ANALYSIS OF COPPER MINING ACCIDENTS IN US FROM 2010-2019

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PRESENTATION OUTLINE

- **Introduction to Research Project** - Mamaita
- **Methodology** - Braci
- **Results** - Joaquin
- **Summary & Conclusion** - Carlha

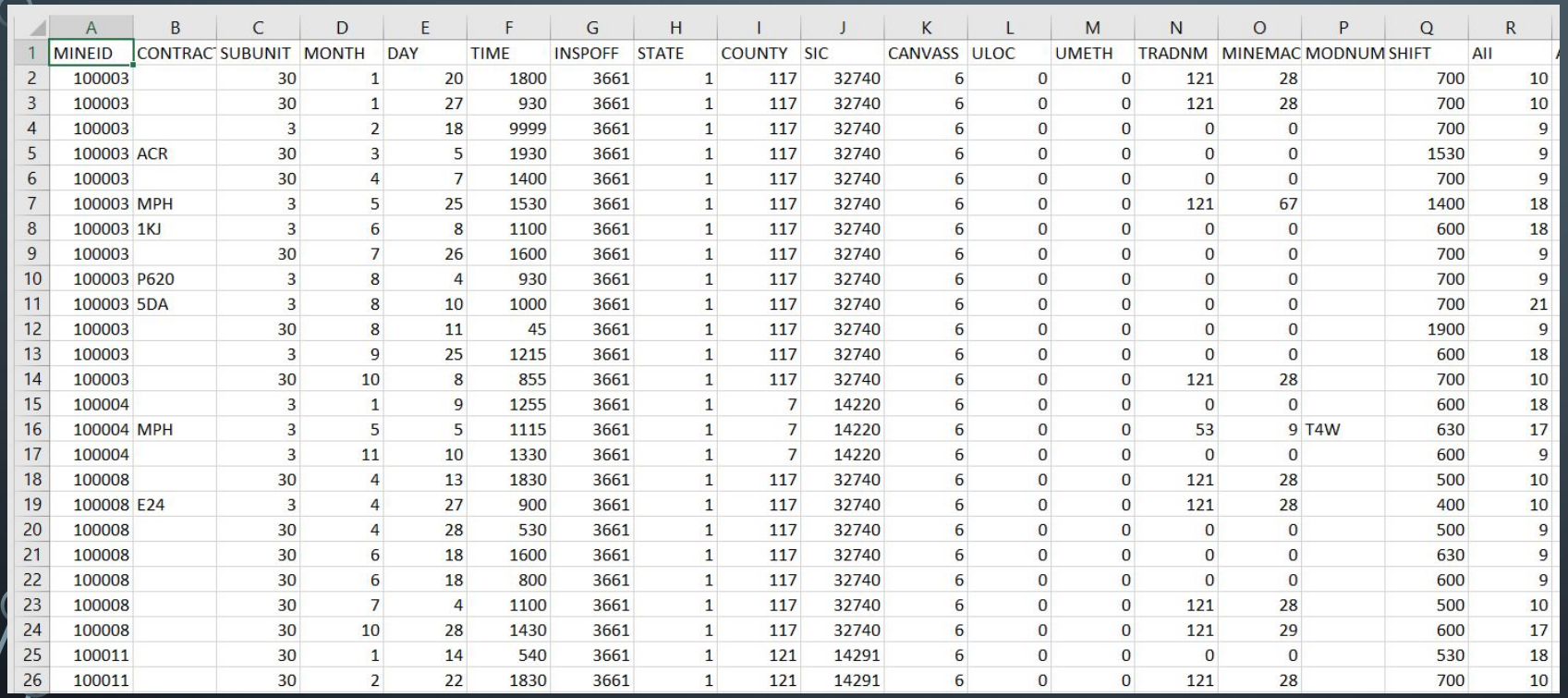
MOTIVATION FOR RESEARCH PROJECT

- Mining is an important, but hazardous industry
- Increased demand for raw materials, such as copper for Electric Vehicles
- Mine Safety Programs reduce injuries and hazards to Mine Personnel through education, training and research

PROJECT DESCRIPTION

- For this project we downloaded MSHA Data which was then analyzed and visualized to determine patterns of accidents.
- Focused on Copper Mining Injuries from 2010-2019 in United States, using:
    1. Number / Frequency of Accidents
    2. Worker Age
    3. Worker Experience
    4. Total Work Days Lost
    5. Injured Body Part

EXAMPLE MSHA DATA



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	MINEID	CONTRAC	SUBUNIT	MONTH	DAY	TIME	INSPOFF	STATE	COUNTY	SIC	CANVASS	ULOC	UMETH	TRADNM	MINEMAC	MODNUM	SHIFT	AII
2	100003		30	1	20	1800	3661	1	117	32740	6	0	0	121	28		700	10
3	100003		30	1	27	930	3661	1	117	32740	6	0	0	121	28		700	10
4	100003		3	2	18	9999	3661	1	117	32740	6	0	0	0	0		700	9
5	100003	ACR	30	3	5	1930	3661	1	117	32740	6	0	0	0	0		1530	9
6	100003		30	4	7	1400	3661	1	117	32740	6	0	0	0	0		700	9
7	100003	MPH	3	5	25	1530	3661	1	117	32740	6	0	0	121	67		1400	18
8	100003	1KJ	3	6	8	1100	3661	1	117	32740	6	0	0	0	0		600	18
9	100003		30	7	26	1600	3661	1	117	32740	6	0	0	0	0		700	9
10	100003	P620	3	8	4	930	3661	1	117	32740	6	0	0	0	0		700	9
11	100003	5DA	3	8	10	1000	3661	1	117	32740	6	0	0	0	0		700	21
12	100003		30	8	11	45	3661	1	117	32740	6	0	0	0	0		1900	9
13	100003		3	9	25	1215	3661	1	117	32740	6	0	0	0	0		600	18
14	100003		30	10	8	855	3661	1	117	32740	6	0	0	121	28		700	10
15	100004		3	1	9	1255	3661	1	7	14220	6	0	0	0	0		600	18
16	100004	MPH	3	5	5	1115	3661	1	7	14220	6	0	0	53	9	T4W	630	17
17	100004		3	11	10	1330	3661	1	7	14220	6	0	0	0	0		600	9
18	100008		30	4	13	1830	3661	1	117	32740	6	0	0	121	28		500	10
19	100008	E24	3	4	27	900	3661	1	117	32740	6	0	0	121	28		400	10
20	100008		30	4	28	530	3661	1	117	32740	6	0	0	0	0		500	9
21	100008		30	6	18	1600	3661	1	117	32740	6	0	0	0	0		630	9
22	100008		30	6	18	800	3661	1	117	32740	6	0	0	0	0		600	9
23	100008		30	7	4	1100	3661	1	117	32740	6	0	0	121	28		500	10
24	100008		30	10	28	1430	3661	1	117	32740	6	0	0	121	29		600	17
25	100011		30	1	14	540	3661	1	121	14291	6	0	0	0	0		530	18
26	100011		30	2	22	1830	3661	1	121	14291	6	0	0	121	28		700	10

MSHA Records: 9,000 + / year, 59 columns of data

HYPOTHESIS / RESEARCH QUESTIONS

What are the most common accidents / injuries?

