

Weekly Capstone Update Meeting

Oct 3 2022

PA Dept. of Labor & Industry + CMU

Goals for today

Propose four main project deliverables & get feedback

Discuss work completed this past week

Discuss timeline for next weeks

Done this past week

October

2 Sprint 2



- 9 Midterm, Thurs. 10/13 @ 1:40pm (<u>Zoom</u>)
- 16 Break, no meeting
- **23** Sprint 3
- 30

- Developed outline for project deliverables
- Ran predictions locally on Jupyter notebook – wahoo!
- Conducted exploratory data analysis on claim, employee, and medical cost datasets
- Continued research similar solutions around the US
- Updated repository with past team documents and latest requirements (in review)
- Prepared for midterm presentation

Questions

What is the status of unblocking statisticians from viewing results in Power BI?

What tools do the statisticians use?

How do you measure success? Any target metric?

Proposed project deliverables

Upload medical costs to database through the interface

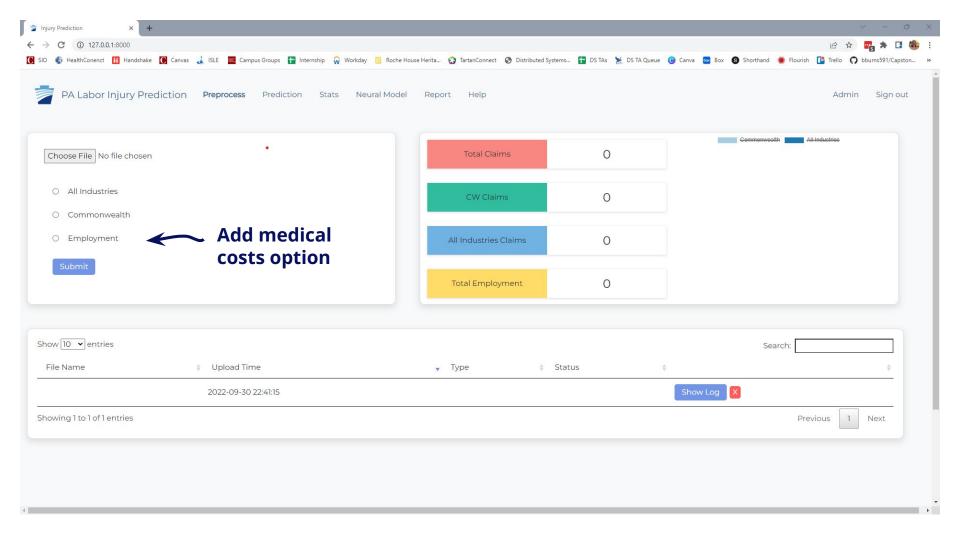
Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application

Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application



Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application

Prediction output in Excel

A	В	С	D	E	F	G	Н	1	J	K	L	M	N	0	Р
	naics_code	county	year	month	date	severity	claim_number	emp_count	injury_rate	type	county_formatted	month_str	naics_level	commonwealth	task_id
27	62	Adams County	2020	9	9/1/2020	All	8	4959	0.001613228	Actual	Adams County PA	September	2	TRUE	10
28	62	Adams County	2020	10	10/1/2020	High	1	5069	0.000197278	Actual	Adams County PA	October	2	TRUE	10
29	62	Adams County	2020	10	10/1/2020	Low	7	5069	0.001380943	Actual	Adams County PA	October	2	TRUE	10
30	62	Adams County	2020	10	10/1/2020	Medium	3	5069	0.000591833	Actual	Adams County PA	October	2	TRUE	10
31	62	Adams County	2020	10	10/1/2020	All	11	5069	0.002170053	Actual	Adams County PA	October	2	TRUE	1
32	62	Adams County	2020	11	11/1/2020	High	1	5030	0.000198807	Actual	Adams County PA	November	2	TRUE	1
33	62	Adams County	2020	11	11/1/2020	Low	5	5030	0.000994036	Actual	Adams County PA	November	2	TRUE	1
34	62	Adams County	2020	11	11/1/2020	Medium	4	5030	0.000795229	Actual	Adams County PA	November	2	TRUE	1
35	62	Adams County	2020	11	11/1/2020	All	10	5030	0.001988072	Actual	Adams County PA	November	2	TRUE	1
36	62	Adams County	2020	12	12/1/2020	High	1	5008	0.000199681	Actual	Adams County PA	December	2	TRUE	1
37	62	Adams County	2020	12	12/1/2020	Low	1	5008	0.000199681	Actual	Adams County PA	December	2	TRUE	1
38	62	Adams County	2020	12	12/1/2020	Medium	3	5008	0.000599042	Actual	Adams County PA	December	2	TRUE	1
39	62	Adams County	2020	12	12/1/2020	All	5	5008	0.000998403	Actual	Adams County PA	December	2	TRUE	1
0	62	Adams County	2021	1	1/1/2021	All	8.851568932	5008	0.001767486	Predicted	Adams County PA	January	2	TRUE	1
1	62	Adams County	2021	2	2/1/2021	All	12.74997932	5008	0.002545922	Predicted	Adams County PA	February	2	TRUE	1
2	62	Adams County	2021	3	3/1/2021	All	3.075329879	5008	0.000614083	Predicted	Adams County PA	March	2	TRUE	1
3	62	Adams County	2021	4	4/1/2021	All	5.53084577	5008	0.001104402	Predicted	Adams County PA	April	2	TRUE	1
4	62	Adams County	2021	5	5/1/2021	All	9.663631519	5008	0.001929639	Predicted	Adams County PA	May	2	TRUE	1
5	62	Adams County	2021	6	6/1/2021	All	10.51307236	5008	0.002099256	Predicted	Adams County PA	June	2	TRUE	1
6	62	Adams County	2021	7	7/1/2021	All	15.52448577	5008	0.003099937	Predicted	Adams County PA	July	2	TRUE	1
7	62	Adams County	2021	8	8/1/2021	All	13.25968038	5008	0.0026477	Predicted	Adams County PA	August	2	TRUE	1
8	62	Adams County	2021	9	9/1/2021	All	9.227483115	5008	0.001842549	Predicted	Adams County PA	September	2	TRUE	1
9	62	Adams County	2021	10	10/1/2021	All	12.01606167	5008	0.002399373	Predicted	Adams County PA	October	2	TRUE	1
10	62	Adams County	2021	11	11/1/2021	All	11.10469734	5008	0.002217392	Predicted	Adams County PA	November	2	TRUE	1
11	62	Adams County	2021	12	12/1/2021	All	6.148434919	5008	0.001227723	Predicted	Adams County PA	December	2	TRUE	1

