Link & Learn: Matching Illinois Crash & Hospital Data then Studying the Results

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Data Linkage

- UIS began work on linking statewide crash and hospital inpatient and ED records in 2019
  - CDC funded initial project, transitioned to IDOT grant
  - Participants:
    - UIS Institute for Legal, Legislative, and Policy Studies
    - IDOT Bureau of Safety Programs and Engineering
    - IDPH Injury Prevention Program
- IDOT participated in NHTSA CODES data linkage program from 2006-2014 – IL crash/hospital data successfully linked & methods recorded
  - Large project of 20 states, a national center, additional resources

Data Linkage: Disparate Data

Crash Data Only

- KABCO injury
  - Fatality
  - Police account of injury severity
- Vehicle type
- Helmet, seatbelt, child restrain use
- Speed a factor?
  - Some issues with this field
- Built environment variables
- Pedestrian/cyclist actions

Hospital Data Only

- Injury specifics (concussion et al.)
- Clinical severity level (AIS score)
- Hospital charges
- Discharge disposition
  - Home, rehab/long term care, transfer to other facility, mortality
- Race and ethnicity
- Patient home zip code – very useful to study & target communities

Data Linkage: Methods

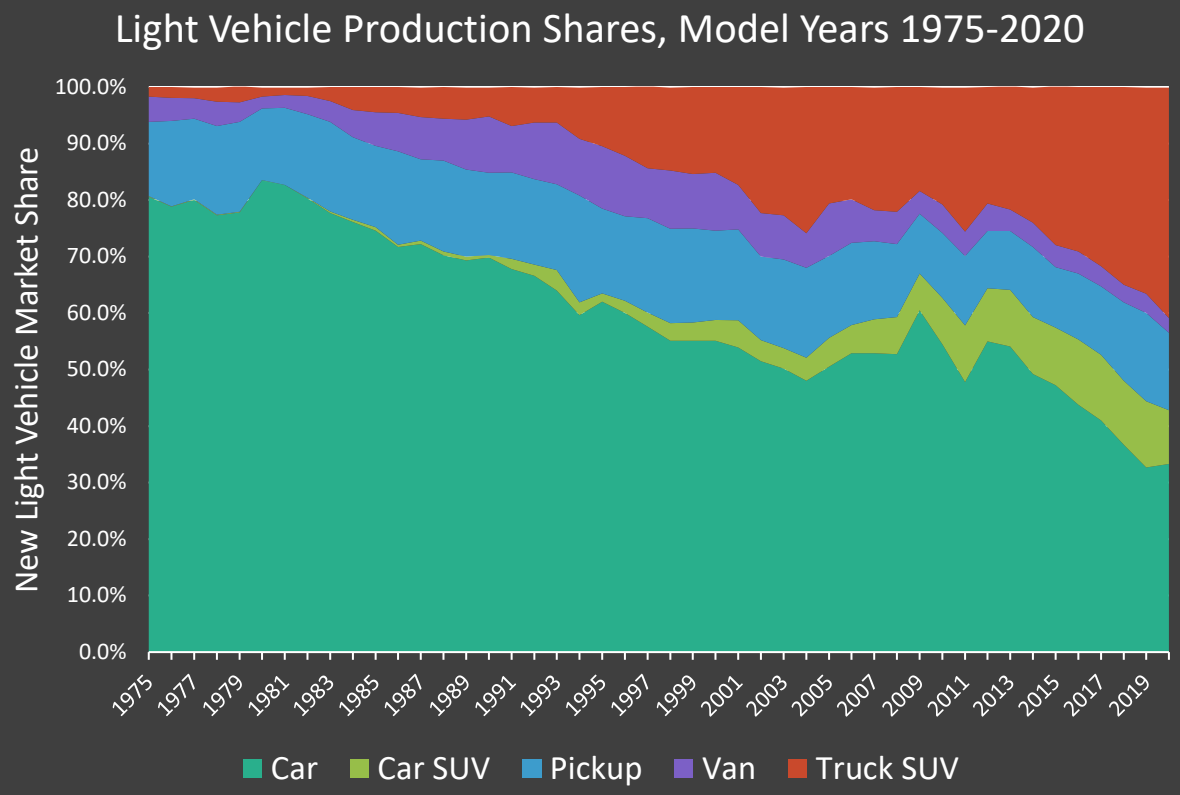
- Probabilistic (Fellegi-Sunter), commonly used when names absent
  - Calculates the odds of matching by field (variable): birthday, age, gender, crash date, crash county, flag fields for injury and MV crash
- Imputation of missing links: addresses weak linkage variables
  - Useful for Illinois data – no person names, ~10% of values missing DOB, dominant Cook County
- Developed by the NHTSA CODES project
  - LinkSolv from Strategic Matching, Inc. (Mike McGlincy)

