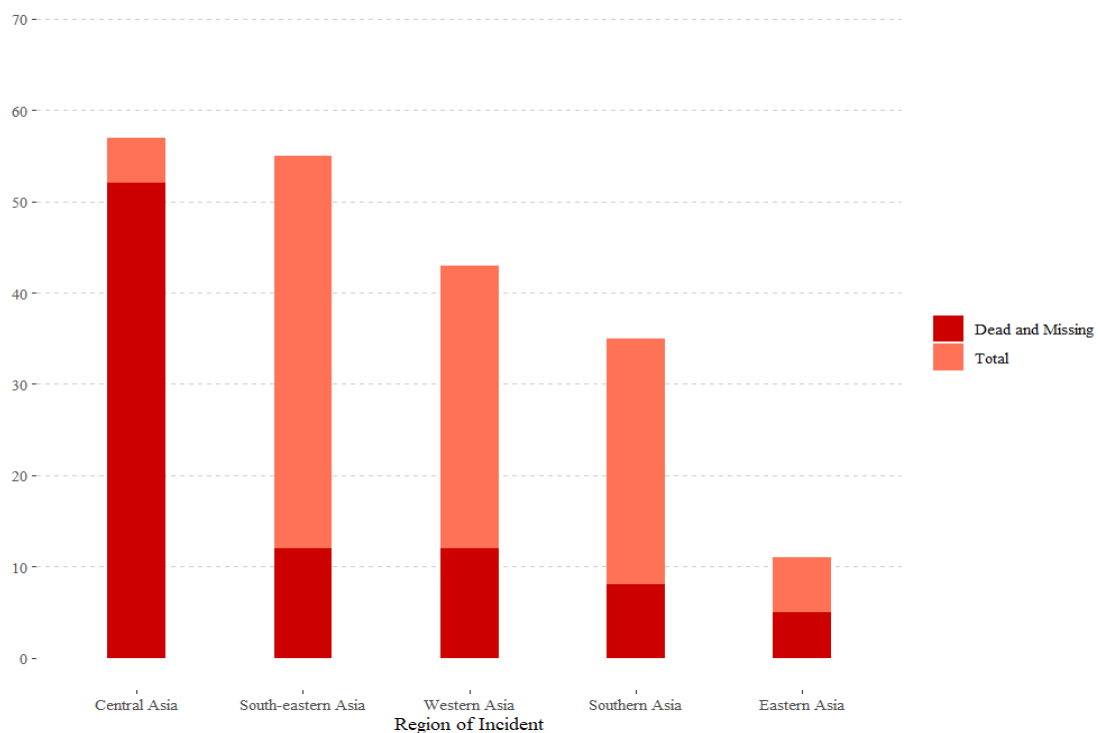
Region of Incident	Percentage of Dead and Missing (avg)
Central Asia	90 % *
Eastern Asia	46 %
Western Asia	28 %
Southern Asia	23 %
South-eastern Asia	22 %

*One incident

To continue, the next aim is to reveal the origin of people involved in the incidents that occurred in the region of Asia. It arises that the majority of people on average that get involved in incidents that occur in Western Asia come from Ethiopia and Somalia whereas the majority of people of the incidents of Southern Asia come from Myanmar. As far as Southern-eastern Asia is concerned, the majority of people involved on average is from Myanmar and Malaysia. Eastern Asia has on average very few instances involving people from Vietnam, China and Bangladesh. Finally, regarding Central Asia, it is apparent that the majority of people involved on average come from Uzbekistan.

Average Number of People per Incident: **Asia** (2014 - 2022)
by Country of Origin & Region of Incident
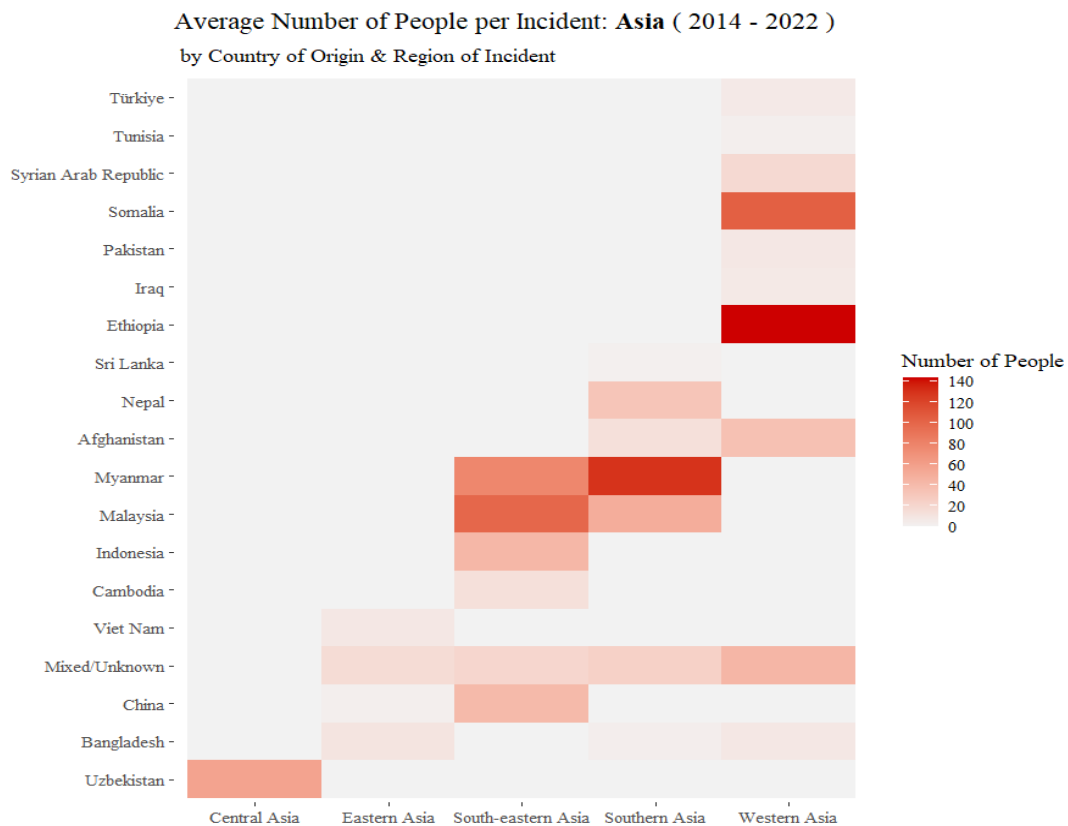
We also created the same plot but for the **total number** of survivors adding an interactive twist using Tableau to monitor any differences between the different months of the year.

Apparently, not all regions are safe as some of them, while they have a large number of people coming through, lack a high number of survivors. This phenomenon heightens especially in the winter months.

The regions with the most survivors appear to be the Southern-eastern and Western part of Asia with most individuals coming from Myanmar, Ethiopia and Mixed or Unknown countries.

We proceed our analysis with a diagram that aims to showcase the total population per incident in comparison with the number of deceased per region of Asia and cause of death. On initial inspection, there is an occurrence that instantly draws the attention. The point of interest is one incident that included in total around 200 people out of which approximately 160 died. This incident took place on Western Asia and the deaths were violence-related. In this plot is also depicted the one incident that took place in Central Asia (colored with magenta) and it arises that it was related to transport.

Population per Incident VS Number of Deceased: **Asia**
by Cause of Death & Region (2014-2022)

Lastly, the following Sankey plot presents the main Regions of Origins and Regions of Incident as well as the cause of death. The Tableau Public plots are in Beta and it is probable that they will be changed at the end of the month due to the fact that Beta ends. We saved a **video presentation** of the plot for this reason.