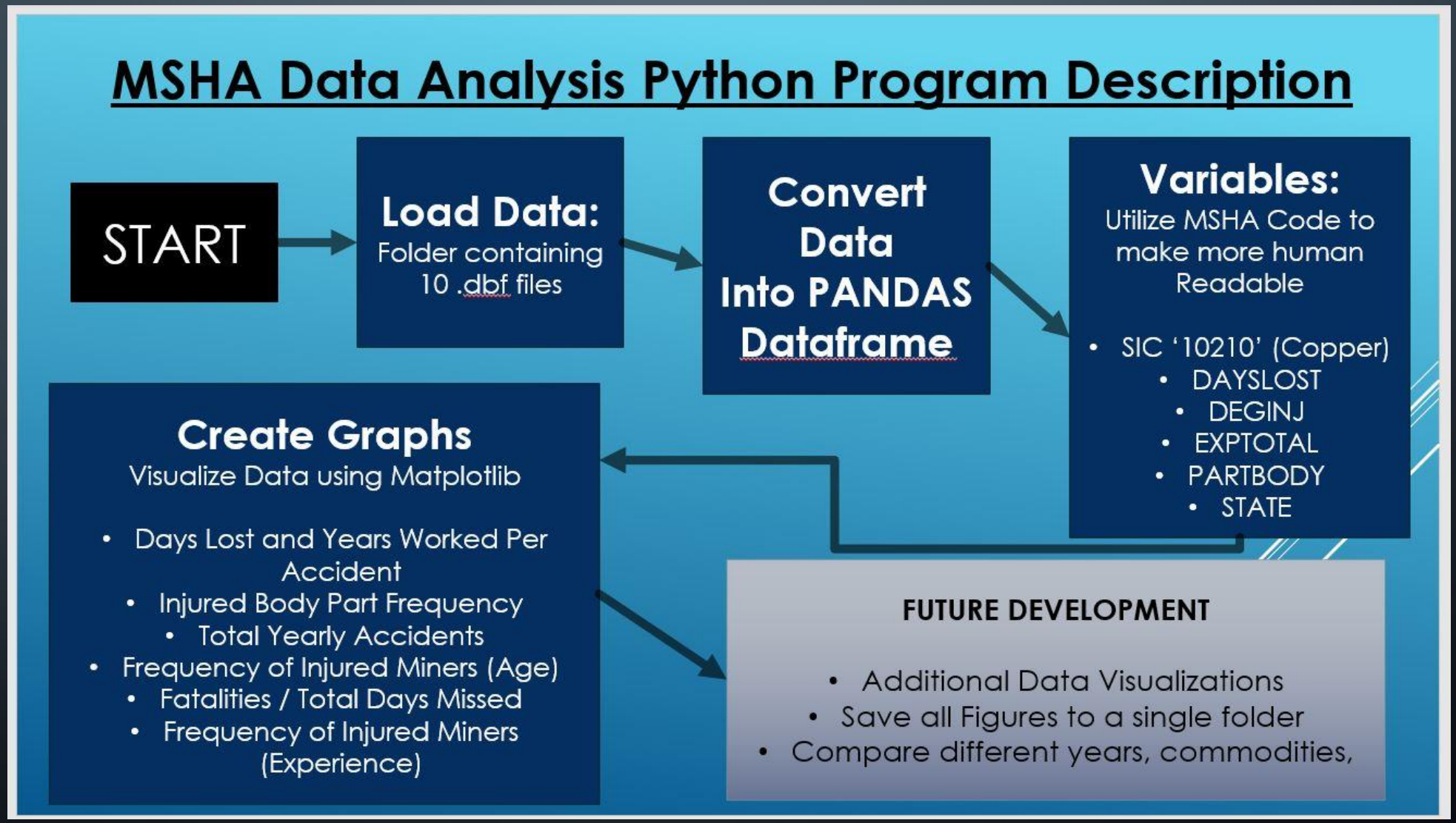
How does Mine Worker Age and Experience affect injuries?

How can we improve safety programs based on this information?

METHODOLOGY

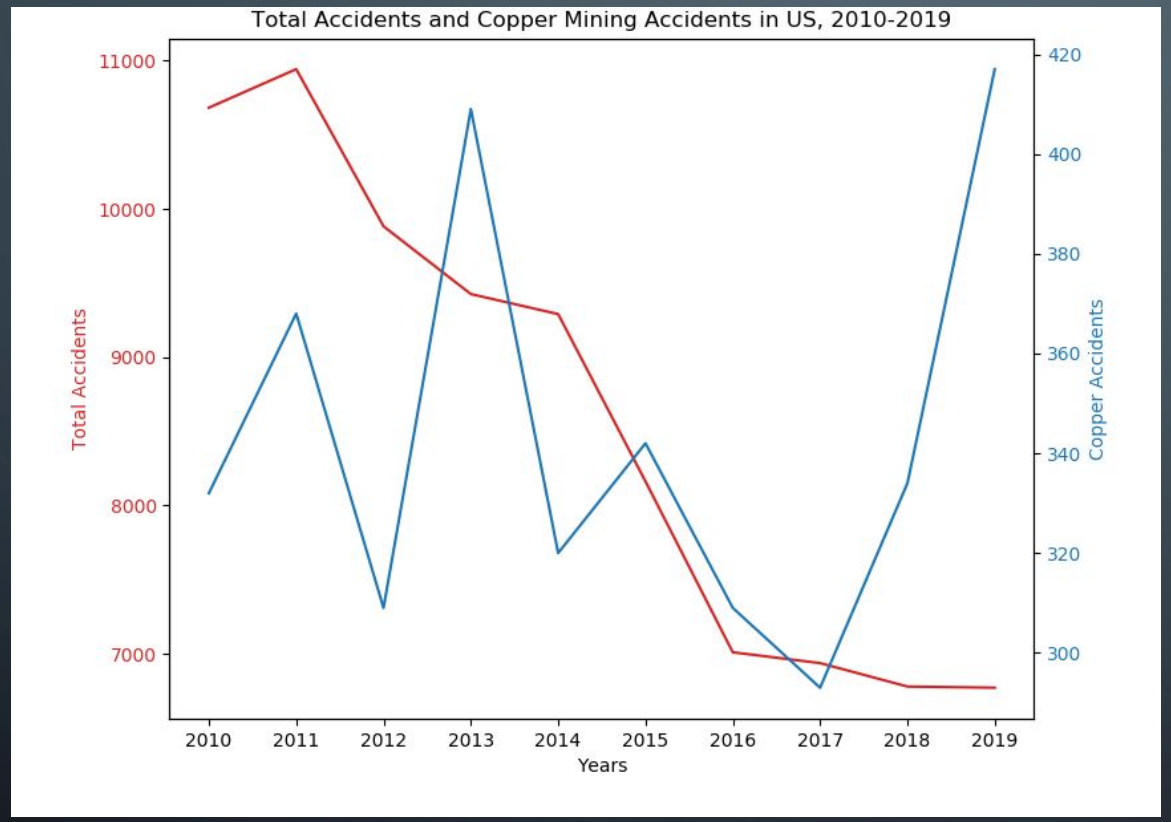
- For this project:
  - Python program was developed to filter, sort, analyze and visualize data which were downloaded
  - Categorized Data using variables such as:
    - DAYSLOST
    - EXPTOTAL
    - PARTBODY
  - Trends in data were analyzed to provide recommendations to industry to improve safety training