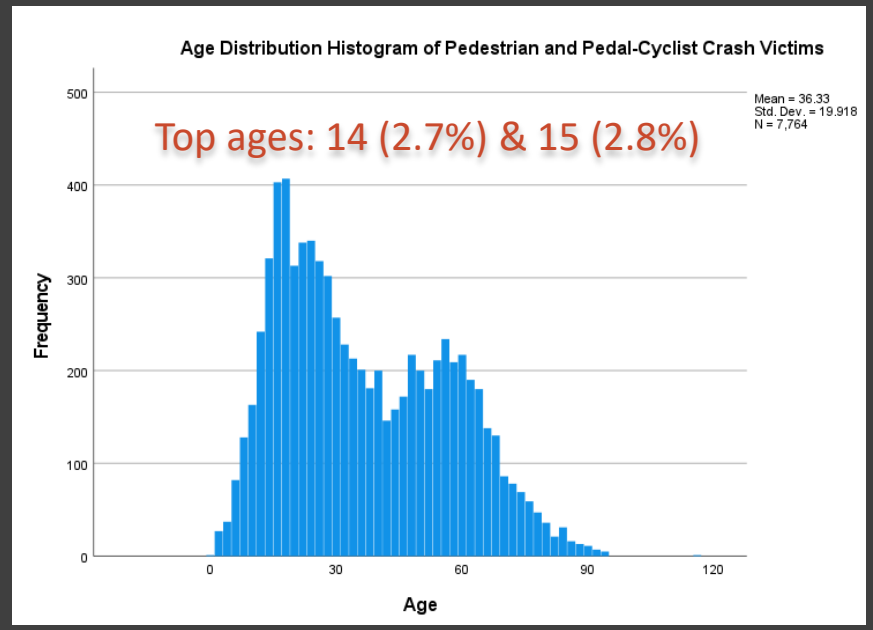
Data Linkage: Results

- Under CDC grant crash/hospital records for 2016-2018 were linked, with similar results from the 2008-2011 data

Year	KABCO	Crash Record Candidates	Links to Hospital Record	% Link
2016	O	664,028	27,030	4.1%
	All Other (KABC)	94,183	45,511	48.3%
	Total	758,211	72,541	9.6%
2017	O	637,291	23,144	3.6%
	All Other (KABC)	94,647	44,572	47.1%
	Total	731,938	67,716	9.3%
2018	O	647,337	21,412	3.3%
	All Other (KABC)	95,157	45,206	47.5%
	Total	742,494	66,618	9.0%

Study: Large Vehicles & Peds/Cycs (CDC grant)





	Injury Severity					
Vehicle Type	O	C	B	A	K	% of all
Passenger Car	64.7%	64.7%	62.5%	58.6%	38.4%	62%
Pickup Truck	4.5%	5.1%	5.2%	7.0%	12.6%	5.6%
SUV	14.9%	14.2%	14.4%	15.1%	25.4%	14.7%
Van/Minivan	4.4%	5.6%	6.0%	6.0%	6.1%	5.8%

Study: Large Vehicles & Peds/Cycs (CDC grant)

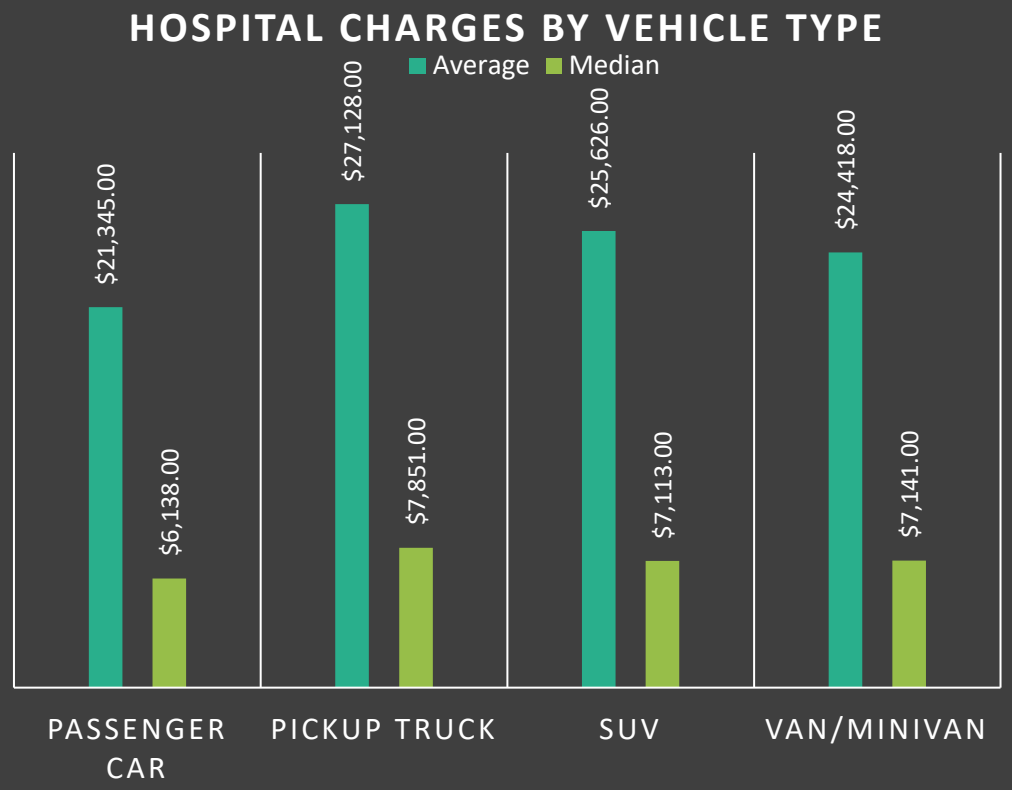
- Kids (<18) were 8 times more likely to be killed when struck by a SUV compared to kids struck by a passenger car
  - SUVs were involved in ~40% childhood fatalities, but striking vehicle in just ~17 of childhood cases
- Adults (18-64) were 4 times more likely to be killed when struck by a pickup truck compared to adults struck by a passenger car
- Seniors (65+) were 3 times more likely to be killed when struck by a pickup truck compared to seniors struck by a passenger car
- Pickup trucks, SUVs, & vans made up 44% of fatalities but just 26% of ped/cyc crashes