The plot can be found here:
https://public.tableau.com/app/profile/spyros.mastrodimitris/viz/SankeyFinal_168802
44860020/SankeyDiagram

The video presentation can be found here:
https://drive.google.com/file/d/1sYyJYDGI0kHRfRBRZQpo2Tvk2X0-jG3K/view?us
p=sharing

Migration Route

Let us now examine the average number of people per incident. It emerges that the majority of people that are involved on average in incidents that take place in the Horn of Africa to Yemen crossing come from Ethiopia followed by Somalia. This is probably due to the fact that these two countries are close to this channel. Moreover, the moving force behind the migratory movements from Somalia could be the civil war that afflicts the country for years whereas for Ethiopia could be the Tigray War, a conflict that lasted from 2020 to 2022. Of course other reasons may apply.
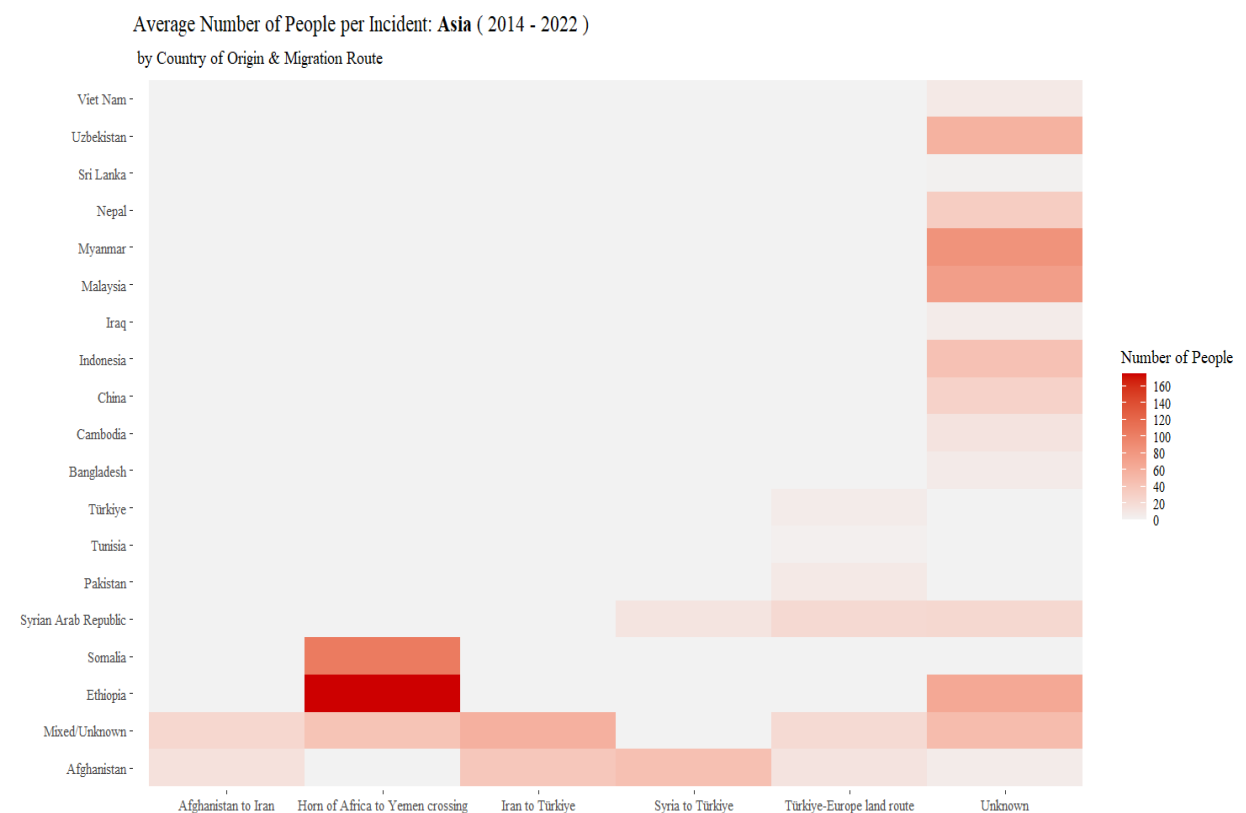
Furthermore, we proceed to examine the fluctuating levels of safety and danger along migration routes over the years. To achieve this, we created an interactive plot utilizing Tableau that incorporates the number of survivors as a key metric.

It becomes evident that there is a significant increase regarding 2022 in comparison to 2014. Note that the low number of survivors in 2014 may be due to under-reporting. Fortunately, the reporting of incidents has dramatically improved in the past 8 years.

It emerges that the highest number of surviving individuals appears in the Horn of Africa to Yemen crossing, a passage that also has the most deaths as the previous plots demonstrate.

Number of Survivors per Route (2014)

Processed Country of ..	Afghanistan to Iran	Horn of Africa to Yemen crossing	Iran to Türkiye	Syria to Türkiye	Türkiye-Europe land route	Unknown
Viet Nam						
Uzbekistan						
Sri Lanka						
Nepal						
Myanmar						527
Malaysia						
Iraq						
Indonesia						122
China						1
Cambodia						40
Bangladesh						
Türkiye						
Tunisia						
Pakistan						
Syrian Arab Republic						
Somalia						
Ethiopia						
Mixed/Unknown		33				19
Afghanistan			6			

Number of Survivors per Route (2022)

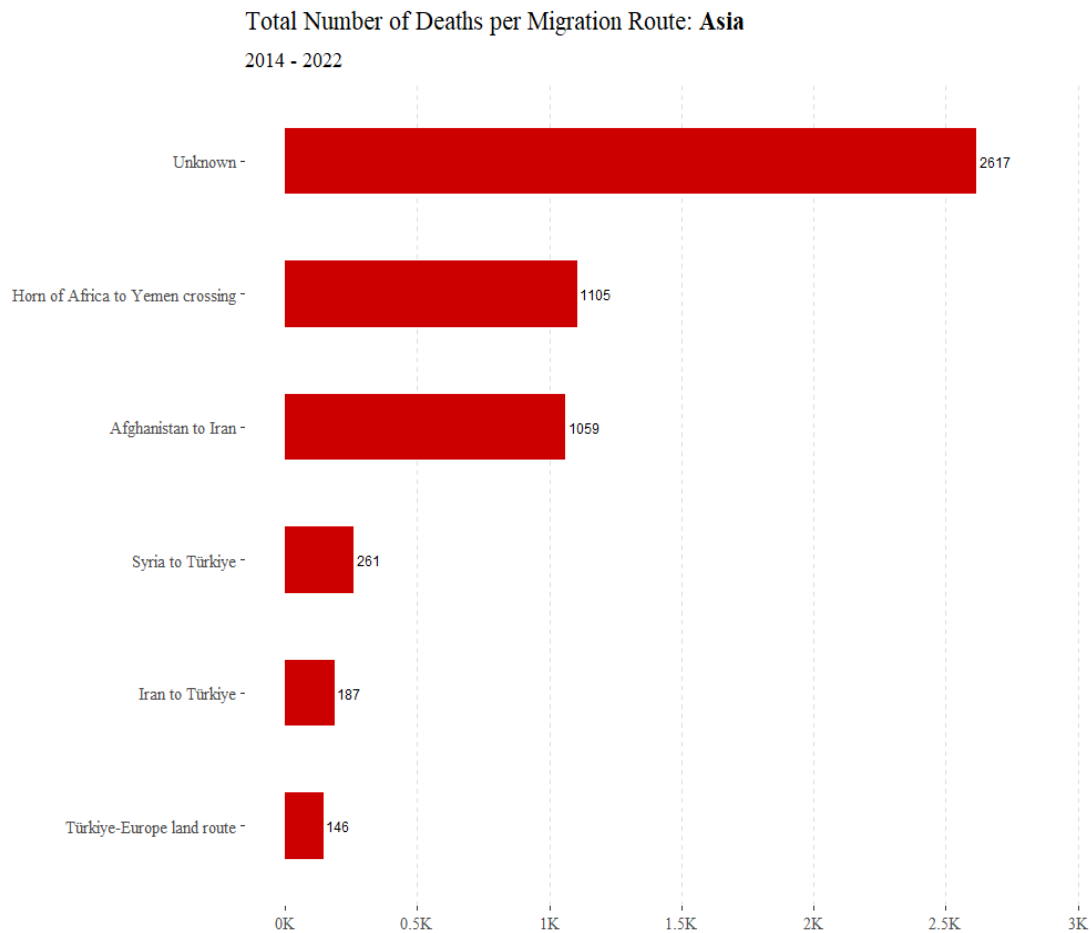| Processed Country of ..	Afghanistan to Iran	Horn of Africa to Yemen crossing	Iran to Türkiye	Syria to Türkiye	Türkiye-Europe land route	Unknown
Viet Nam						
Uzbekistan						
Sri Lanka						1
Nepal						
Myanmar						1.452
Malaysia						45
Iraq						
Indonesia						154
China						53
Cambodia						15
Bangladesh						
Türkiye						
Tunisia						
Pakistan						12
Syrian Arab Republic				21	180	
Somalia						
Ethiopia		113				58
Mixed/Unknown	16	952			25	202
Afghanistan	40		41		25	6

