Characteristics of paramedics' collisions for the province of Quebec from 2010 to 2020

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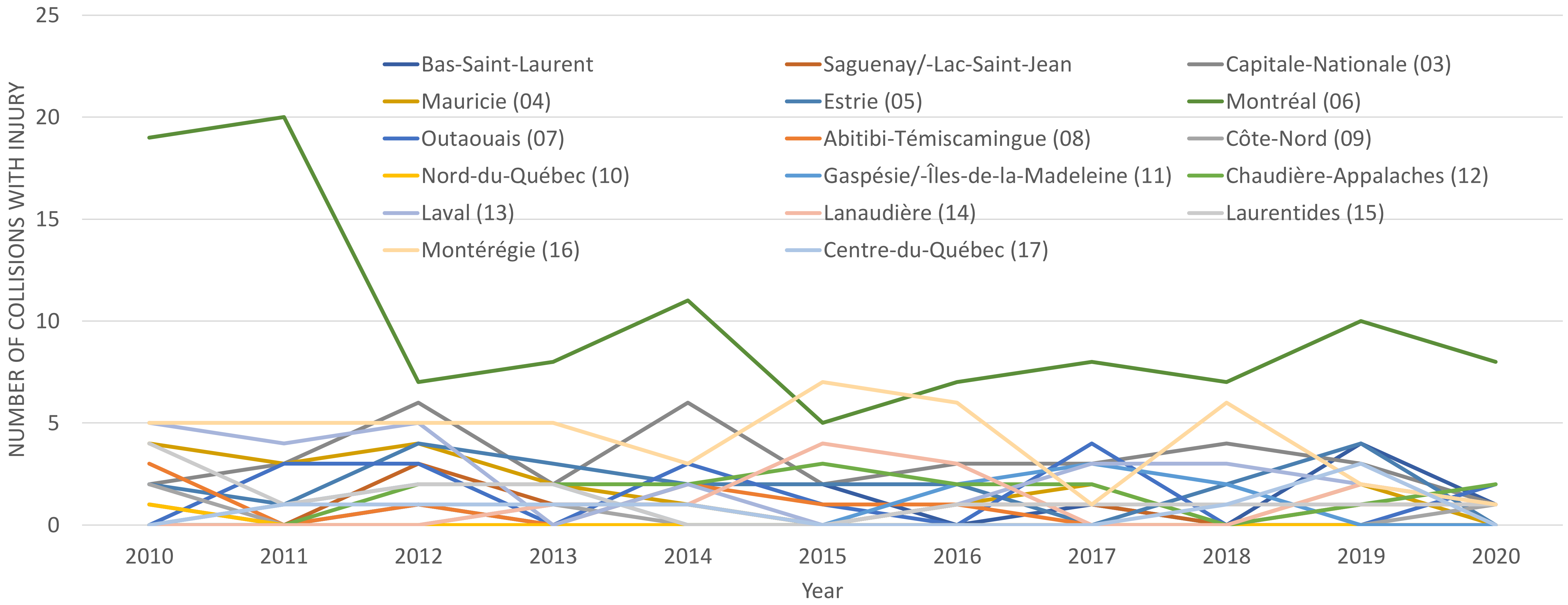
Problematics

- 33% of drivers involved in traffic collisions are commercial and emergency professionals
- $250 billion is the annual global cost of emergency collisions.
- 2% of all workers involved in road collisions led to 25%-30% of total mortality from 2000 to 2008 in Quebec.
- 1228 is the total paramedics’ collisions (370 injury collisions and 858 non-injury collisions) between 2010 and 2020 in the province of Quebec.