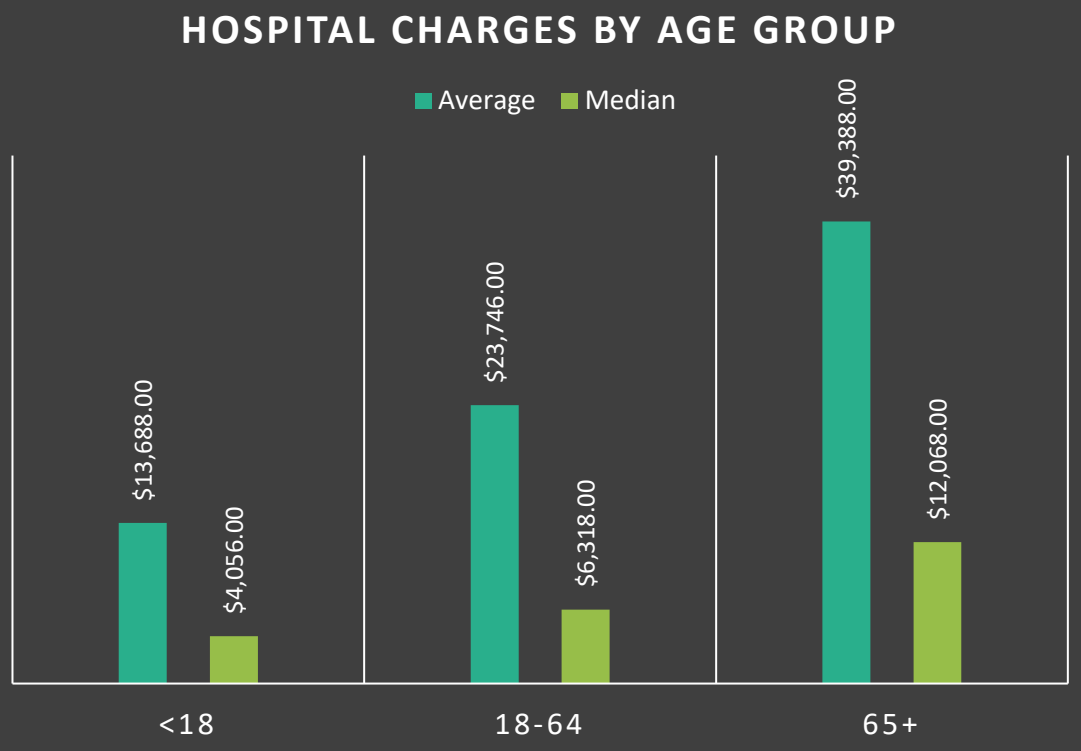
			Injury Severity Scale					
Age Group	Vehicle Type		K	A	B	C	O	Total
Under 18	Passenger Car	Within Cars	0.20%	12.90%	55.70%	28.10%	3.10%	100%
		Within Severity	18.80%	57.80%	61.90%	64.80%	60.90%	61.80%
	Pickup Truck	Within Pickups	1.40%	19%	52%	24.50%	3.10%	100%
		Within Severity	12.50%	8.40%	5.70%	5.60%	6%	6.10%
	SUV	Within SUVs	1.60%	14.30%	57.40%	23.60%	3.10%	100%
		Within Severity	40.60%	17.50%	17.40%	14.90%	16.60%	16.90%
	Van/Minivan	Within Vans	1.40%	15.90%	55.10%	25.10%	2.50%	100%
		Within Severity	12.50%	6.80%	5.80%	5.50%	4.60%	5.90%
18-64	Passenger Car	Within Cars	1.20%	16.10%	50.40%	29.20%	3.10%	100%
		Within Severity	36.90%	58.50%	62.70%	64.80%	65.50%	62.10%
	Pickup Truck	Within Pickups	4.80%	21.80%	45.30%	25.20%	2.80%	100%
		Within Severity	12.60%	7%	5%	4.90%	5.20%	5.50%
	SUV	Within SUVs	3.60%	18%	47.90%	27.90%	2.70%	100%
		Within Severity	23.70%	14.60%	13.30%	13.80%	12.70%	13.90%
	Van/Minivan	Within Vans	2%	16.80%	52.10%	27.10%	2%	100%
		Within Severity	5.50%	5.70%	6%	5.60%	3.90%	5.80%
65+	Passenger Car	Within Cars	4.60%	22.40%	47.70%	23.90%	1.50%	100%
		Within Severity	47.70%	60.80%	62.70%	63.70%	60.70%	61.60%
	Pickup Truck	Within Pickups	13.20%	16.70%	43.90%	25.40%	0.90%	100%
		Within Severity	13.50%	4.50%	5.70%	6.70%	3.60%	6.10%
	SUV	Within SUVs	9.80%	21.70%	45.80%	21%	1.70%	100%
		Within Severity	26.10%	15%	15.30%	14.30%	17.90%	15.70%
	Van/Minivan	Within Vans	5.50%	27.60%	40.90%	23.60%	2.40%	100%
		Within Severity	6.30%	8.20%	5.90%	6.90%	10.70%	6.80%