Another Tableau plot was employed to inform the viewer about the volume of people that fled towards another region and went dead or missing. In this case, the focus is shifted on gender with children being included in a separate category.

Note that the gender identification is based on a third-party interpretation of the victim's gender from information available in official documents, autopsy reports, witness testimonies, and/or media reports. (source)

As one can notice, the "Horn of Africa to Yemen" and "Afghanistan to Iran" were by far the most traveled while "Syria to Turkey" displayed the highest **percentage** of Children refugees. Regarding women and men, it arises that the highest number of dead or missing is observed in the Horn of Africa to Yemen crossing.
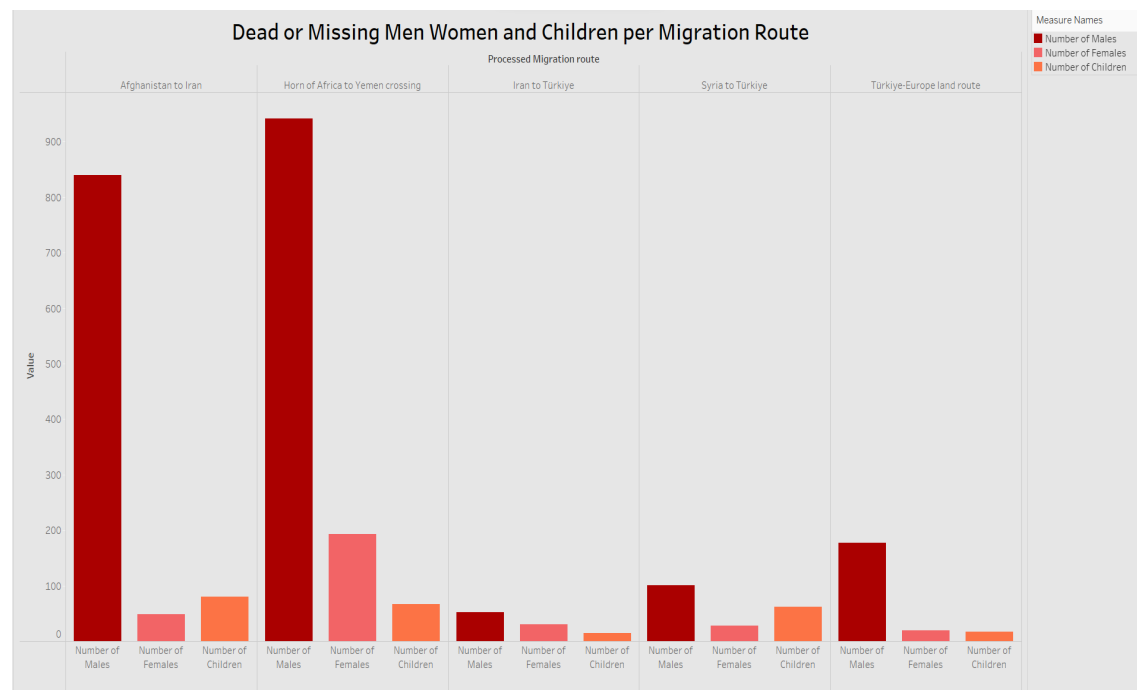
We continue our analysis by examining the total number of deaths per migration route regarding the continent of Asia. From the following plot and table it becomes apparent that the route with the most deaths is unknown with 48% of deaths occurring in an unspecified channel. The first known most lethal route appears to be the crossing from Horn of Africa to Yemen with 21% of recorded deaths taking place there followed by the route from Afghanistan to Iran with 20%.

Total Number of Deaths per Migration Route: Asia
2014 - 2022

Migration Route	Value
Unknown	2617
Horn of Africa to Yemen crossing	1105
Afghanistan to Iran	1059
Syria to Türkiye	261
Iran to Türkiye	187
Türkiye-Europe land route	146

| Migration Route	Percentage of Deceased
Unknown	48%
Horn of Africa to Yemen Crossing	21%
Afghanistan to Iran	20%
Syria to Türkiye	5%
Iran to Türkiye	3%
Türkiye-Europe land route	3%

Cause of Death

Delving further, we employ a barchart that portrays the total number of migration-related deaths that occurred in the region of Asia. It emerges that the most common cause of death is violence as 31% of the recorded deaths are attributed to this cause followed by transport-related incidents and drowning with 21% .