Problematics → Objectives → Methodology → Results → Discussion

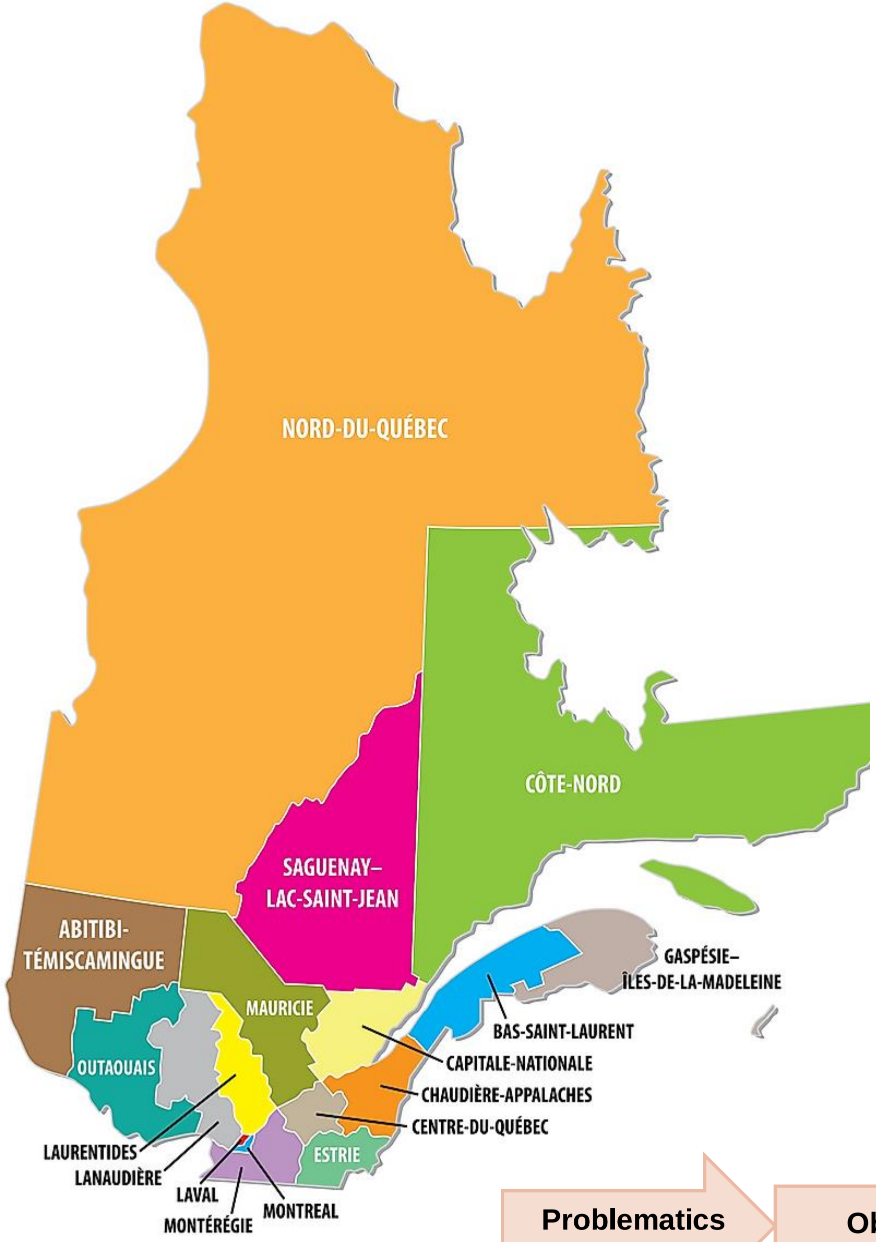


Number of collisions with Injury involving paramedics in the province of Quebec between 2010 and 2020 per administrative region

Problematics → **Objectives** → **Methodology** → **Results** → **Discussion**

Objectives

- Document how Ambulance Collisions are distributed across the 17 regions of the province of Quebec.
- Evaluating the variables impacting the quantity as well as the severity of paramedics’ collisions.
- Compare the results of Montréal and Montérégie regions with the rest of the province of Quebec.



Data Collection

- Data from Société de l'assurance automobile du Québec (SAAQ)
- Period from 2010 to 2020.
- 17 regions of Quebec
- Collisions involving an ambulance

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Data Collection

Collisions Characteristics	Environment Characteristics	Road and traffic characteristics
Time of day	Type of environment	Speed limit posts at the scene
Days of Week	Surface States	Configuration of the road
Number of vehicles involved in collisions	Lighting conditions	Traffic Condition
Type of Collisions	Weather conditions	Work zone
Mode of transportation involved in collisions	Work zone	Lighting conditions
		Localization of collisions
		Asphalt condition

Logistic Regression

- Explore the impact of factors in the odds ratio of paramedic collisions severity.

$$\ell = Log\,\frac{P}{1-P} = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

- Variance Inflation Factor (VIF) is used to check the multicollinearity.

Accuracy of Model

The performance of a model is described by:

- Number of true positive (TP), true negative (TN), false positive (FP), and false-negative (FN).
- Area under Receiver Operating Characteristic (ROC) curve