Study: Large Vehicles & Peds/Cycs (CDC grant)

- Blacks were overrepresented as pedestrian and cyclist crash victims
- Outside of Chicago: Blacks ~10% of population, but 23% of pedestrian/cyclist crash victims
- Within Chicago, about at parity: 29.6% Black and 31% of pedestrian and cyclist crash victims
- All Illinois: Black population of 14.2%, and 27% of pedestrian and cyclist crash victims

Study: Large Vehicles & Peds/Cycs (CDC grant)





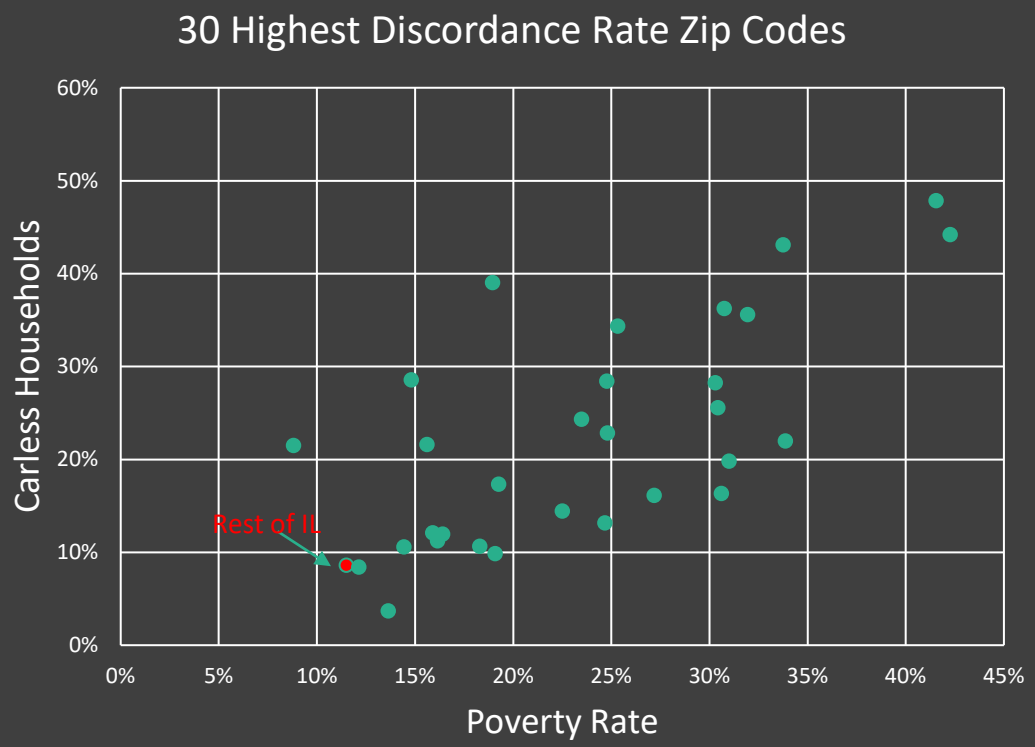
Study: Unreported Ped Crashes (CDC grant)