Historic values

A	В	C	D	E	E	G	Н		J	K	L	M	N	0	Р
	naics_code	county	year	month	date	severity	claim_number	emp_coun	injury_rate	type	county_formatted	month_str	naics_level	commonwealth	task_i
27	62	Adams County	2020	9	9/1/2020	All	8	495	0.001613228	Actual	Adams County PA	September	2	TRUE	1
28	62	Adams County	2020	10	10/1/2020	High	1	506	0.000197278	Actual	Adams County PA	October	2	TRUE	1
29	62	Adams County	2020	10	10/1/2020	Low	7	506	0.001380943	Actual	Adams County PA	October	2	TRUE	1
30	62	Adams County	2020	10	10/1/2020	Medium	3	506	0.000591833	Actual	Adams County PA	October	2	TRUE	
31	62	Adams County	2020	10	10/1/2020	All	11	506	0.002170053	Actual	Adams County PA	October	2	TRUE	
32	62	Adams County	2020	11	11/1/2020	High	1	503	0.000198807	Actual	Adams County PA	November	2	TRUE	1
33	62	Adams County	2020	11	11/1/2020	Low	5	503	0.000994036	Actual	Adams County PA	November	2	TRUE	
34	62	Adams County	2020	11	11/1/2020	Medium	4	503	0.000795229	Actual	Adams County PA	November	2	TRUE	
35	62	Adams County	2020	11	11/1/2020	All	10	503	0.001988072	Actual	Adams County PA	November	2	TRUE	1 3
36	62	Adams County	2020	12	12/1/2020	High	1	500	0.000199681	Actual	Adams County PA	December	2	TRUE	
37	62	Adams County	2020	12	12/1/2020	Low	1	500	0.000199681	Actual	Adams County PA	December	2	TRUE	
38	62	Adams County	2020	12	12/1/2020	Medium	3	500	0.000599042	Actual	Adams County PA	December	2	TRUE	
39	62	Adams County	2020	12	12/1/2020	All	5	500	0.000998403	Actual	Adams County PA	December	2	TRUE	
0	62	Adams County	2021	1	1/1/2021	AII	8.851568932	500	0.001767486	Predicted	Adams County PA	January	2	TRUE	8
1	62	Adams County	2021	2	2/1/2021	All	12.74997932	500	0.002545922	Predicted	Adams County PA	February	2	TRUE	
2	62	Adams County	2021	3	3/1/2021	All	3.075329879	500	0.000614083	Predicted	Adams County PA	March	2	TRUE	
3	62	Adams County	2021	4	4/1/2021	All	5.53084577	500	0.001104402	Predicted	Adams County PA	April	2	TRUE	1
4	62	Adams County	2021	5	5/1/2021	All	9.663631519	500	0.001929639	Predicted	Adams County PA	May	2	TRUE	
5	62	Adams County	2021	6	6/1/2021	All	10.51307236	500	0.002099256	Predicted	Adams County PA	June	2	TRUE	
6	62	Adams County	2021	7	7/1/2021	All	15.52448577	500	0.003099937	Predicted	Adams County PA	July	2	TRUE	
7	62	Adams County	2021	8	8/1/2021	All	13.25968038	500	0.0026477	Predicted	Adams County PA	August	2	TRUE	
8	62	Adams County	2021	9	9/1/2021	All	9.227483115	500	0.001842549	Predicted	Adams County PA	September	2	TRUE	
9	62	Adams County	2021	10	10/1/2021	All	12.01606167	500	0.002399373	Predicted	Adams County PA	October	2	TRUE	
10	62	Adams County	2021	11	11/1/2021	All	11.10469734	500	0.002217392	Predicted	Adams County PA	November	2	TRUE	
11	62	Adams County	2021	12	12/1/2021	All	6.148434919	500	0.001227723	Predicted	Adams County PA	December	2	TRUE	

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39	62	Adams County	2020	12	12/1/2020	All	5	5008	0.000998403	Actual	Adams County PA	December	2	TRUE	
n	62	Adams County	2021	- 1	1/1/2021	ΛII	Q Q5156QQ27	รกกฐ	n nn1767/196	Dradictad	Adams County DA	lanuary	2	TRITE	
1	62	Adams County	2021	2	2/1/2021	All	12.74997932	5008	0.002545922	Predicted	Adams County PA	February	2	TRUE	
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5	62	Adams County	2021	6	6/1/2021	All	10.51307236	5008	0.002099256	Predicted	Adams County PA	June	2	TRUE	
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Predicted values