PYTHON PROGRAM



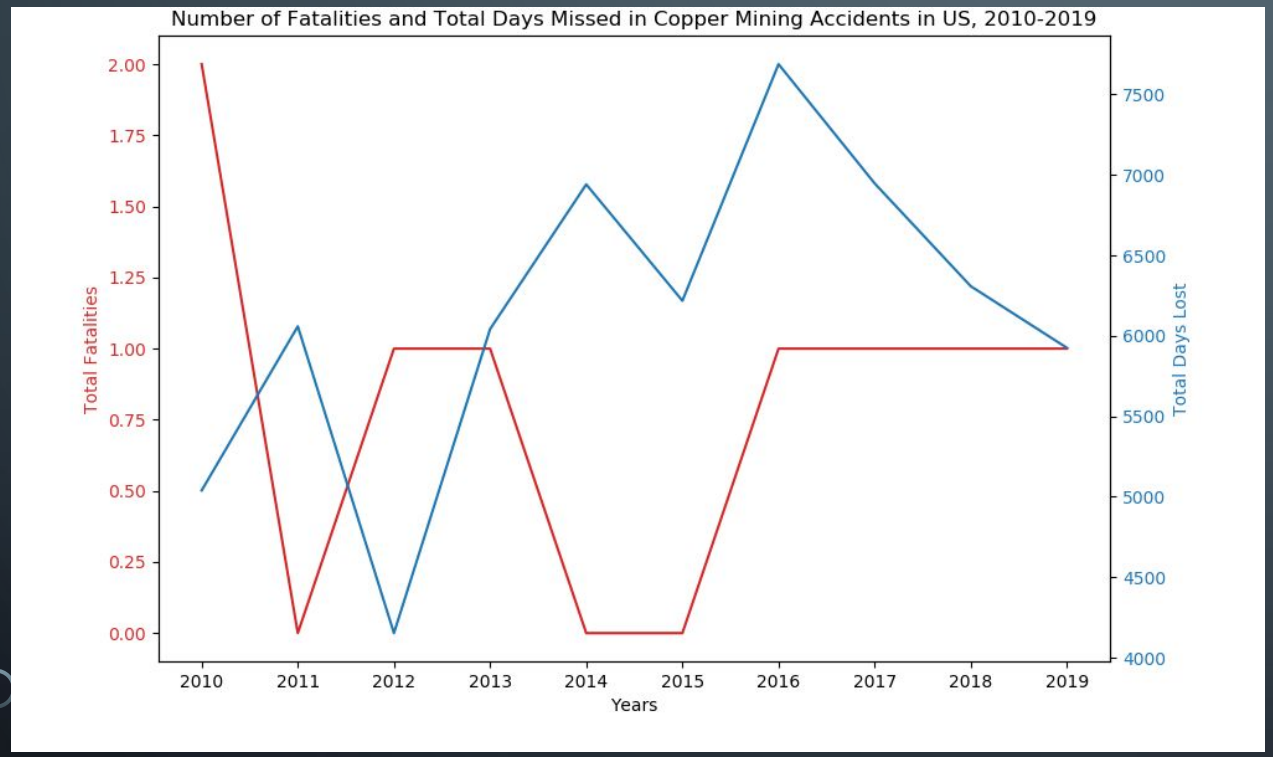
RESULTS

TOTAL MINING AND COPPER MINING ACCIDENTS IN US



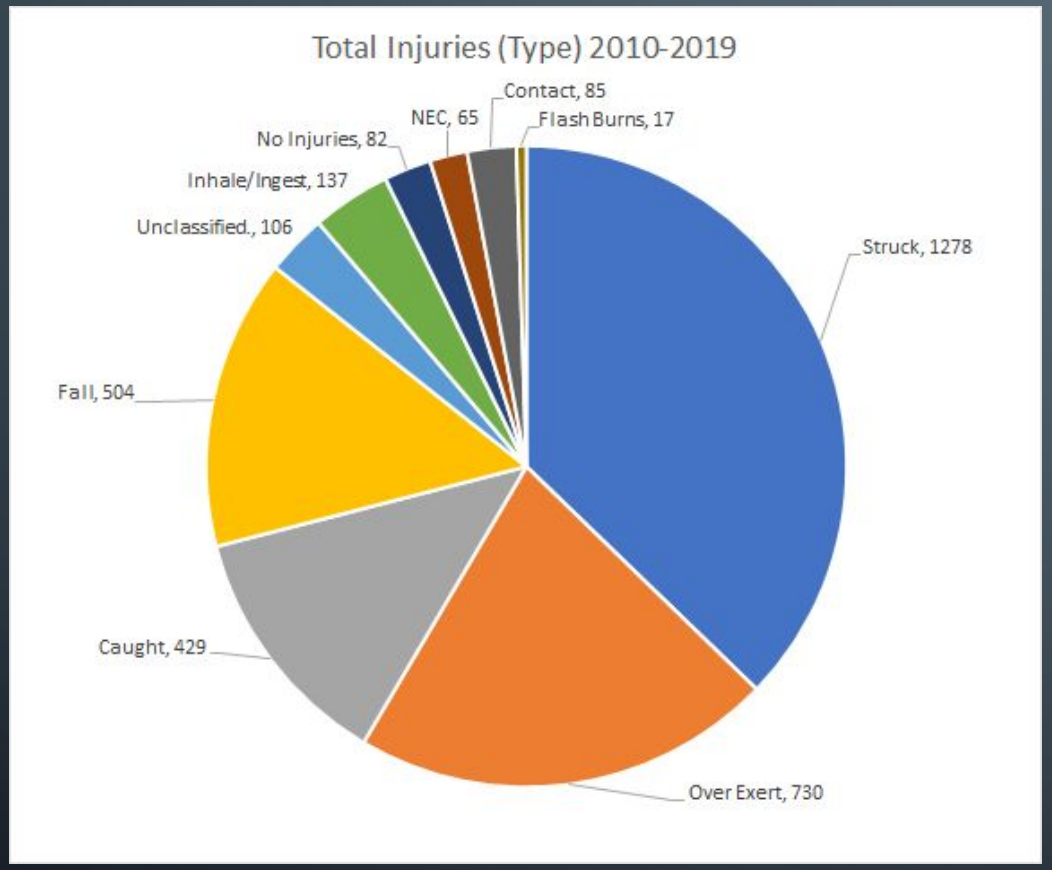
Mining Industry accidents are reducing while Copper Mining Accidents increased from 2017-2019.

TOTAL FATALITIES AND LOST WORKDAYS



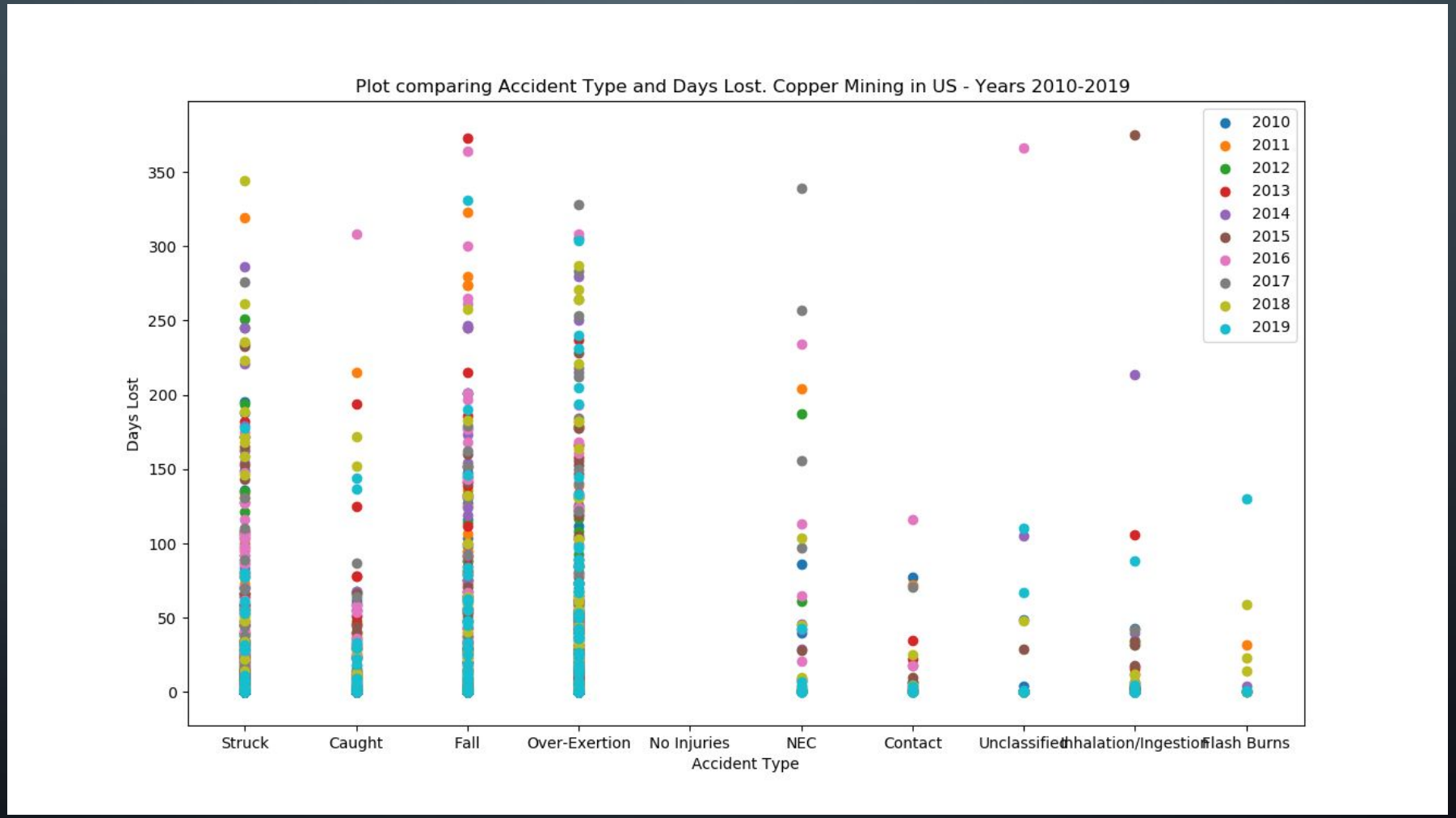
Problem: Injuries and thousands of lost workdays per year.