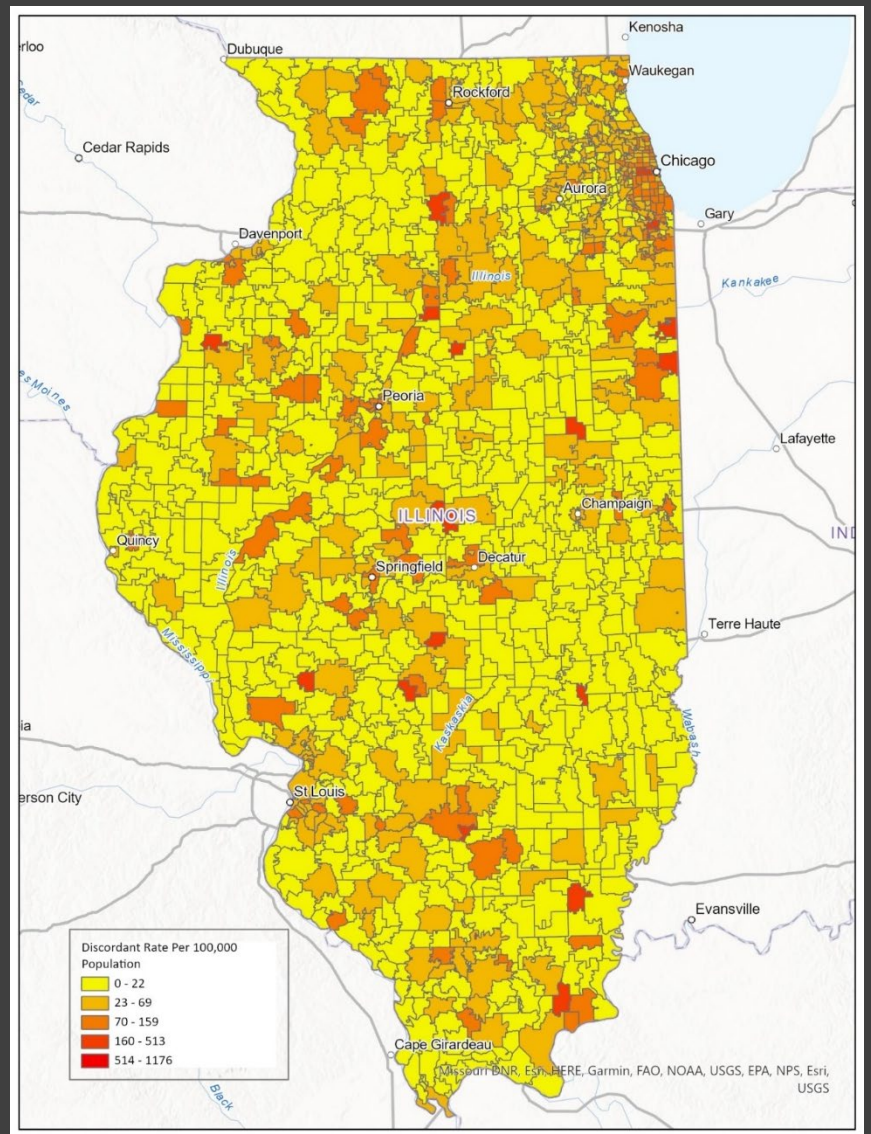
- Communities may miss out on mitigation funding/efforts if pedestrian crashes are not reported to police
  - Does this happen in Illinois? If so, where and to whom?
- Following data linkage, study cases in hospital file coded (ICD-10) as a pedestrian struck by motor vehicle that did not match to crash report
  - These victims sought medical treatment without calling police
- ~45% of those seeking treatment following being struck by a motor vehicle reported incident to police
  - → Average discordance rate (unlinked cases) ~55%
  - Not evenly distributed across communities

Study: Unreported Ped Crashes (CDC grant)

Pedestrian Characteristic		*All of Illinois*			*Cook County*			*IL Exclusive of Cook Co.*		
		Cases in Hospital File	Unlinked Hospital Cases	Discordance Rate	Cases in Hospital File	Unlinked Hospital Cases	Discordance Rate	Cases in Hospital File	Unlinked Hospital Cases	Discordance Rate
Age	<18	1889	938	49.7%	1199	559	46.6%	690	379	54.9%
	18-64	8434	4850	57.5%	5858	3133	53.5%	2576	1717	66.7%
	65+	1272	659	51.8%	888	415	46.7%	384	244	63.5%
Sex	Male	6472	3739	57.8%	4251	2327	54.7%	2221	1412	63.6%
	Female	5121	2708	52.9%	3692	1780	48.2%	1429	928	64.9%
Ethnicity	Hispanic/Latino	1730	925	53.5%	1462	749	51.2%	268	176	65.7%
	Non-Hispanic	9791	5448	55.6%	6424	3133	48.8%	3367	2155	64.0%
Race	American Indian or Alaska Native	49	18	36.7%	39	13	33.3%	-	-	-
	Asian	333	132	39.6%	284	111	39.1%	49	21	42.9%
	Black or African American	3867	2276	58.9%	2974	1668	56.1%	893	608	68.1%
	Native Hawaiian or Other Pacific Islander	40	20	50.0%	34	16	47.1%	-	-	-
	White	5037	2844	56.5%	2728	1364	50.0%	2309	1480	64.1%
	Declined or Unknown	56	24	42.9%	52	23	44.2%	-	-	-
	Other	2139	1100	51.4%	1789	897	50.1%	350	203	58.0%
	Two or More	74	33	44.6%	45	15	33.3%	29	18	62.1%
Substances	Alcohol	165	103	62.4%	99	59	59.6%	66	44	66.7%
	Cannabis	151	101	66.9%	93	62	66.7%	58	39	67.2%
	Opioid	152	89	58.6%	130	75	57.7%	22	14	63.6%
	Cocaine	120	79	65.8%	87	56	64.4%	33	23	69.7%
	Other Drug	36	28	77.8%	19	15	78.9%	17	13	76.5%
Head Injury Severity	0	9058	5275	58.2%	6223	3369	54.1%	2835	1915	67.5%
	1	1518	699	46.0%	981	406	41.4%	537	293	54.6%
	2	604	284	47.0%	454	209	46.0%	150	75	50.0%
	3	400	182	45.5%	279	128	45.9%	121	54	44.6%
Thorax Injury Severity	0	10395	5812	55.9%	7233	3737	51.7%	3162	2075	65.6%
	1	658	375	57.0%	392	215	54.8%	266	160	60.2%
	2	361	175	48.5%	209	104	49.8%	152	71	46.7%
	3	172	84	48.8%	105	50	47.6%	67	34	50.7%