Α	В	С	D	E	F	G	Н	1	J	K	L	M	N	0	Р
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34	62	Adams County	2020	11	11/1/202	0 Medium	4	5030	0.000795229	Actual	Adams County PA	November	2	TRUE	10
35	62	Adams County	2020	11	11/1/202	0 All	10	5030	0.001988072	Actual	Adams County PA	November	2	TRUE	10
36	62	Adams County	2020	12	12/1/202	0 High	1	5008	0.000199681	Actual	Adams County PA	December	2	TRUE	10
37	62	Adams County	2020	12	12/1/202	0 Low	1	5008	0.000199681	Actual	Adams County PA	December	2	TRUE	10
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39	62	Adams County	2020	12	12/1/202	D All	5	5008	0.000998403	Actual	Adams County PA	December	2	TRUE	10
0	62	Adams County	2021	1	1/1/202	1 All	8.851568932	5008	0.001767486	Predicted	Adams County PA	January	2	TRUE	10
1	62	Adams County	2021	2	2/1/202	1 All	12.74997932	5008	0.002545922	Predicted	Adams County PA	February	2	TRUE	10
2	62	Adams County	2021	3	3/1/202	1 All	3.075329879	5008	0.000614083	Predicted	Adams County PA	March	2	TRUE	10
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5	62	Adams County	2021	6	6/1/202	1 All	10.51307236	5008	0.002099256	Predicted	Adams County PA	June	2	TRUE	10
6	62	Adams County	2021	7	7/1/202	1 All	15.52448577	5008	0.003099937	Predicted	Adams County PA	July	2	TRUE	10
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10	62	Adams County	2021	11	11/1/202	1 All	11.10469734	5008	0.002217392	Predicted	Adams County PA	November	2	TRUE	10
11	62	Adams County	2021	12	12/1/202	1 All	6.148434919	5008	0.001227723	Predicted	Adams County PA	December	2	TRUE	1

	G	Н				J	K
	severity	laim_number	emp_d	count	injury_	rate	type
0	All	8		4959	0.001	613228	Actual
0	High	1		5069	0.000	197278	Actual
0	Low	7		5069	0.001	380943	Actual
0	Medium	3		5069	0.000	591833	Actual
0	All	11		5069	0.002	170053	Actual
0	High	1		5030	0.000	198807	Actual
0	Low	5		5030	0.000	994036	Actual
0	Medium	4		5030	0.000	795229	Actual
0	All	10		5030	0.001	988072	Actual
0	High	1		5008	0.000	199681	Actual
0	Low	1		5008	0.000	199681	Actual
0	Medium	3		5008	0.000	599042	Actual
0	All	5		5008	0.000	998403	Actual
1	All	8.851568932		5008	0.001	767486	Predicted
1	All	12.74997932		5008	0.002	545922	Predicted
1	All	3.075329879		5008	0.000	614083	Predicted
1	All	5.53084577		5008	0.001	104402	Predicted
1	All	9.663631519		5008	0.001	929639	Predicted
1	All	10.51307236		5008	0.002	099256	Predicted
1	All	15.52448577		5008	0.003	099937	Predicted
1	All	13.25968038		5008	0.0	026477	Predicted
1	All	9.227483115		5008	0.001	842549	Predicted
1	All	12.01606167		5008	0.002	399373	Predicted
1	All	11.10469734		5008	0.002	217392	Predicted
1	All	6.148434919		5008	0.001	227723	Predicted

```
Severity = injury cause score (0 - 8)
+
injury nature score (0 - 8)
```

Low = 0 to 7

Medium = 8 to 13

High = 13 to 16

	G	Н		1		J	K
	severity	laim_number	emp_	count	injury	rate	type
0	All	8		4959	0.001	613228	Actual
0	High	1		5069	0.000	197278	Actual
0	Low	7		5069	0.001	380943	Actual
0	Medium	3		5069	0.000	591833	Actual
0	All	11		5069	0.002	170053	Actual
0	High	1		5030	0.000	198807	Actual
0	Low	5		5030	0.000	994036	Actual
0	Medium	4		5030	0.000	795229	Actual
0	All	10		5030	0.001	988072	Actual
0	High	1		5008	0.000	199681	Actual
0	Low	1		5008	0.000	199681	Actual
0	Medium	3		5008	0.000	599042	Actual
0	All	5		5008	0.000	998403	Actual
1	All	8.851568932		5008	0.001	767486	Predicted
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1	All	5.53084577		5008	0.001	104402	Predicted
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1	All	10.51307236		5008	0.002	099256	Predicted
1	All	15.52448577		5008	0.003	099937	Predicted
1	All	13.25968038		5008	0.0	026477	Predicted
1	All	9.227483115		5008	0.001	842549	Predicted
1	All	12.01606167		5008	0.002	399373	Predicted
1	All	11.10469734		5008	0.002	217392	Predicted
1	All	6.148434919		5008	0.001	227723	Predicted

Severity = injury cause score (0 - 8) + injury nature score (0 - 8)

Low = 0 to 7

Medium = 8 to 13

High = 13 to 16



Make this smarter with medical costs



Note -

Currently, severity only splits injury rates on **historic values.**

It **does not** contribute to predictions.