Total Number of Deaths per Cause of Death: **Asia**
2014 - 2022
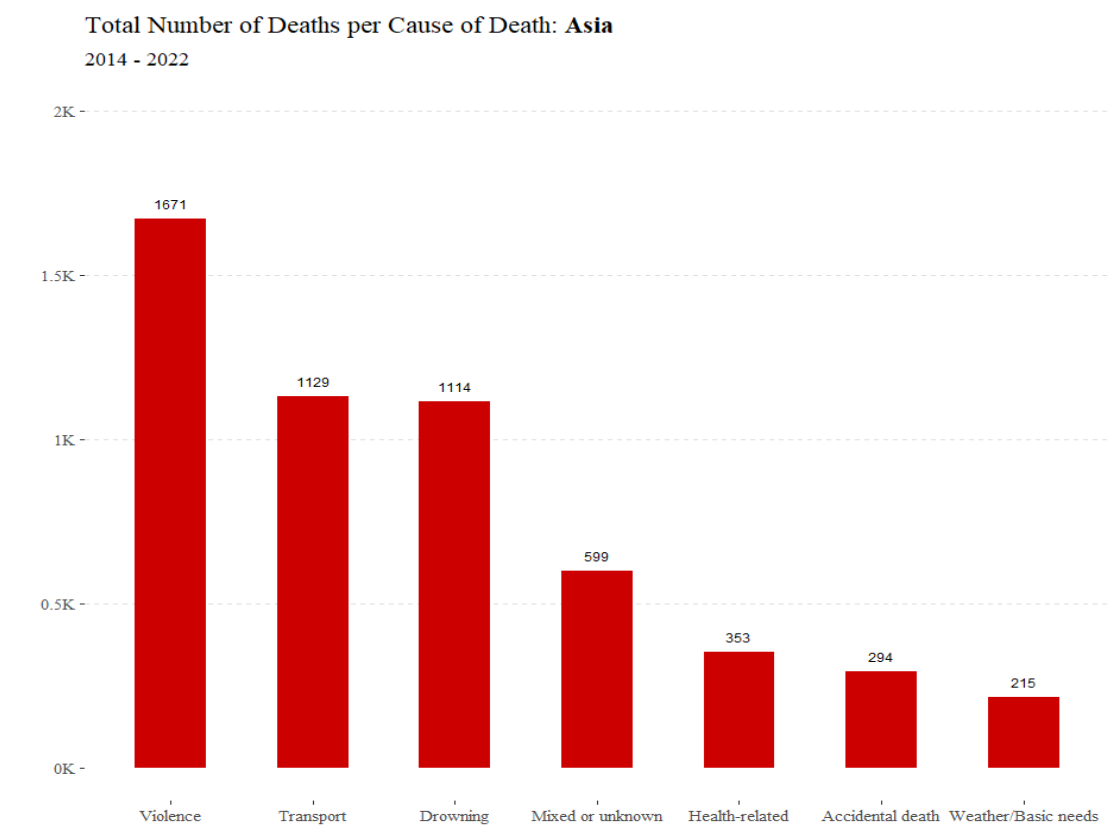
Cause of Death	Percentage (Asia)
Violence	31 %
Drowning	21 %
Transport	21 %
Mixed or unknown	11 %
Health-related	7 %
Accidental death	5 %
Weather/Basic needs	4 %

Regarding the other continents, it arises that the most common cause of death during migration is drowning as it comprises 41% of the total deaths. Violence is the 5th most common cause with 7% of the deaths being attributed to this cause. The appearance of drowning in the first place appears to be logical since the most deaths took place in the Mediterranean.

Total Number of Deaths per Cause of Death: **Other Continents**
2014 - 2022
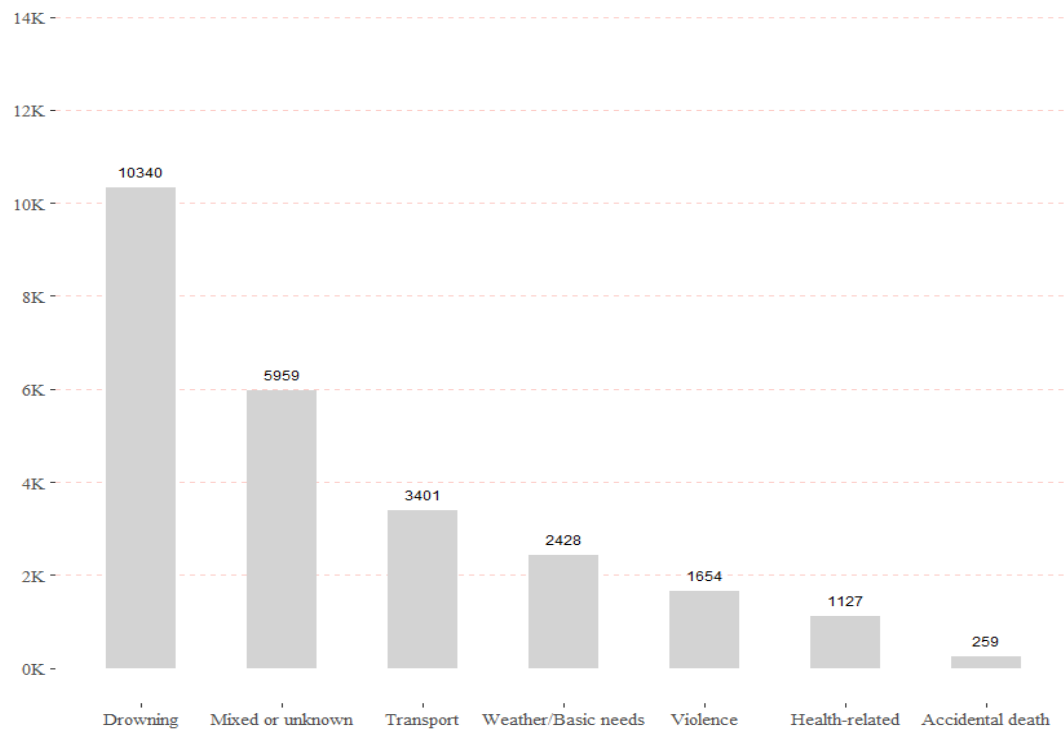
| Cause of Death	Percentage (Other)
Drowning	41%
Mixed or unknown	24%
Transport	14%
Weather/Basic needs	10%
Violence	7%
Health-related	4%
Accidental death	1%

Violence

Since the most common cause of death during migration for the continent of Asia is Violence, the rest of the analysis focuses on this cause.
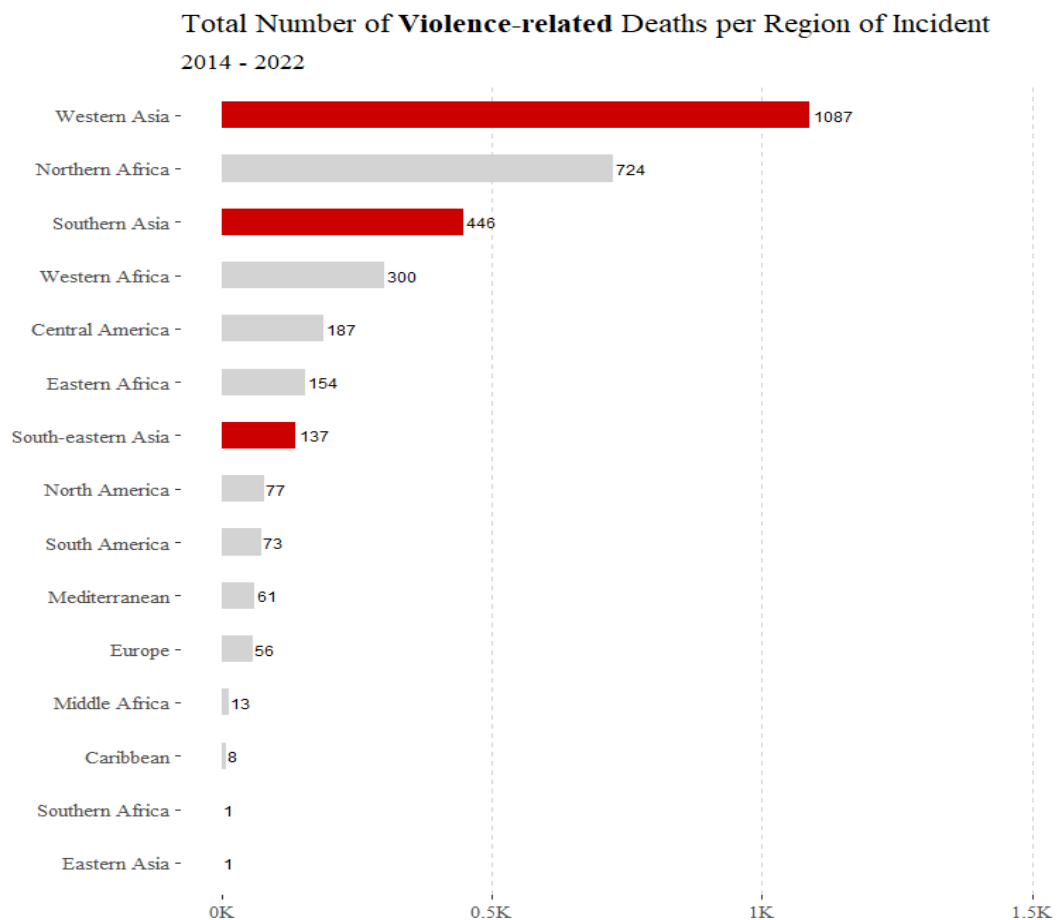
Given this newly acquired knowledge, a valid question would be whether this cause of death is equally prevalent across other continents. As one may notice, Asia has the most violence-related deaths during migration followed by Africa.