TOTAL INJURY TYPES, 2010-2019

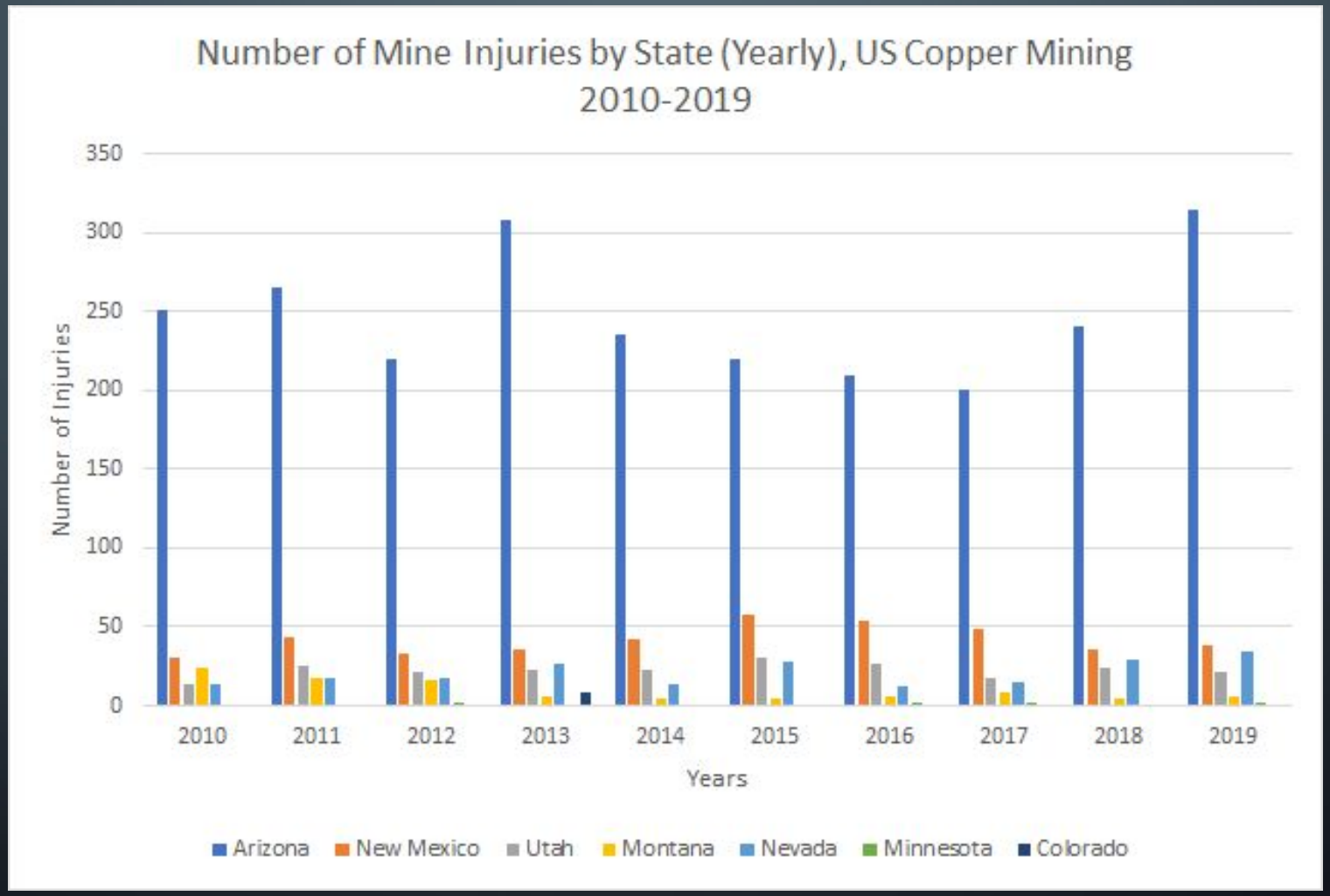


Struck was most common injury type. 5 Injury types resulted in 80%+ of accidents.

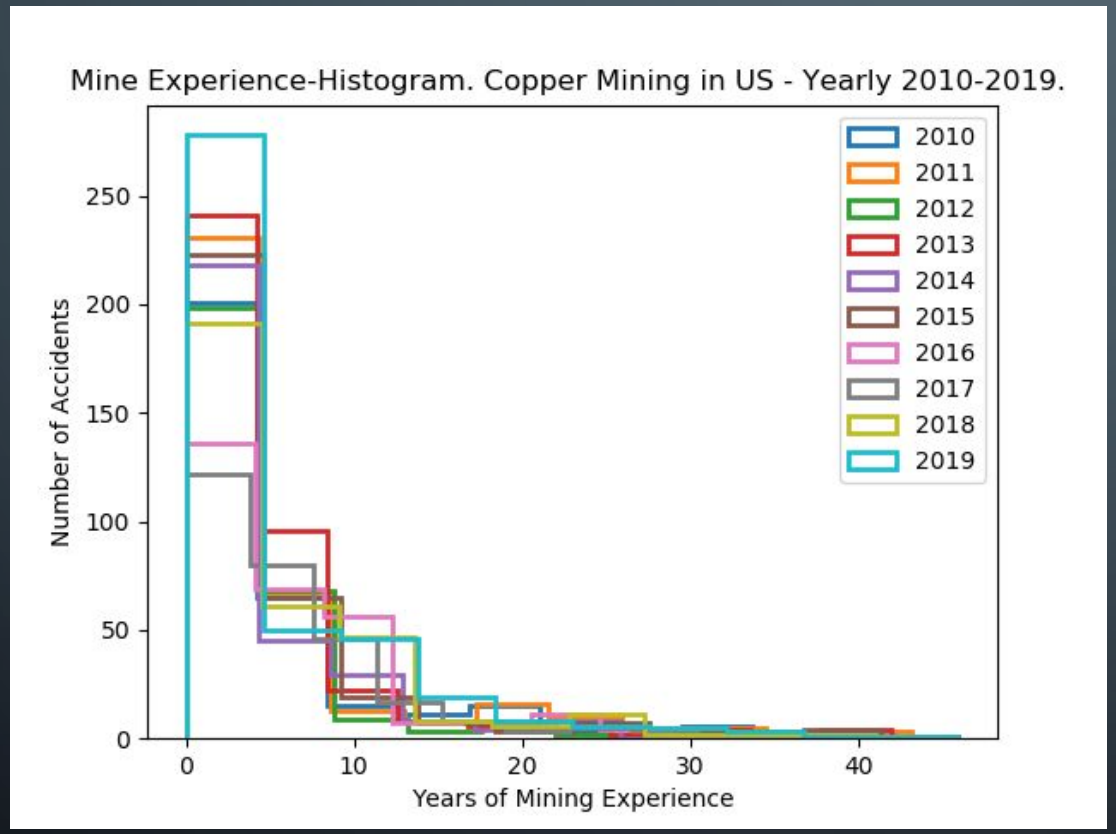
ACCIDENT TYPE AND DAYS LOST



GEOGRAPHIC LOCATIONS OF ACCIDENTS (STATES)