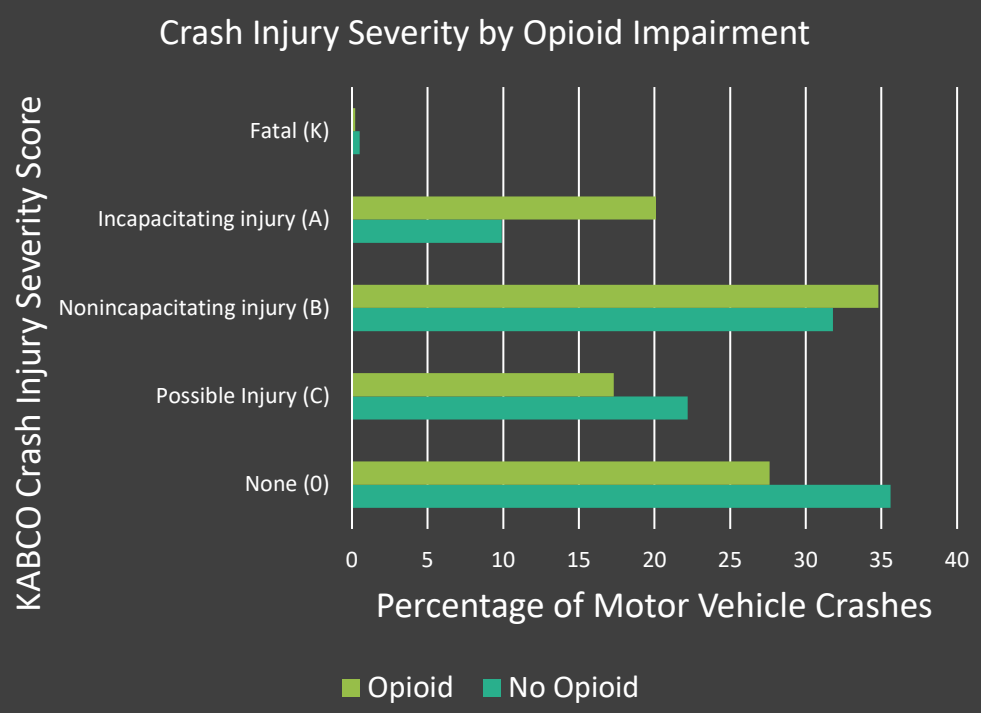
Study: Unreported Ped Crashes (CDC grant)