Total Violence-related Deaths per Continent
2014 - 2022

| Continent	Deaths
Asia	1671
Africa	1192
America	345
Europe	117
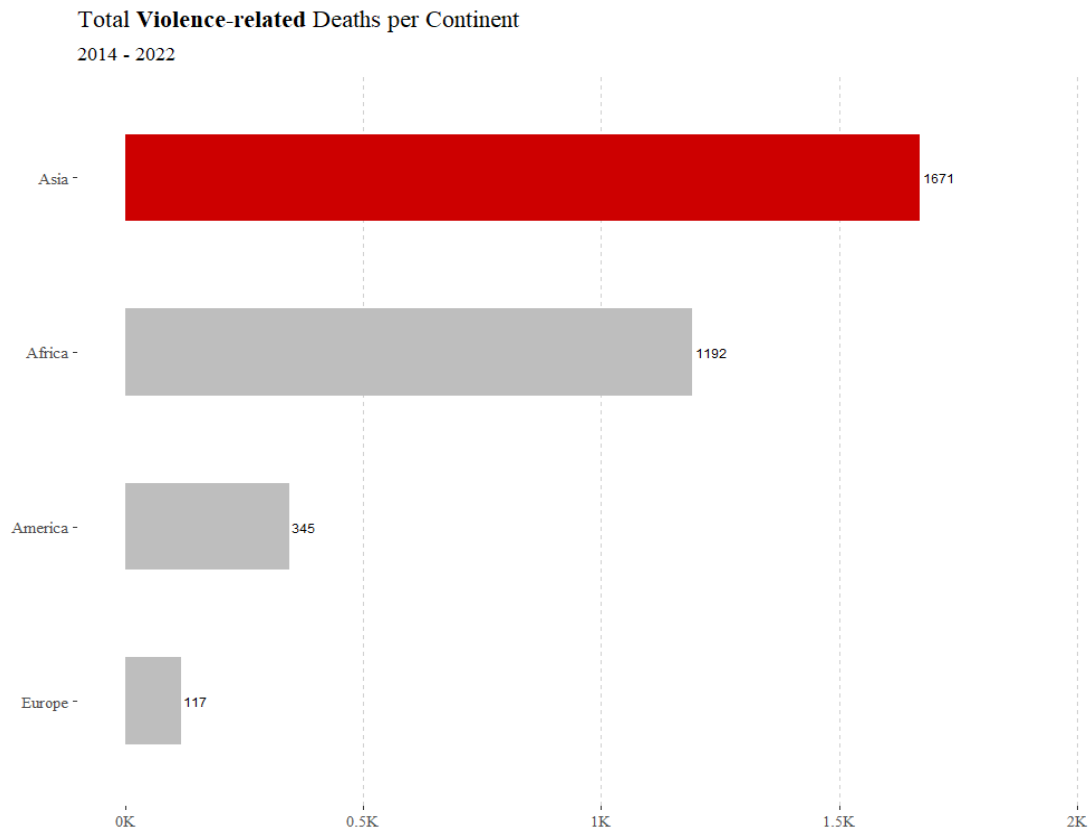
Let us now examine how the violence-related deaths per continent change as time progresses. Regarding Asia, there appear to be some fluctuations between 2014 and 2019 followed by an increase in total violence-related deaths from 2020 to 2022. Moving on to Africa, the highest mortality appears in the time span of 2015 to 2019. Regarding America there seems to be an increase from 2018 to 2021. Finally, the values concerning Europe follow the same fluctuating pattern over the years.