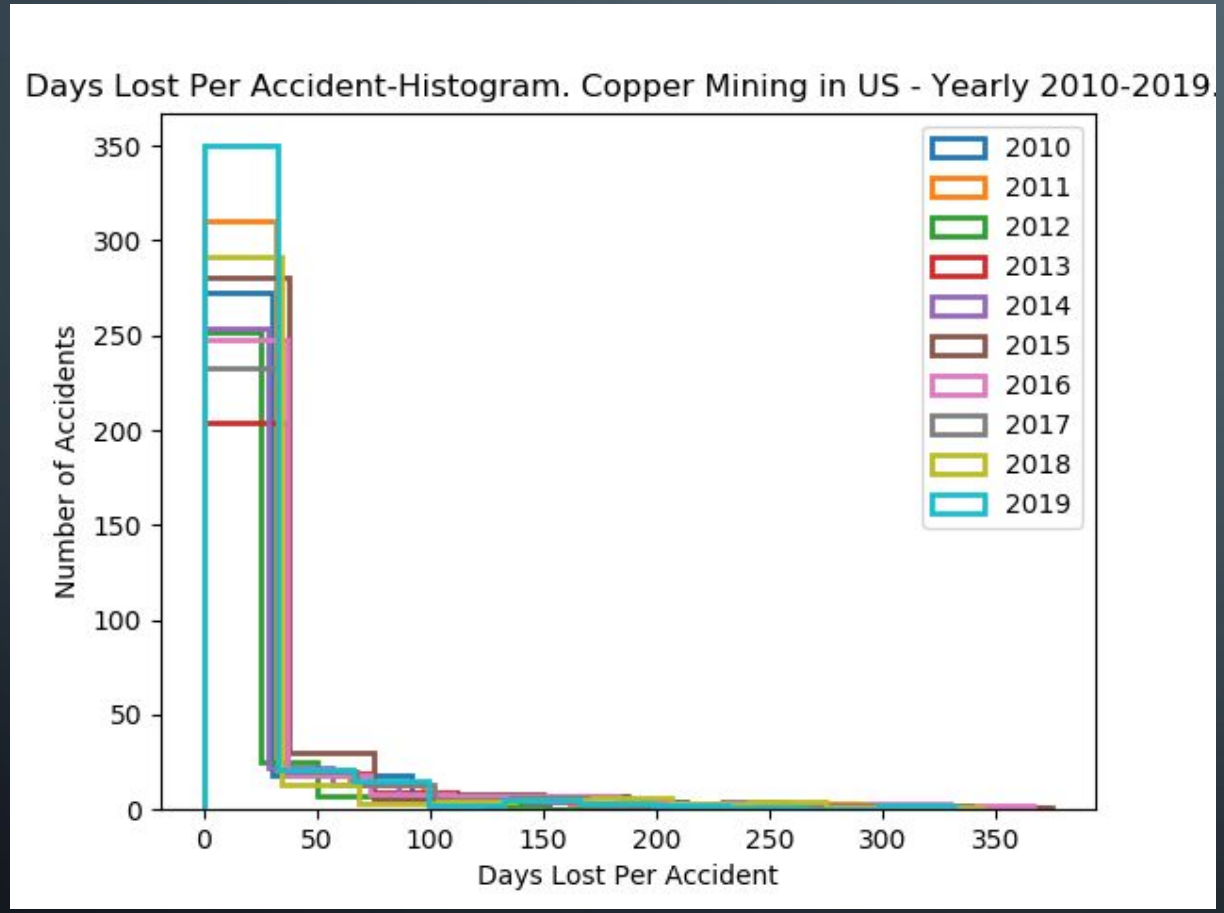


HISTOGRAM – YEARS OF MINE EXPERIENCE, NUMBER OF ACCIDENTS



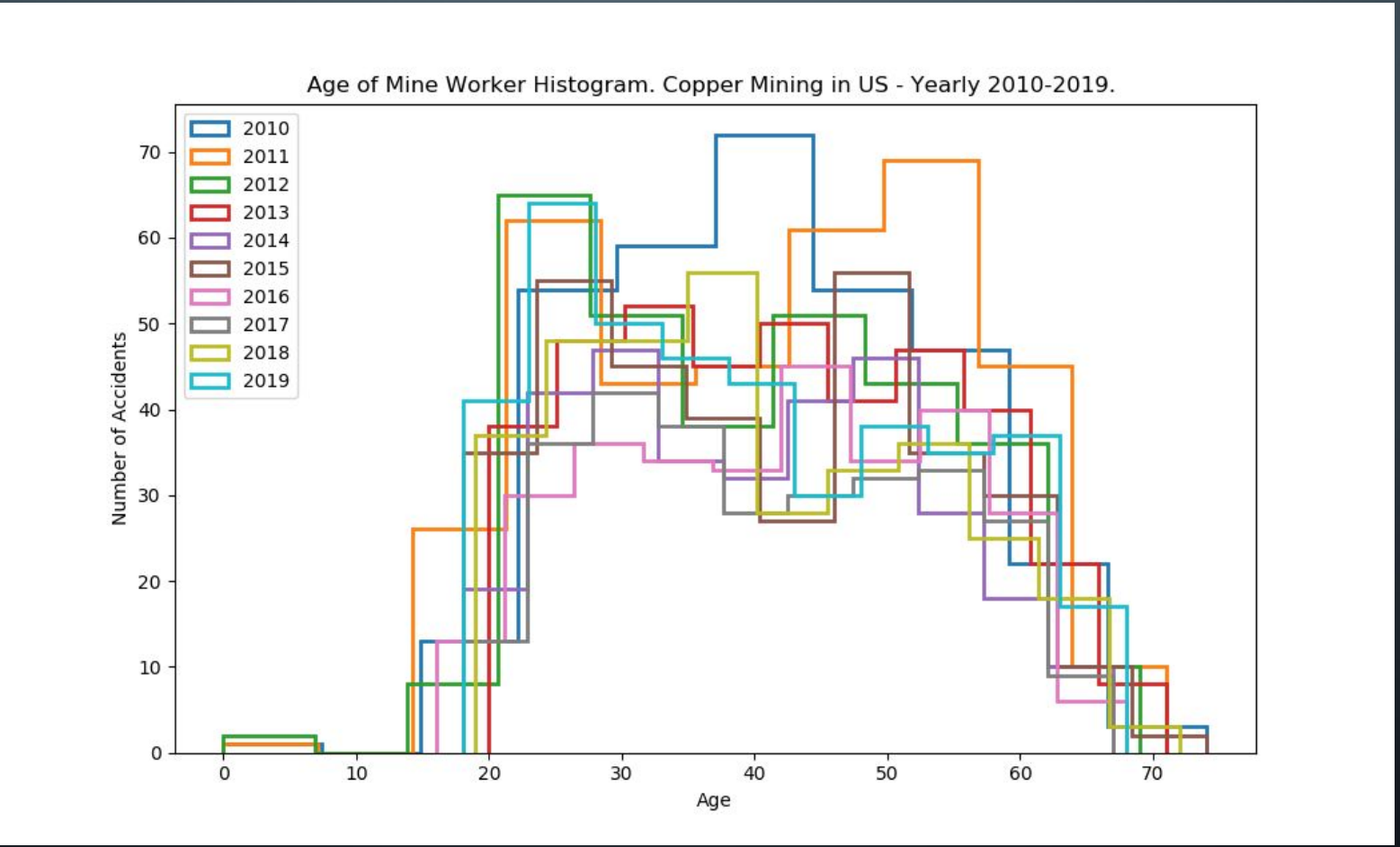
Most accidents occured to miners with less than 5 years experience. Very few injuries after 20 years of Mine Experience.