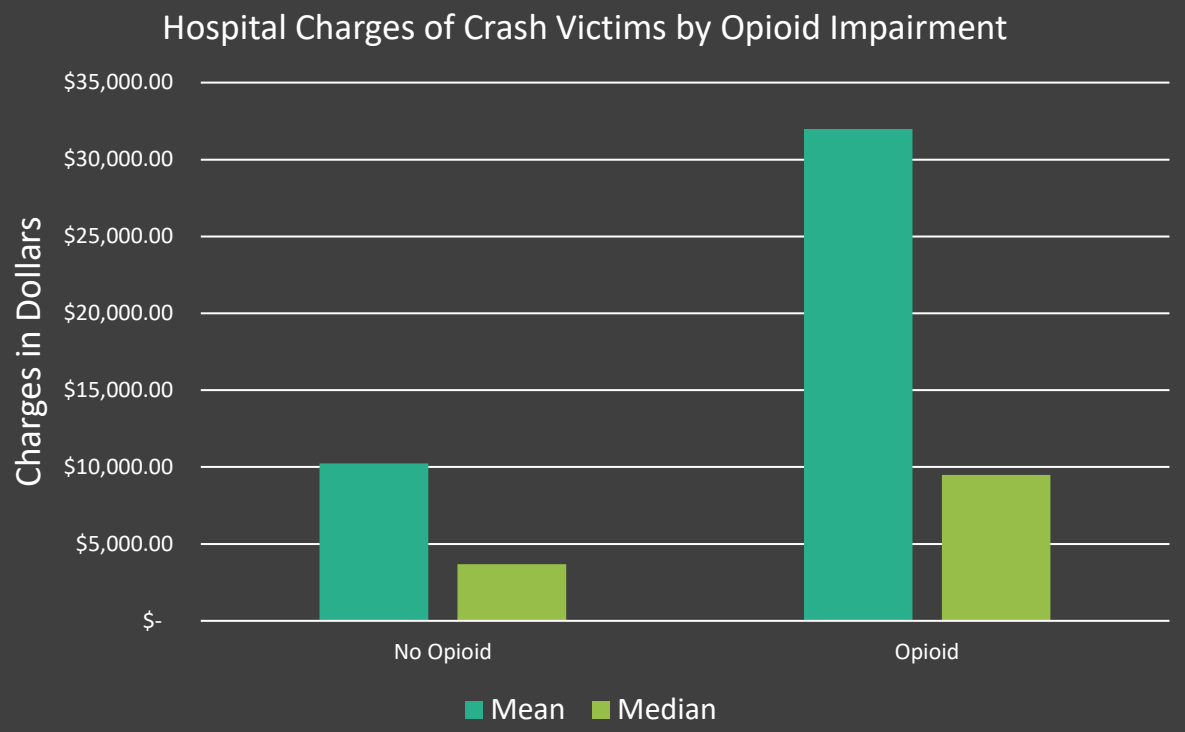




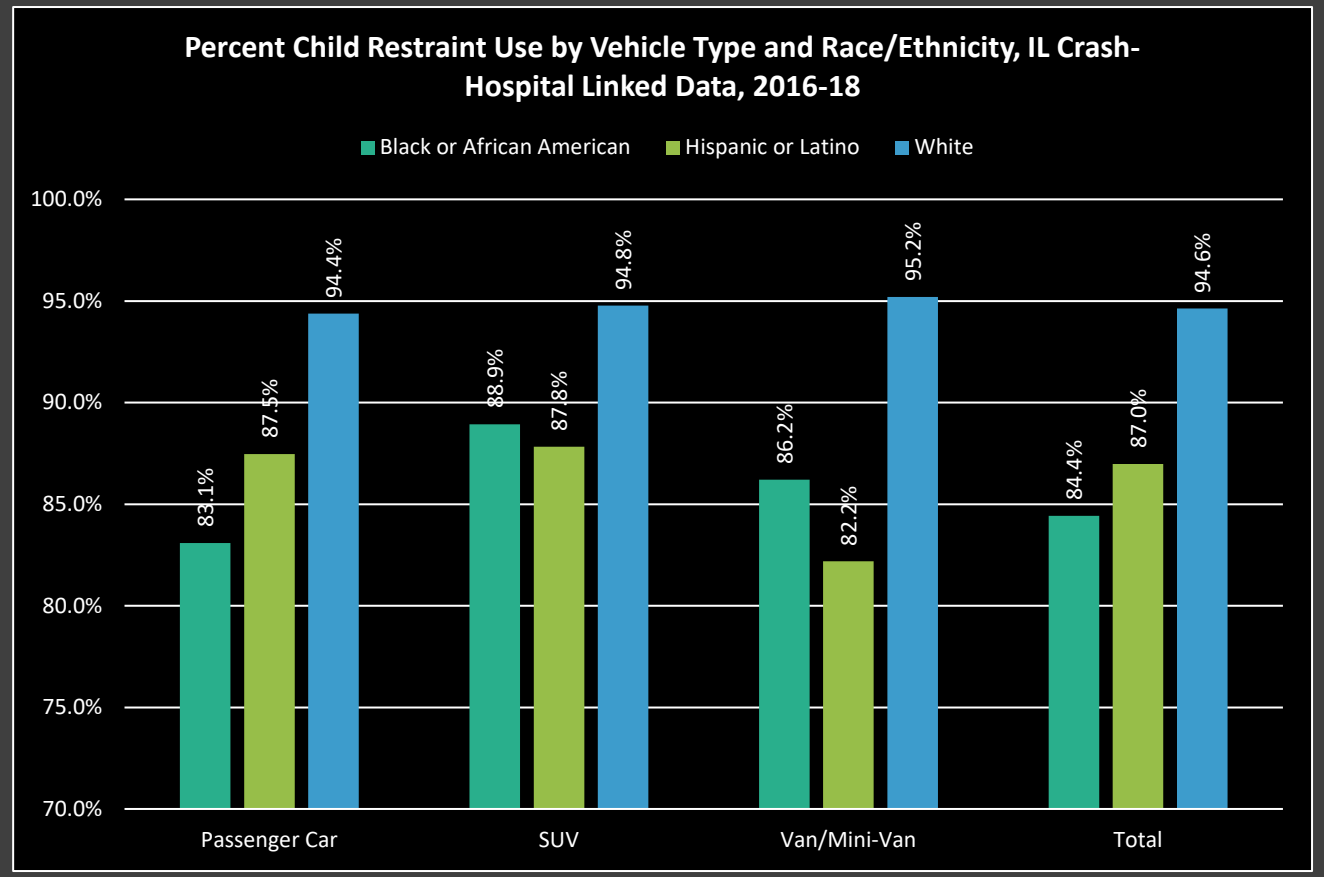
Study: Opioids and MV Crashes (CDC grant)

- 1,217 motor vehicle crashes in which at least 1 driver was diagnosed at the hospital as positive for opioids
  - 14% of those also had other substances present





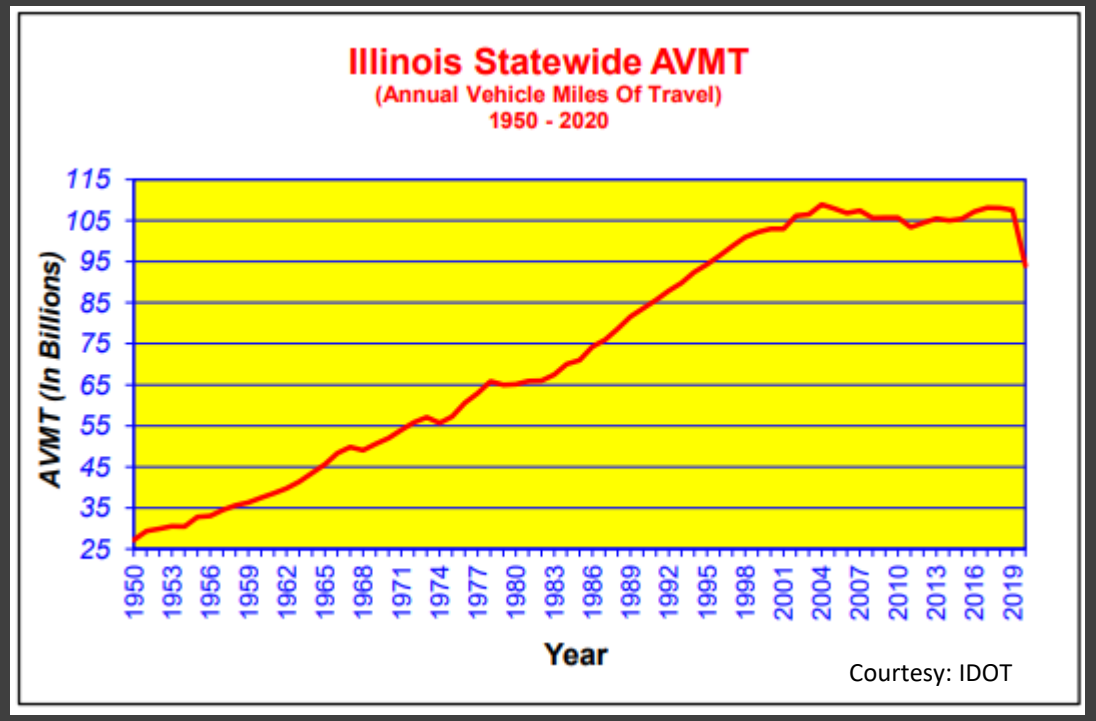
Study: Carseat Usage (CDC grant)