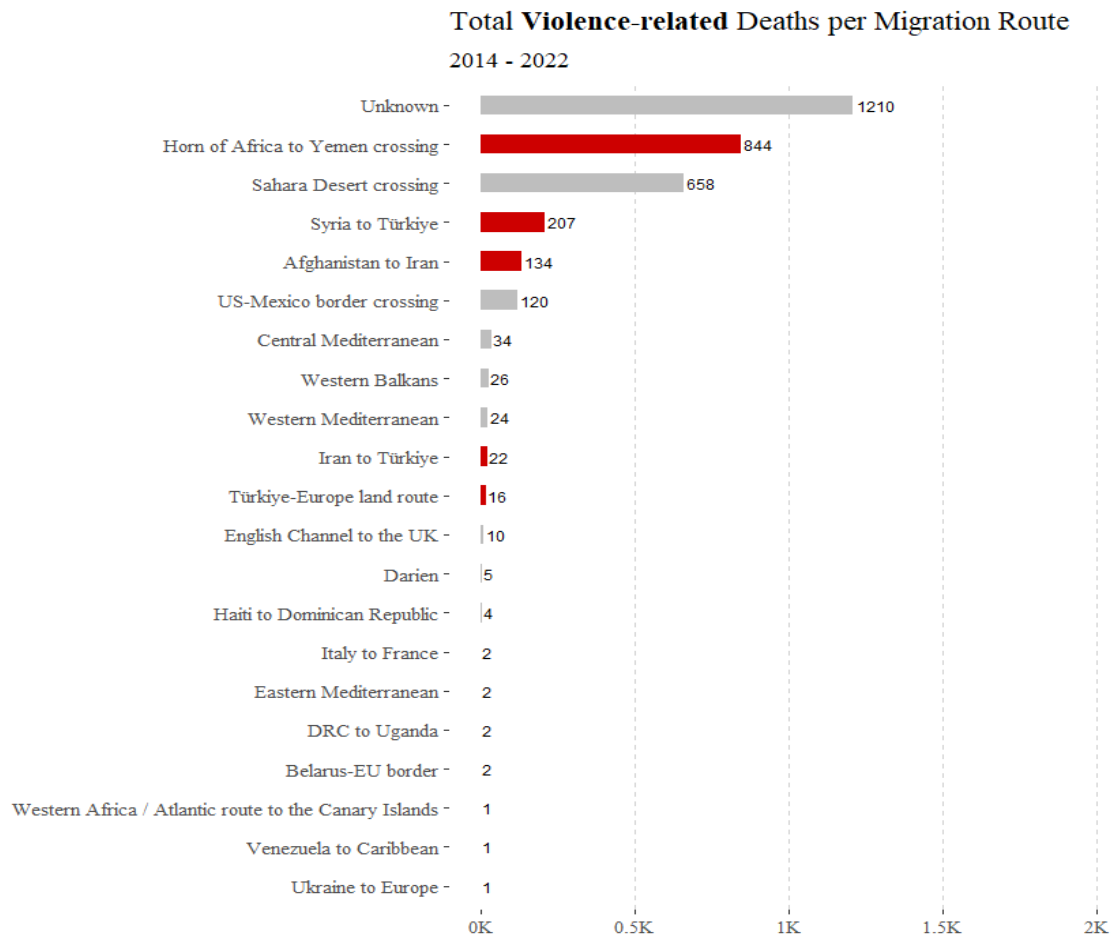Total **Violence-related** Deaths per Year & Continent
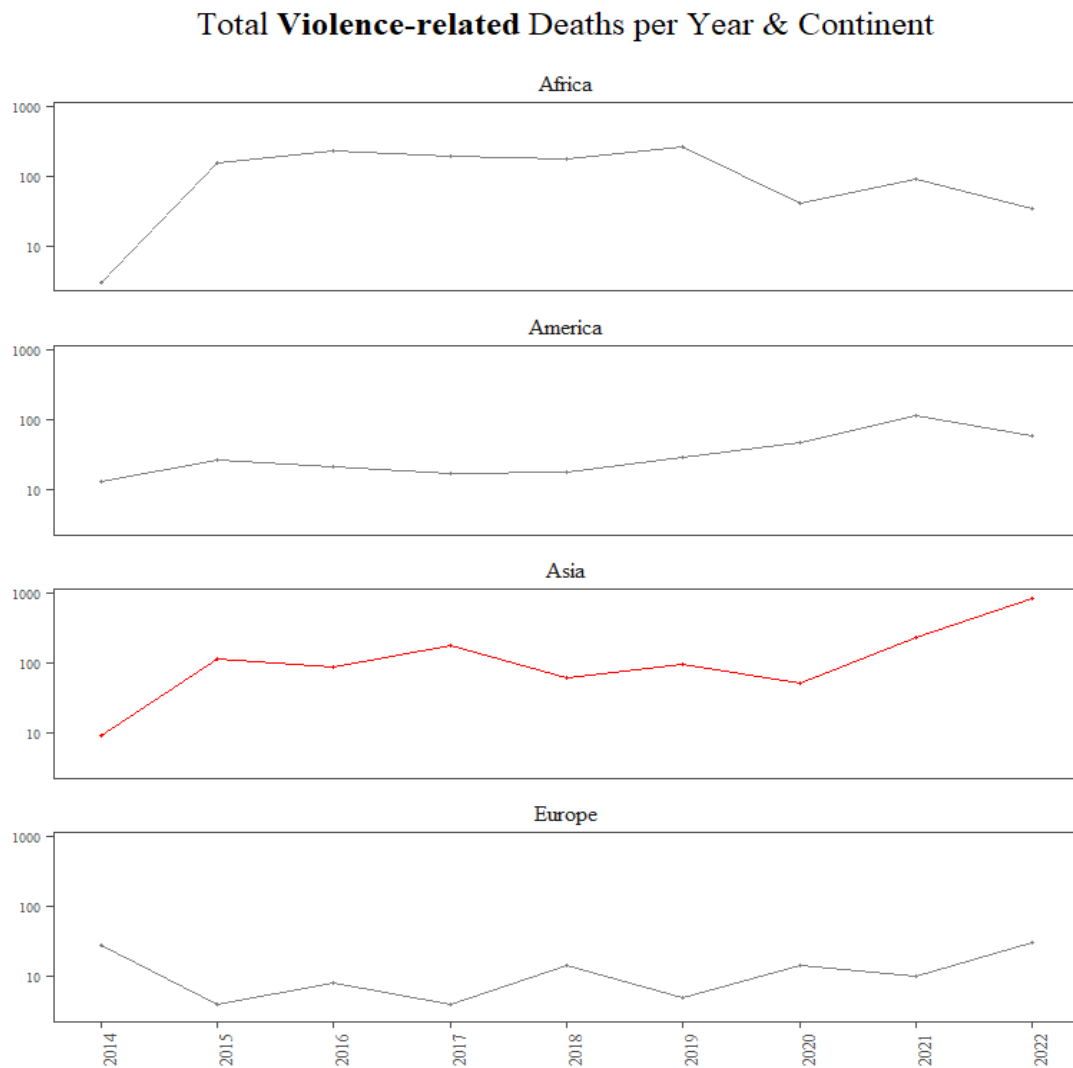
The next insight to acquire is how the violence-related deaths per region of Asia compare to the rest of regions. It appears that the region with the most such deaths is Western Asia followed by Northern Africa and Southern Asia. Regarding the first, **57%** of the total deaths that occurred in this area are due to violence since out of 1915 deaths 1087 were related to this cause.

Total Number of **Violence-related** Deaths per Region of Incident
2014 - 2022

Region	Deaths
Western Asia	1087
Northern Africa	724
Southern Asia	446
Western Africa	300
Central America	187
Eastern Africa	154
South-eastern Asia	137
North America	77
South America	73
Mediterranean	61
Europe	56
Middle Africa	13
Caribbean	8
Southern Africa	1
Eastern Asia	1

The subsequent graph depicts the violence-related deaths that occurred during migration per region of incident over time for all the continents included in the dataset. The subplot that draws the attention is the one of Western Asia as there appears to be a great increase from 2021 to 2022.

**Total Violence-related Deaths per Region of Incident**
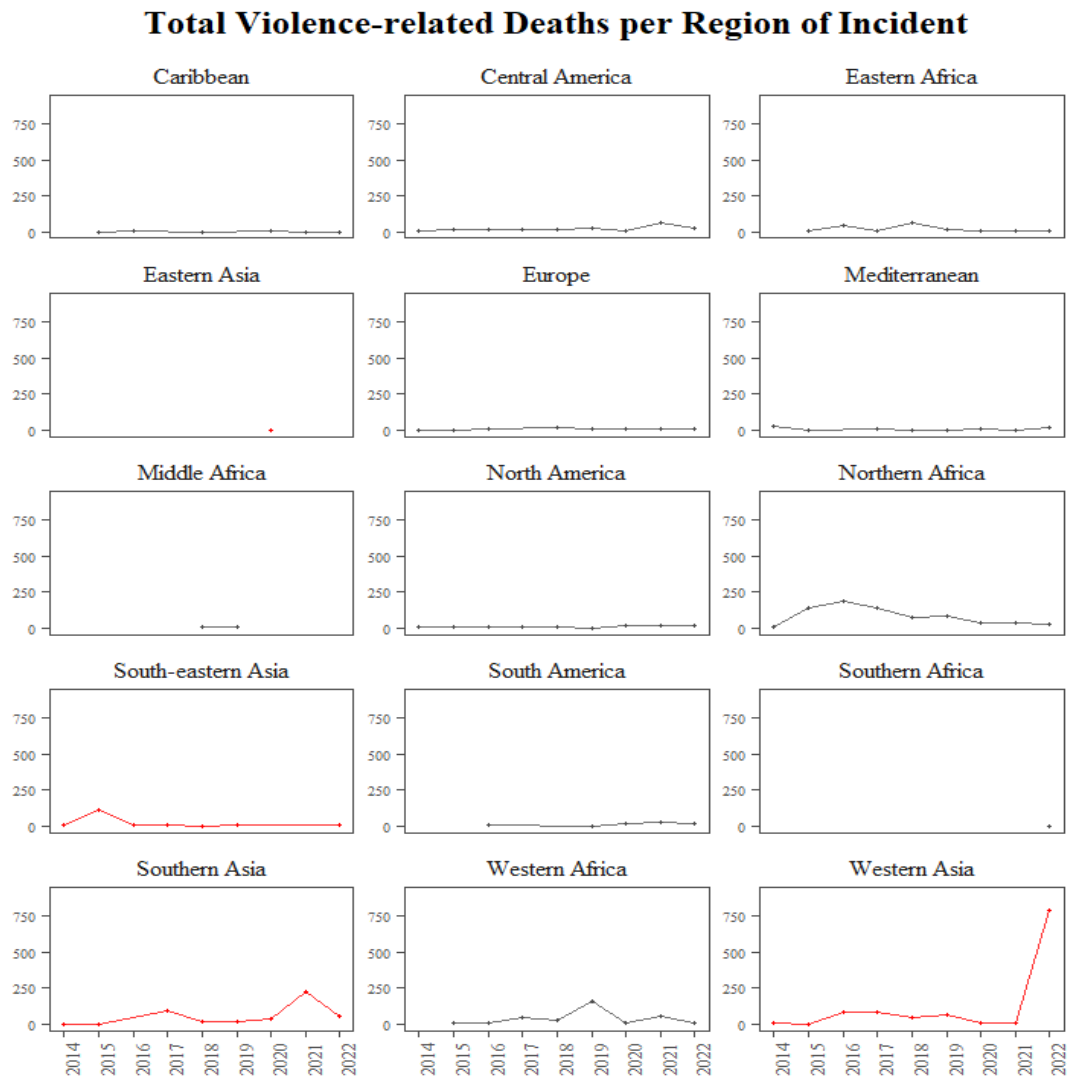
As far as the migration route is concerned, it appears that 3 passages of Asia are among the top 5 channels with the most **violence-related deaths**. The Horn of Africa to Yemen crossing is the first known area with the most recorded deaths that are attributed to violence. Since the total number of deaths in this area is 1,105 and the violence-related deaths for the same region are 884, it emerges that **80%** of the deaths in this passage were violent.