Predicted severity rates is something that future teams could explore.

	G	Н	1	J	K
	severity	laim_number	emp_count	injury_rate	type
0	All	8	4959	0.001613228	Actual
0	High	1	5069	0.000197278	Actual
0	Low	7	5069	0.001380943	Actual
0	Medium	3	5069	0.000591833	Actual
0	All	11	5069	0.002170053	Actual
0	High	1	5030	0.000198807	Actual
0	Low	5	5030	0.000994036	Actual
0	Medium	4	5030	0.000795229	Actual
0	All	10	5030	0.001988072	Actual
0	High	1	5008	0.000199681	Actual
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1	All	8.851568932	5008	0.001767486	Predicted
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1	All	12.01606167	5008	0.002399373	Predicted
1	All	11.10469734	5008	0.002217392	Predicted
1	All	6.148434919	5008	0.001227723	Predicted

Severity = injury cause score (0 - 8) + injury nature score (0 - 8)

Low = 0 to 7

Medium = 8 to 13

High = 13 to 16



Make this smarter with medical costs

- Is this aligned with the goal?

Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

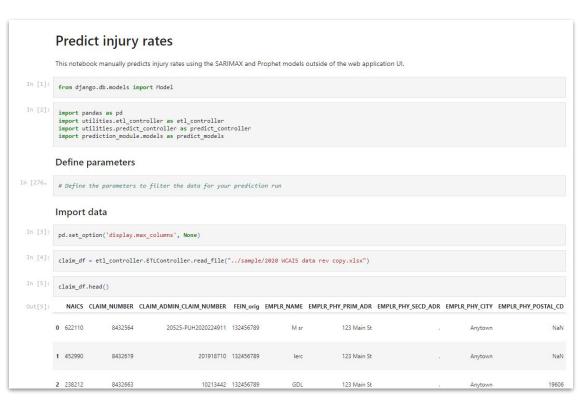
Run predictions outside of the web application

Alternative option to web application

Specify parameters (county, NAICS)

Get results (Excel, charts)

Used for development, future teams



Current draft

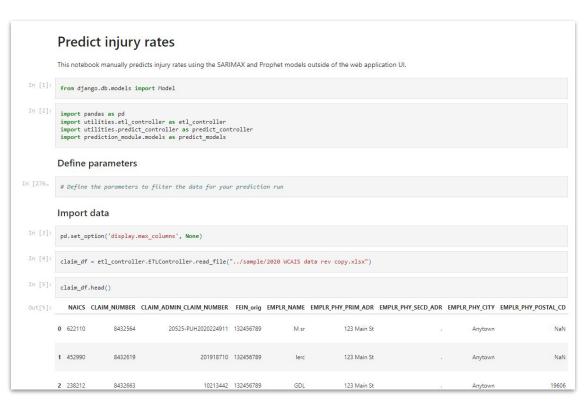
Alternative option to web application

Specify parameters (county, NAICS)

Get results (Excel, charts)

Used for development, future teams

- → Is this interesting?
- → Do you currently use notebook solutions?
- → Is this technically feasible?