HISTOGRAM – DAYS LOST PER ACCIDENT

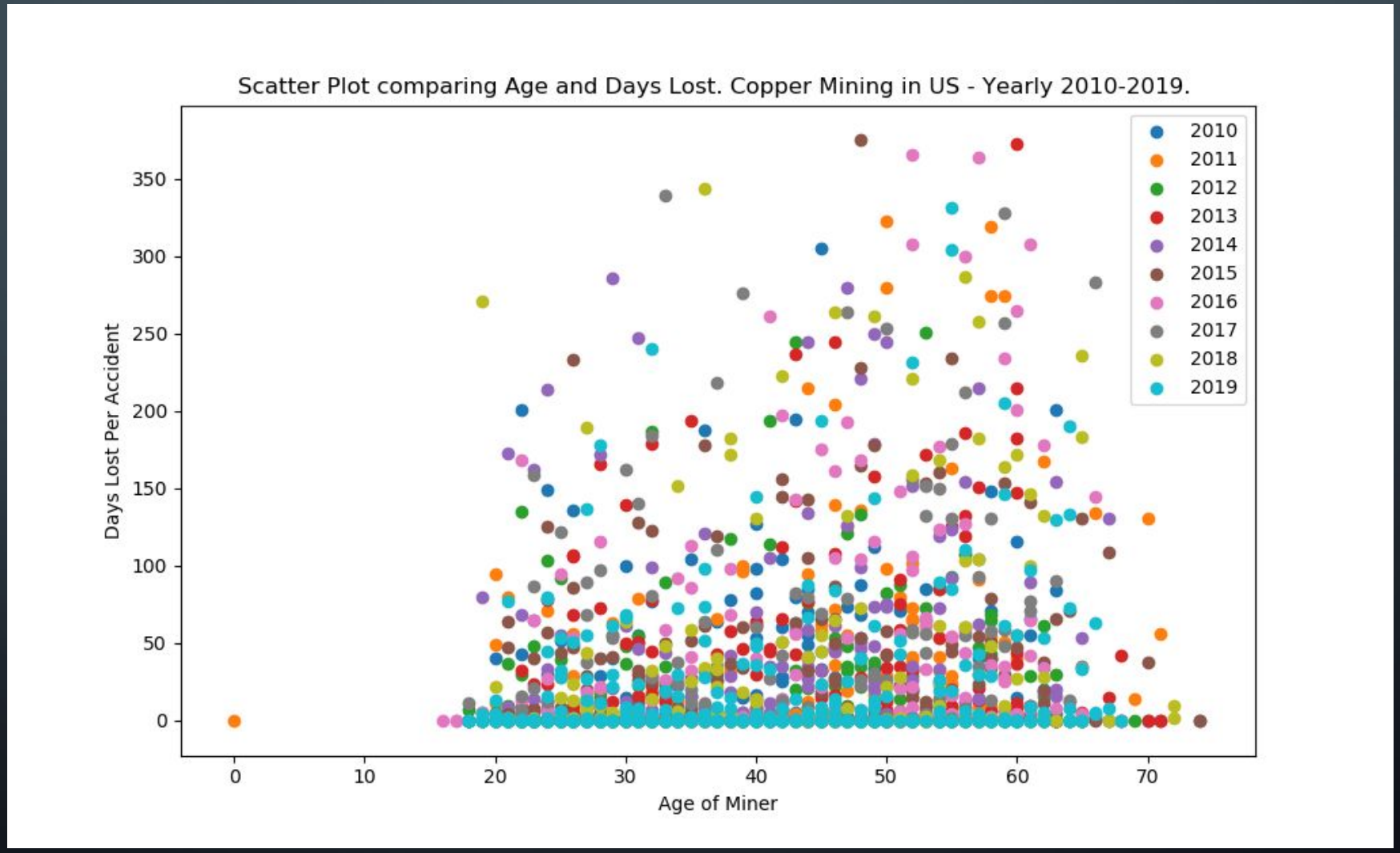


Most injuries resulted in zero days lost of work time.

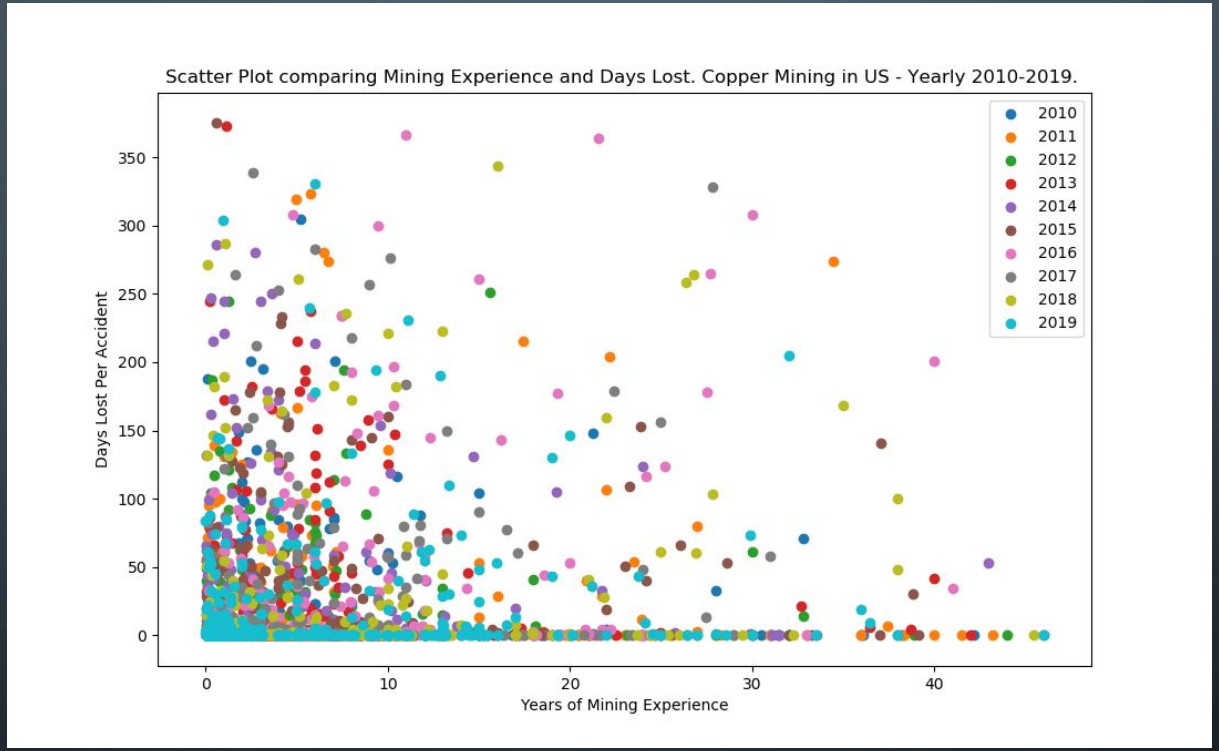
AGE OF MINE WORKER AND FREQUENCY OF INJURIES



