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**The Unseen Impact of Impaired Driving Crashes:
Data on Distraction, Drinking, Drugs, and Disparities**

Anna Gaichas, MS – Nadav Cassuto, PhD
Toward Zero Deaths Annual Statewide Conference
October 23, 2024

PROTECTING, MAINTAINING AND IMPROVING THE HEALTH OF ALL MINNESOTANS

Overview

- What's happening nationally?

- How does Minnesota compare?

- What can MDH data add?

- Severity, hospital treatment, and injury outcomes

- Distractions, alcohol, and narratives

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Impaired Driving Nationally & in Minnesota

- US 2020: 12,654 people killed by alcohol-impaired drivers (30% of traffic deaths)

- MN 2020: 89 people killed by alcohol-impaired drivers (23% of traffic deaths)

- MN 2020: 1921 people seriously injured by alcohol-impaired drivers (22% of serious injuries)

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MDH Injury & Violence Prevention

- Traffic Safety Data Linkage & Analysis

- Traumatic Brain and Spinal Cord Injury Registry

- Center for Occupational Health & Safety

- Alcohol/Drug Abuse Epidemiology & Prevention

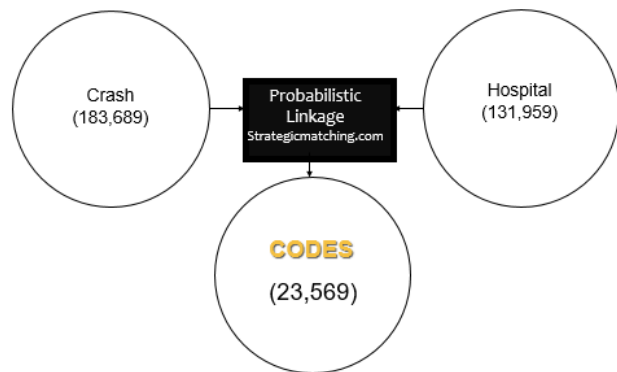- Suicide Epidemiology & Prevention

- & more

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The CODES Program

Crash Outcome Data Evaluation System

- A System the links
- Crash to Hospital, Ambulance, and other Data
- To Evaluate Cost and Health Outcomes

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CODES Data Integration

- Crash Outcome Data Evaluation System (CODES)
  - Integrating crash data with: Hospital inpatient & emergency department data

Crash (183,689) → Probabilistic Linkage Strategicmatching.com ← Hospital (131,959)

CODES (23,569)

75-80% of MV traffic hospital cases linked

Data Sources to Link to Crash by Status

Data Sources	Linked	Processing	Planned
Hospital & emergency department discharge	2016-2022, 2006-2012	2023	2024+
Trauma registry	2006-2012	2016-2023	2024+
Traumatic brain & spinal cord injury registry	2006-2012	2016-2023	2024+
Death certificates	2006-2012	2016-2023	2024+
EMS		2016-2023	2024+
All payer claims data			TBD
Syndromic surveillance			TBD

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## Hospital Data Additional Components

- Hospital-determined injury severity
- Other medical information
  - Injury type (e.g., brain injury)
  - Outcome
  - Payer
  - Resources used (emergency department vs. inpatient, length of stay, cost estimates)
- Trauma Registry (alcohol/drug use , vital signs, narrative, etc.)

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Impaired Driving Linked Hospital-Treated Injury 2021

- Number of patients: 1121 (3% of all linked cases)

- Hospitalized: 223 (5% of all linked cases)

- Severe Injury (ISS 16+): 187 (6% of all linked cases)

- Traumatic Brain Injury: 169 (5% of all linked cases)

- Spinal Cord Injury: 10 (6% of all linked cases)

- Median Hospital Cost: $3,003 ($1,240 for all linked)