Total **Violence-related** Deaths per Migration Route
2014 - 2022

| Route	Deaths
Unknown	1210
Horn of Africa to Yemen crossing	844
Sahara Desert crossing	658
Syria to Türkiye	207
Afghanistan to Iran	134
US-Mexico border crossing	120
Central Mediterranean	34
Western Balkans	26
Western Mediterranean	24
Iran to Türkiye	22
Türkiye-Europe land route	16
English Channel to the UK	10
Darien	5
Haiti to Dominican Republic	4
Italy to France	2
Eastern Mediterranean	2
DRC to Uganda	2
Belarus-EU border	2
Western Africa / Atlantic route to the Canary Islands	1
Venezuela to Caribbean	1
Ukraine to Europe	1

Geospatial Information

We developed our presented diagrams on the "Hands on Challenge" to encompass more of the world data. Starting from the map of the incidents using the provided coordinates and on hover displaying the article title, the cause of death, the country of origin, the number of men, women and children as well the number of dead and missing. With the ability of filtering by cause of death and by year.
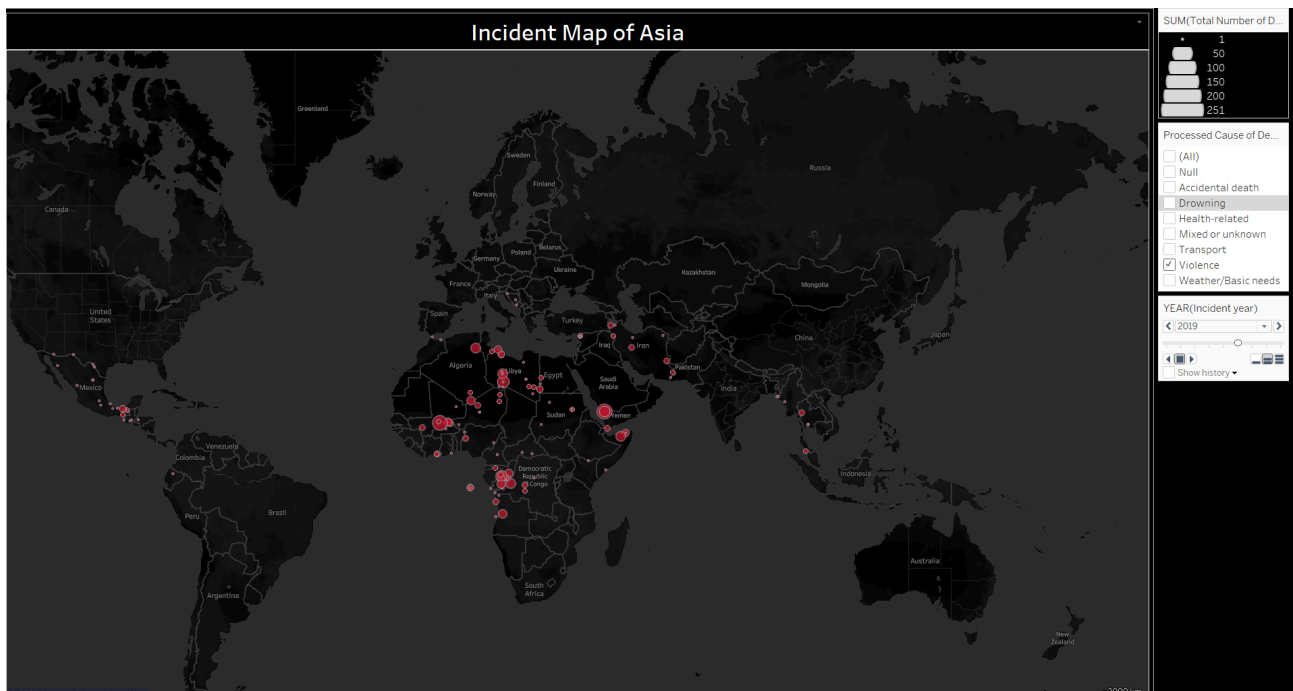
Next we have a dashboard that presents the country of origin of the dead and a bubble plot presenting the dead and missing by Region of Incident while also presenting the number of Women and children present. Also changing year by year. The point of the dashboard is to create a theoretical route between the starting and finishing countries as well to present any changes over a time period.
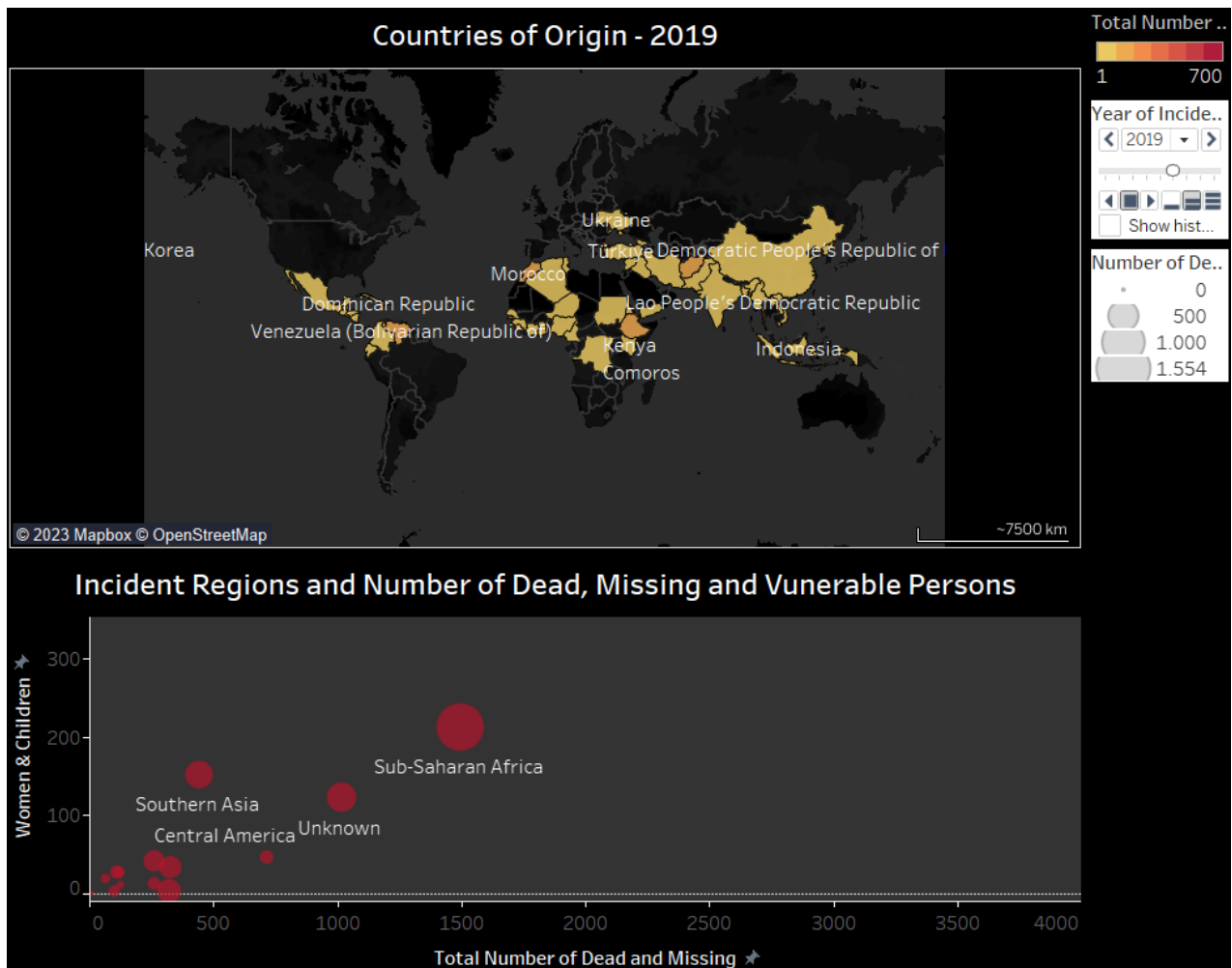
We also wanted to connect the hotspots of migration to the stability of those countries. So we used the Global peace index in the following graph. Presenting the Peace score of each country in a map by the values of 2019 and on hover showing a line plot of the historical values.
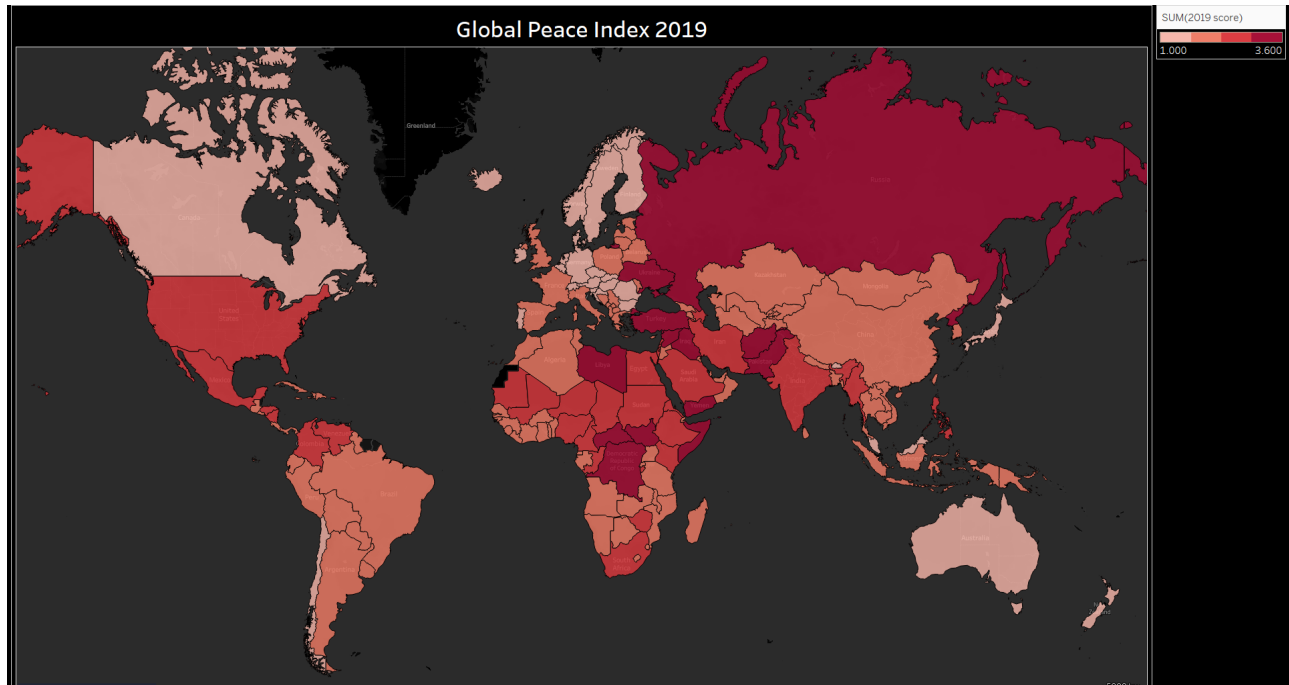
In combination with the dashboard we observe that more stable and poor countries but in closer proximity to 1rst world countries produce a greater flow of people. For example Morocco and Congo. Where we see a stronger correlation in peace and children involved for example Syria and Myanmar.