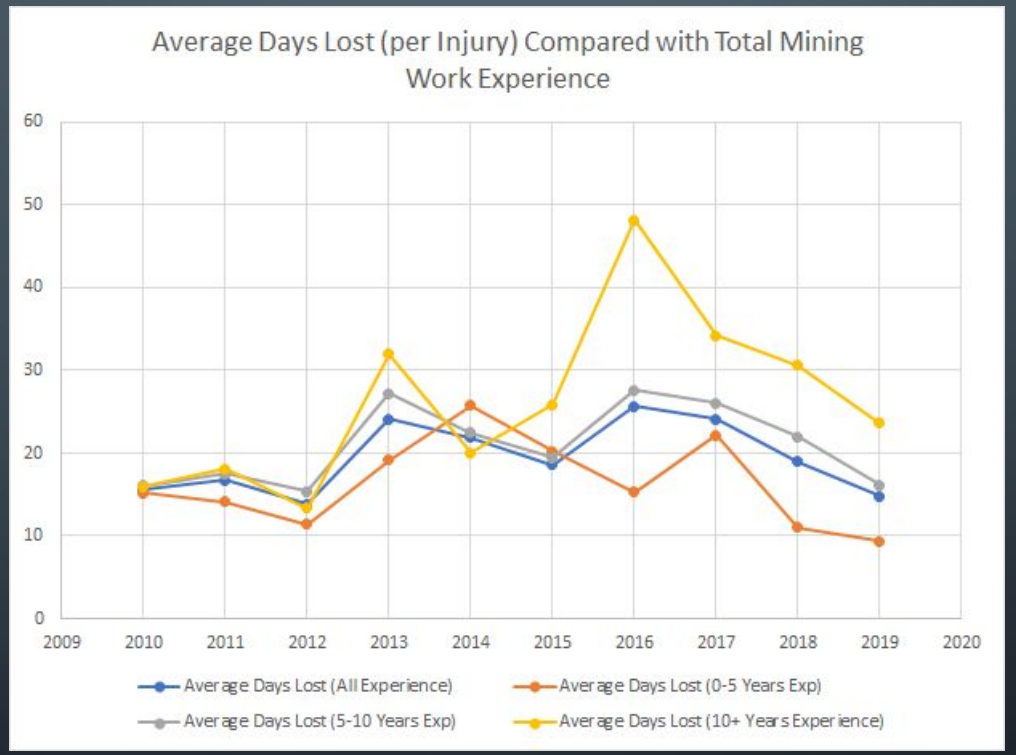
WORKER AGE AND DAYS LOST PER ACCIDENT



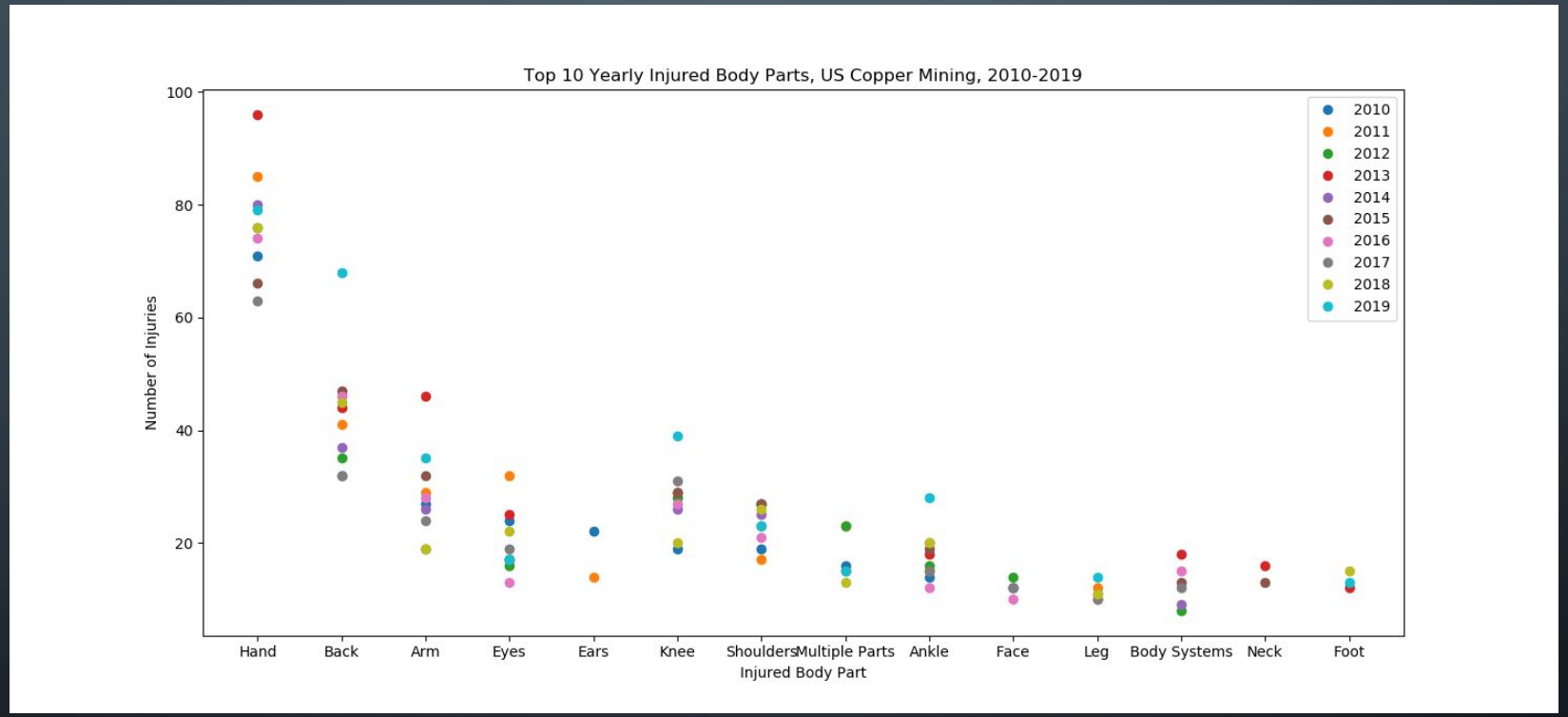
YEARS OF MINE EXPERIENCE AND DAYS LOST PER ACCIDENT SCATTER PLOT