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Using CODES Data-2018-2021

Presented by Nadav Cassuto Ph.D

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Crash Data Variables

VarName	N	Minimum	Maximum	Sum	Mean	Std. Deviation
YEAR	21183	2021	2021	42810843	2021	0
age_yr2	21099	0	104.45	817473.8	38.7447	19.79799
Car.age_yr2	20131	-1.04	111.07	217343	10.7964	6.8688
ControllerTypeCde_p.Motor_Vehicle_in_Transport.01	21183	0	1	19884	0.9387	0.23993
VehicleUseCde.Normal.01	21183	0	1	19647	0.9275	0.25934
PrimaryContributorCde.No_Clear_Contributing_Factor.01	21183	0	1	17741	0.8375	0.36891
CarAge.X.PersonAge	20061	0	2	16062	0.8007	0.70872
TypeOfBill.Emergency.Department.01	21183	0	1	16079	0.7591	0.42767
WeatherCde.Clear.01	21183	0	1	15549	0.734	0.44186
PositionCde.Driver.01	21183	0	1	15317	0.7231	0.44749
positionstdall.driver.01	21183	0	1	15281	0.7214	0.44833
Driver.01	21183	0	1	15281	0.7214	0.44833
SafetyEquipmentUseCde.Lap_and_Shoulder_Belt_Used.01	21183	0	1	14424	0.6809	0.46613
CrashTypeCde.Motor_Vehicle_in_Transport.01	21183	0	1	14383	0.679	0.46688
MostHarmfulEventCde.Motor_Vehicle_In_Transport.01	21183	0	1	13453	0.6351	0.48142
PhysicalConditionCde.Apparently_Normal.01	21183	0	1	12796	0.6041	0.48906
TransportTypeCde.EMS_Ground.01	21183	0	1	11572	0.5463	0.49786
vehtypestdall.car.01	21183	0	1	9853	0.4651	0.49879
VehicleTypeCde.Passenger_Car.01	21183	0	1	9836	0.4643	0.49874
AirbagCde.Not_Deployed.01	21183	0	1	8781	0.4145	0.49265
vehtypestdall.pickupvan.01	21183	0	1	8747	0.4129	0.49237
InjuryClassCde.Possible_Injury.01	21183	0	1	6955	0.3283	0.46962
maxais.1.01	21183	0	1	6804	0.3212	0.46695
InjuryClassCde.Suspected_Minor_Injury.01	21183	0	1	6631	0.313	0.46374
VehicleTypeCde.Sport_Utility_Vehicle.01	21183	0	1	5732	0.2706	0.44428
InjuryClassCde.No_Apparent_Injury.01	21183	0	1	5185	0.2448	0.42996
positionstdall.passenger.01	21183	0	1	4864	0.2296	0.4206
PersonTypeENum.Passenger.01	21183	0	1	4864	0.2296	0.4206
maxais.0.01	21183	0	1	4067	0.192	0.39388
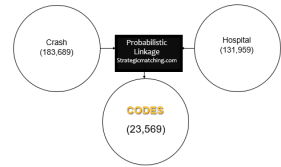
Crash Data Variables

VarName	N	Minimum	Maximum	Sum	Mean	Std. Deviation
tbi.01	18168	0	1	2018	0.1111	0.31423
VehicleMakeTxt.TOYT.01	21183	0	1	2095	0.0989	0.29853
TypeOfBill.Inpatient.01	21183	0	1	2089	0.0986	0.29815
VehicleTypeCde.Pickup.01	21183	0	1	1979	0.0934	0.29103
InjuryClassCde.Suspected_Serious_Injury.01	21183	0	1	1754	0.0828	0.27559
MostHarmfulEventCde.Overturn_Rollover.01	21183	0	1	1737	0.082	0.27437
RISS.above15.Severe.Injury.01	21183	0	1	1678	0.0792	0.27008
PrimaryContributorCde.Unknown.01	21183	0	1	1484	0.0701	0.25525
CrashTypeCde.Overturn.Rollover.01	21183	0	1	1468	0.0693	0.25397
VehicleMakeTxt.HOND.01	21183	0	1	1451	0.0685	0.25261
SafetyEquipmentUseCde.None.01	21183	0	1	1392	0.0657	0.24779
VehicleMakeTxt.DODG.01	21183	0	1	1190	0.0562	0.23027
PhysicalConditionCde.Has_Been_Drinking_Alcohol.01	21183	0	1	1113	0.0525	0.22312
PhysicalConditionCde.Unknown.01	21183	0	1	1087	0.0513	0.22064
SafetyEquipmentUseCde.None_Used_Motor_Vehicle_Occupant.01	21183	0	1	1062	0.0501	0.21823
VehicleMakeTxt.UK.01	21183	0	1	1048	0.0495	0.21686
VehicleModelTxt.UK.01	21183	0	1	1049	0.0495	0.21696
vehtypestdall.motorcycle.01	21183	0	1	1032	0.0487	0.21528
WeatherCde.Rain.01	21183	0	1	1012	0.0478	0.21329
VehicleMakeTxt.NISS.01	21183	0	1	1003	0.0473	0.21239
WeatherCde.Snow.01	21183	0	1	972	0.0459	0.20924
VehicleTypeCde.Motorcycle.01	21183	0	1	945	0.0446	0.20645
TransportTypeCde.Other.01	21183	0	1	893	0.0422	0.20095
VehicleTypeCde.Passenger_Van.01	21183	0	1	844	0.0398	0.1956
AirbagCde.Unknown.01	21183	0	1	815	0.0385	0.19234
VehicleMakeTxt.JEEP.01	21183	0	1	707	0.0334	0.17962
PositionCde.Second_Seat_Right.01	21183	0	1	703	0.0332	0.17913
maxais.4.01	21183	0	1	680	0.0321	0.17627
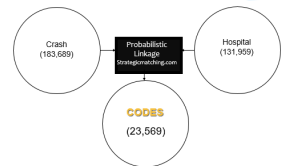
TBI Model-Logistic Regression from Most Important (9) to Least Important (1) Variables

- **Logistic Regression**
  - Running the LR to get the best combination of variables predicting the probability for TBI.