	Child Restraint Used	Child Restraint Not Used or Used Improperly
Average Charges	$2,461	$11,092
Moderate or Higher Severity for Any Injury	2.5%	9.2%
Moderate or Higher Severity Head Injury	0.6%	4.1%

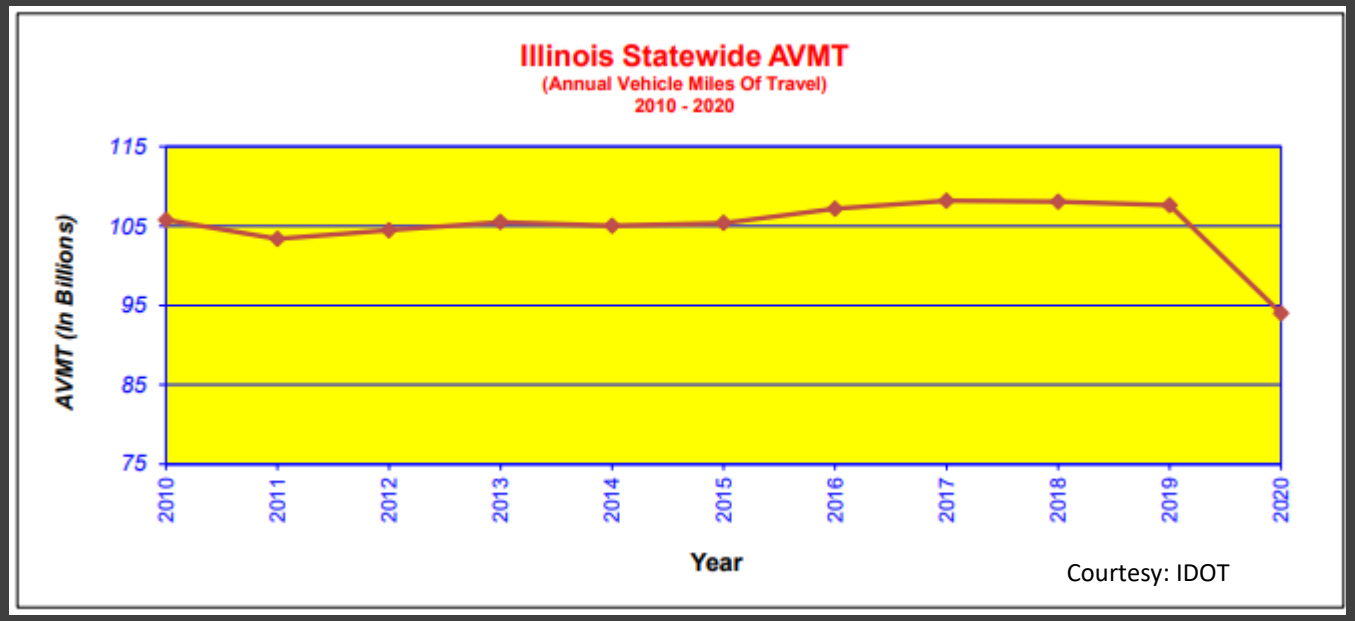
Planned Study: 2020 Motorists (IDOT grant)

- Link 2019 & 2020 crash and hospital files
- Illinois saw a 13% drop in VMT in 2020
- Did motorists suffer more severe crashes?
- Did fatalities increase?
- Who was involved?
- Which Illinois communities?



Planned Study: 2020 Peds/Cycs (IDOT grant)

- Link 2019 & 2020 crash and hospital files
- That 13% drop in VMT should reduce ped/cyc crashes, did it?
- Did peds/cycs suffer more severe crashes?
- Did fatalities increase?
- Who was involved?
- Which Illinois communities?



Courtesy: IDOT

Planned Study: Impairment (IDOT grant)

- Continue to study relationship between opioids and crashes
- Legalization of cannabis as of 1/1/2020 → any effect on MV crashes?
- Increase cases of impaired crashes during pandemic?

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