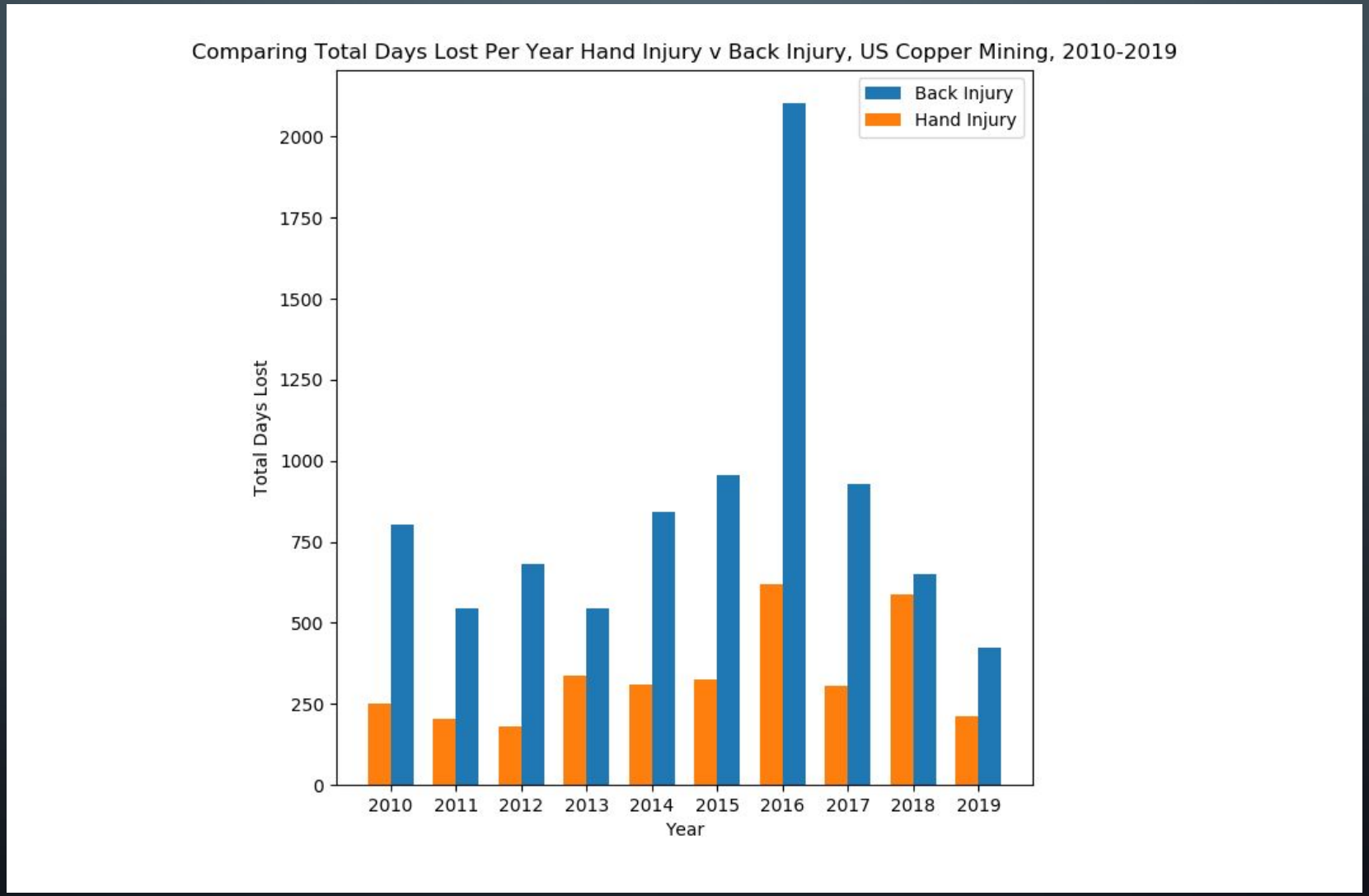
AVERAGE DAYS LOST VS MINE WORK EXPERIENCE



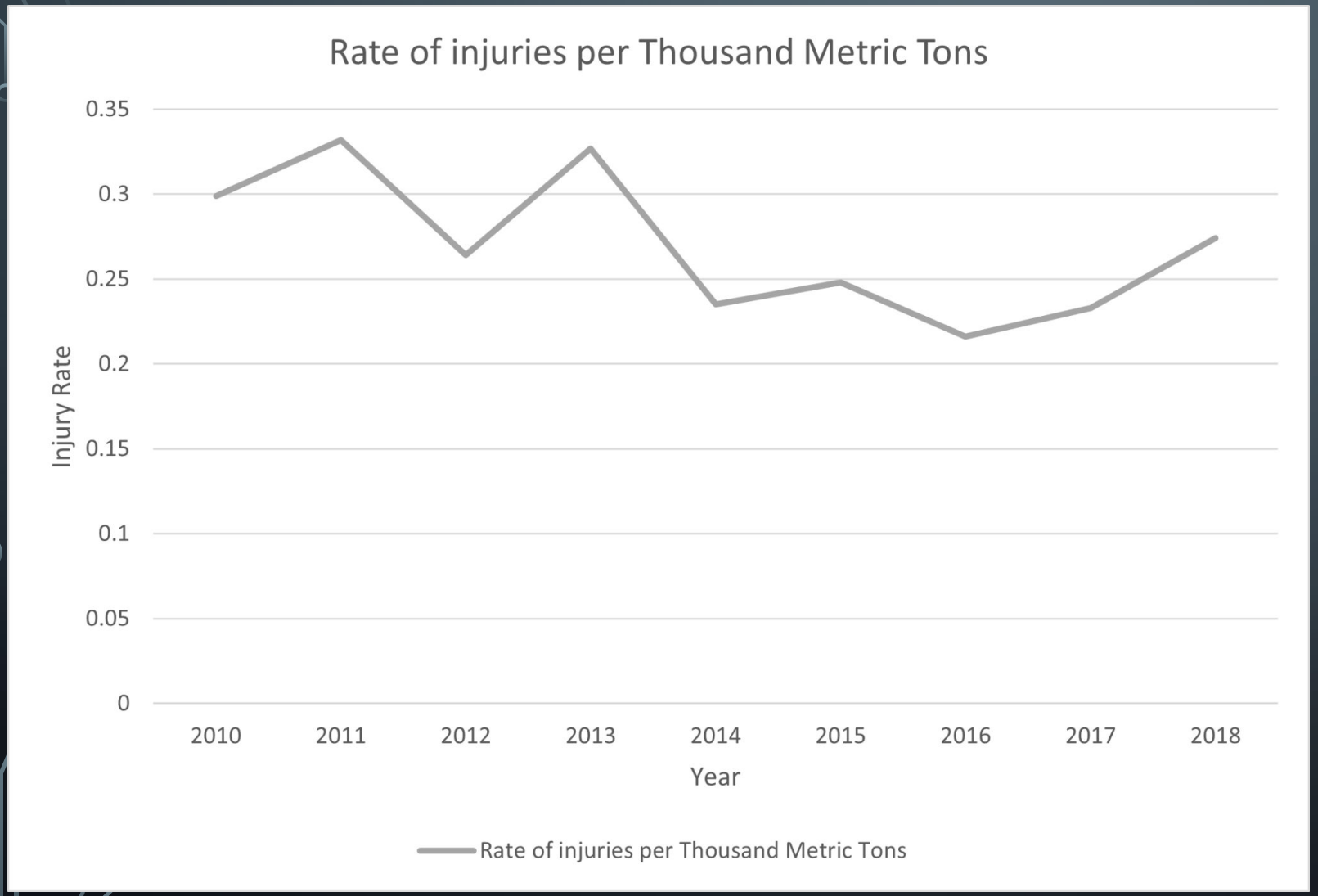
INJURED BODY PART (FREQUENCY) US COPPER MINING 2010-2019



TOTAL DAYS LOST, HAND AND BACK INJURIES



SAFETY RATE OF PRODUCTION - COPPER INDUSTRY



Year	Yearly Copper Production (Thousand Metric Tons)	Number of Reported Accidents (Copper)	Rate of injuries per Thousand Metric Tons
2010	1,110	332	0.299
2011	1,110	368	0.332
2012	1,170	309	0.264
2013	1,250	409	0.327
2014	1,360	320	0.235
2015	1,380	342	0.248
2016	1,430	309	0.216
2017	1,260	293	0.233
2018	1,220	334	0.274
2019	1,300	417	0.321

SUMMARY

- To Summarize, accident data was downloaded from a federally funded (MSHA) database
- Copper Mining Accidents from 2010-2019 were analyzed to understand trends in accidents / injuries
- Although Mining Industry injuries are going down, Copper has seen an increase past two years and increased global demand for Copper due to EV. Safety programs and reducing injuries are paramount.

CONCLUSIONS

- It was noted that most accidents are from inexperienced miners, however, more severe accidents were by experienced miners.
- Safety particularly important in first 0-5 years of Mining Experience
- Most accidents result in zero days of work-time lost and hand was the most commonly injured body part.
- Focus on reducing Back Injuries due to high “Days Work Lost”, Improve PPE for these two areas

FUTURE AREAS OF RESEARCH

- Additional data visualizations with Python Script including different commodities
- Informing Health and Safety Industry Regarding this information and developing Safety Programs
- Research into technologies / materials for eliminating or reducing hand and back injuries

ACKNOWLEDGEMENT

- MINE SAFETY HEALTH ADMINISTRATION (NIOSH, CDC)
- Python PANDAS, MatPlotLib Developers
- Vanessa Salinas
- Previous Presenters in Health and Safety Course

Questions?