1.929
1.555894223
0.449147974

Variables in the Equation

|	B	S.E.	Wald	df	Sig.	Exp(B)	Z	
Step 12								
vehtypestdall.snow.01	1.830	0.428	18.290	1	0.000	6.236	9.5899	9
SafetyEquipmentUseCde.None_Used_Motor_Vehicle_Occupant.01	0.991	0.058	291.299	1	0.000	2.693	1.7030	7
vehtypestdall.atv.01	0.940	0.187	25.195	1	0.000	2.560	1.4054	7
vehtypestdall.motorcycle.01	0.931	0.080	134.373	1	0.000	2.537	1.3551	7
VehicleModelTxt.FXDB.01	0.501	0.163	9.500	1	0.002	1.651	-0.6181	3
SafetyEquipmentUseCde.No_Helmet.01	0.468	0.129	13.051	1	0.000	1.596	-0.7399	3
SafetyEquipmentUseCde.None.01	0.467	0.105	19.619	1	0.000	1.595	-0.7433	3
CarAge.X.PersonAge	0.154	0.020	57.343	1	0.000	1.167	-1.6955	1
Road.Obstacle	0.125	0.021	35.046	1	0.000	1.133	-1.7719	1
driver.driver.seat	-0.086	0.019	19.510	1	0.000	0.918	-2.2501	1
SUV.LIKE_Vehicle	-0.112	0.026	17.888	1	0.000	0.894	-2.3023	1
SafetyEquipmentUseCde.Child_Restraint_System_Rear_Facing.01	-1.818	0.452	16.204	1	0.000	0.162	-3.9322	1

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TBI Model Performance

This model successfully ranks TBI isolating two groups at or above the mean. In the 5th quintile ≈ 22% of the people who suffered TBI are compared with an overall average of 9.9%, whereas the 4th quintile ≈ 10% of the people who suffered TBI which is just about average.

In the 1st quintile only 6.8% of the people who suffered TBI as compared to an overall average of 9.9%

| Quintile	TBI By Quintiles	N	Sum
5	.2180	5518	1203
4	.1046	8277	866
3	.0937	11036	1034
2	.0860	13796	1187
1	.0687	16554	1138
Total	.0984	55181	5428

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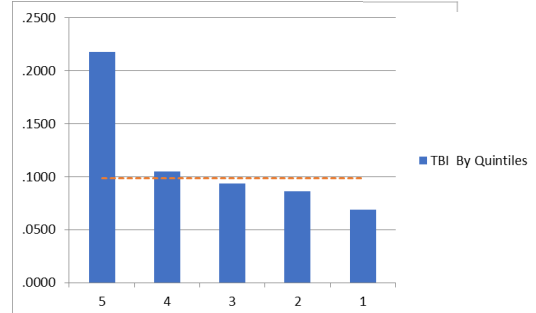
TBI Model Validation Performance(2016-17)

The model validated successfully in ranking the TBI. Isolating two groups at or above the mean. In the 5th quintile ≈ 24% of the people who suffered TBI are compared with an overall average of 9.8%, whereas the 4th quintile ≈ 11% of the people who suffered TBI which is just a little above average.

In the 1st quintile only 5.8% of the people who suffered TBI as compared to an overall average of 9.8%

Quintile	Validation 2016-17 TBI By Quintiles	N	Sum
5	.2428	4361	1059
4	.1073	8724	936
3	.0920	8724	803
2	.0749	10905	817
1	.0586	10904	639
Total	.0975	43618	4254
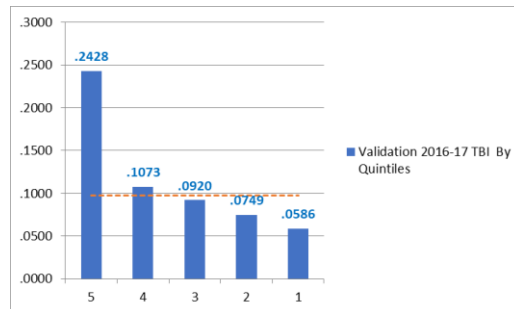
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Crash Data Narrative Variables