Conclusion

To conclude, the analysis of recorded migration incidents reveals distinct patterns and trends. To begin with, there is an increasing trend in the number of incidents in both America and Asia, with Asia experiencing a rapid rise, particularly from 2020 to 2022 with the most occurrences taking place in November of 2022. Fortunately, the number of casualties or disappearances during that month was relatively small. Europe also shows a possible slight increase, mainly during the same time period. Africa exhibits fluctuations, with its highest value occurring in 2019 and a subsequent downward trend from 2020 onwards.

As far as the average number of deceased per incident is concerned, the highest value was recorded in 2014 for the continent of Africa. The next highest value recorded was for Asia for the year of 2015.

Regarding the population of deceased or missing individuals, the highest numbers overall appear in the continent of Europe followed by Asia. The highest value appears in Europe during April of 2015. Focusing on Asia, the highest value emerges in December of 2014. In both cases the number of instances is relatively small.

Moving from a broader perspective that encompasses entire continents to a more focused examination at a subregional level, North America has the highest number of incidents, while Asia exhibits variations among its subregions. Southern Asia stands out with a significant increase in incidents from 2018 to 2022, while Eastern and Central Asia display fewer occurrences. The Mediterranean region emerges as the area with the highest number of fatalities, while Southern Asia and Western Asia also experience notable numbers of deaths.

When it comes to the average number of dead or missing per incident compared to the average number of people involved, it arises that Eastern Asia exhibits a relatively high percentage despite the lower average number of people involved and fewer incidents during the time span under study.

Concerning the origin of the people concerning the incidents that occurred in Asia, the western part of the continent witnesses an influx of individuals from Ethiopia and Somalia passing through the Horn of Africa to Yemen crossing which is the channel with the most recorded deaths the majority of which is attributed to violence. In Southern Asia a higher number of individuals coming from Malaysia and Myanmar is recorded, passing through unknown channels.

Furthermore, violence-related deaths during migration appear to be more prevalent in Asia compared to other continents, with Western Asia experiencing a notable increase in such deaths from 2021 to 2022. These findings emphasize the importance of encouraging peace and stability in the area.

The main reasons of displacement especially for vulnerable population is war external or civil, unrest and general instability while immigration for men seems to be greatly influenced by financial and in general higher standards of living in Europe and North America

Appendix

All members contributed equally to this assignment. The static plots were created by Despoina Angelonidi and Agiopoulos Kaptsikas whereas the interactive plots were constructed by Spyridon Mastrodimitris - Gounaropoulos.