Current draft

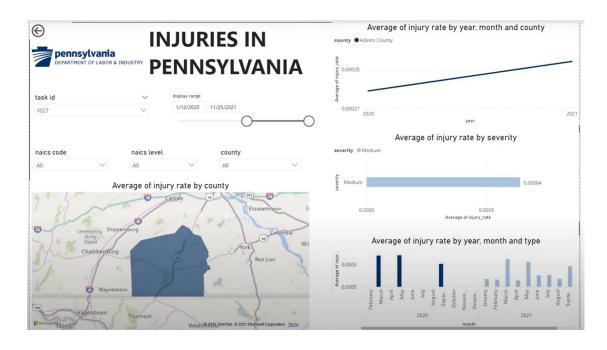
Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application

Add in **top 10** counties & industries with high injury rates

Add analysis of **medical costs**



Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application

Upload medical costs to database through the interface

Analyze injury rates by severity – updated with medical costs

Run predictions outside of the web application

Visual top 5 counties/industries injury rate and medical costs in Power BI report

→ Does this align with your goals?

More completed this week

Ran predictions locally

Ran prediction on small set

- Adams county
- NAICS = 62, Health Care and Social Assistance sector
- 2020

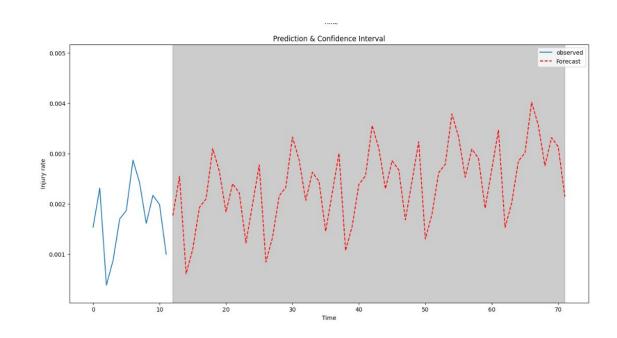
Predicted 2021 monthly values

Excel output (shown early)

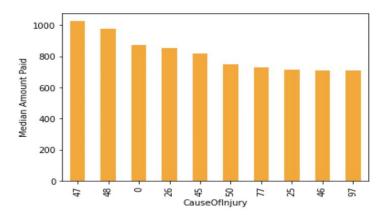
Displayed charts (not Power BI report)

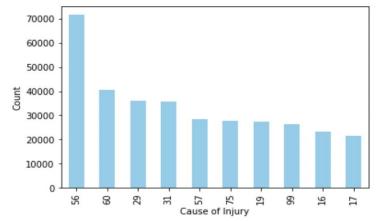
Used Jupyter notebook, not web application





Exploratory data analysis





Analyzed PCRB (medical costs) data

Calculated **top-10** injury causes, nature of injury and parts of body by count and median medical costs

Obtained a **42%** match rate on joining PCRB (medical costs) and WCAIS (claims) data

→ 2018 WCAIS corrupted - resend?

Cause of injury:

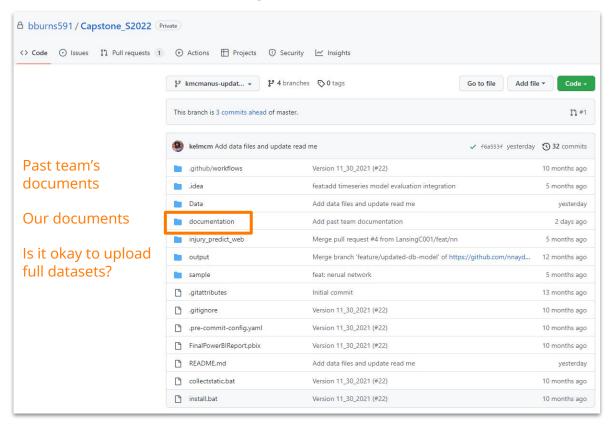
47 = Crash of Airplane

48 = Vehicle Upset

56 = Lifting

60 = Strain by Injury

Update repository with documentation



Next steps

Next week

Conduct midterm presentation, Thursday, Oct. 13 @ 1:40pm (Zoom Link)

Merge documentation to repository

After break, Sprint 3

Create medical costs upload functionality

Re-define and implement severity using medical costs

Demo jupyter notebook to run predictions