Variable Extracted From Crash Data-Nerative	Minimum	Maximum	Sum	Mean	Std. Deviation
NarrativeTxt.Speed.01	0	1	1275	0.0183	0.13391
NarrativeTxt.Hand.Held.Device.01	0	1	3998	0.0573	0.23236
NarrativeTxt.INTOXICATED.01	0	1	512	0.0073	0.08533
NarrativeTxt.notINTOXICATED.01	0	1	11	0.0002	0.01255
NarrativeTxt.VU4.Delivery.01	0	1	576	0.0083	0.09046
NarrativeTxt.VU4.UBER.01	0	1	81	0.0012	0.03404
NarrativeTxt.VU4.LYFT.01	0	1	28	0.0004	0.02002
NarrativeTxt.VU4.TAXI.01	0	1	39	0.0006	0.02363
NarrativeTxt.VU4.Private.Pub.Transp.01	0	1	142	0.002	0.04506

```
compute  NarrativeTxt=UPCASE(NarrativeTxt).
compute  NarrativeTxt.VU4.UBER=index(NarrativeTxt,'UBER').
RECODE NarrativeTxt.VU4.UBER (1 thru hi=1) (else=0) into NarrativeTxt.VU4.UBER.01.
freq var NarrativeTxt.VU4.UBER NarrativeTxt.VU4.UBER.01.

compute  NarrativeTxt=UPCASE(NarrativeTxt).
compute  NarrativeTxt.VU4.LYFT=index(NarrativeTxt,'LYFT').
RECODE NarrativeTxt.VU4.LYFT (1 thru hi=1) (else=0) into NarrativeTxt.VU4.LYFT.01.
freq var NarrativeTxt.VU4.LYFT NarrativeTxt.VU4.LYFT.01.

compute  NarrativeTxt=UPCASE(NarrativeTxt).
compute  NarrativeTxt.VU4.TAXI=index(NarrativeTxt,'TAXI').
RECODE NarrativeTxt.VU4.TAXI (1 thru hi=1) (else=0) into NarrativeTxt.VU4.TAXI.01.
freq var NarrativeTxt.VU4.TAXI NarrativeTxt.VU4.TAXI.01.

compute NarrativeTxt.VU4.Private.Pub.Transp=SUM(NarrativeTxt.VU4.UBER.01,NarrativeTxt.VU4.I
recode NarrativeTxt.VU4.Private.Pub.Transp (1 thru hi=1) (0=0) into NarrativeTxt.VU4.Privat
freq var = NarrativeTxt.VU4.Private.Pub.Transp.01 NarrativeTxt.VU4.Private.Pub.Transp.
```

Trauma Data Scooters example Narrative Variables

yeaR: 2021	Mean	Sum
NarrativeTxt.ScooterLike.01	0.0071	397
NarrativeTxt.SCOOTER.01	0.0056	313
NarrativeTxt.HOVERBOARD.01	0.0006	34
NarrativeTxt.MOTORCYCLE.01	0.0149	837
NarrativeTxt.MOPED.01	0.0008	44

226	comorbid14
227	comorbid15
228	comorbid16
229	InjuryCode1
230	InjuryCode2
231	InjuryCode3
232	InjuryCode4
233	InjuryCode5
234	InjuryCode6
235	InjuryCode7
236	InjuryCode8
237	InjuryCode9
238	InjuryCode10
239	InjuryCode11
240	InjuryCode12
241	InjuryCode13
242	InjuryCode14
243	LocationCode1
244	LocationCode2
245	LocationCode3
246	Obs
247	County
248	NarrativeTxt.SCOOTER
249	NarrativeTxt.SCOOTER.01
250	NarrativeTxt.EPSILON
251	NarrativeTxt.EPSILON.01
252	NarrativeTxt.LIME
253	NarrativeTxt.LIME.01
254	NarrativeTxt.SWAGGER
255	NarrativeTxt.SWAGGER.01
256	NarrativeTxt.HOVERBOARD
257	NarrativeTxt.HOVERBOARD.01
258	NarrativeTxt.JETSON
259	NarrativeTxt.JETSON.01
260	NarrativeTxt.GYROOR
261	NarrativeTxt.GYROOR.01
262	NarrativeTxt.GOTRAX
263	NarrativeTxt.GOTRAX.01
264	NarrativeTxt.HOVER_1
265	NarrativeTxt.HOVER_1.01
266	NarrativeTxt.SEGWAY
267	NarrativeTxt.SEGWAY.01

Thank you! Drive safely!

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