Prediction \ Reference	FALSE	TRUE
FALSE	FP	TP
TRUE	FN	TN

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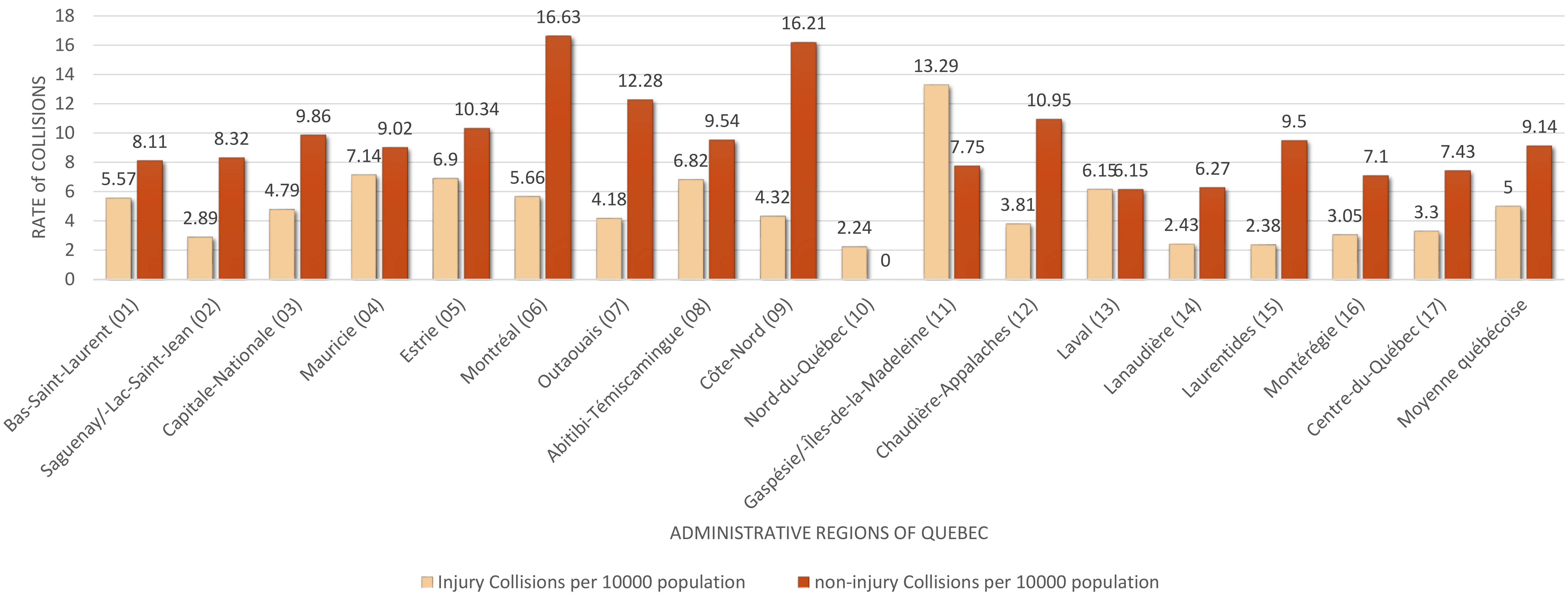

Total number of Injuries and non-Injury collisions per 100,000 population involving paramedics in the province of Quebec between 2010 and 2020 per regions

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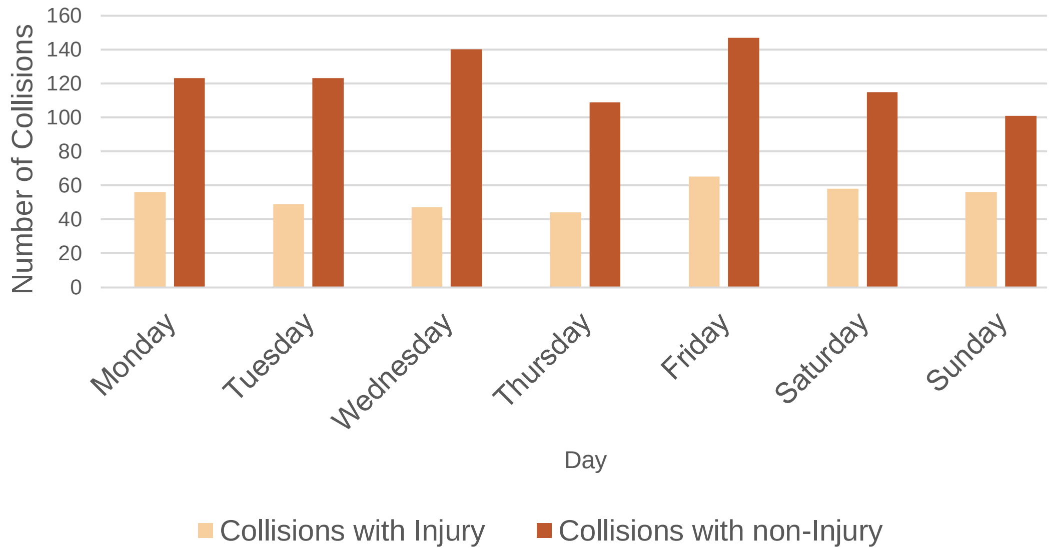
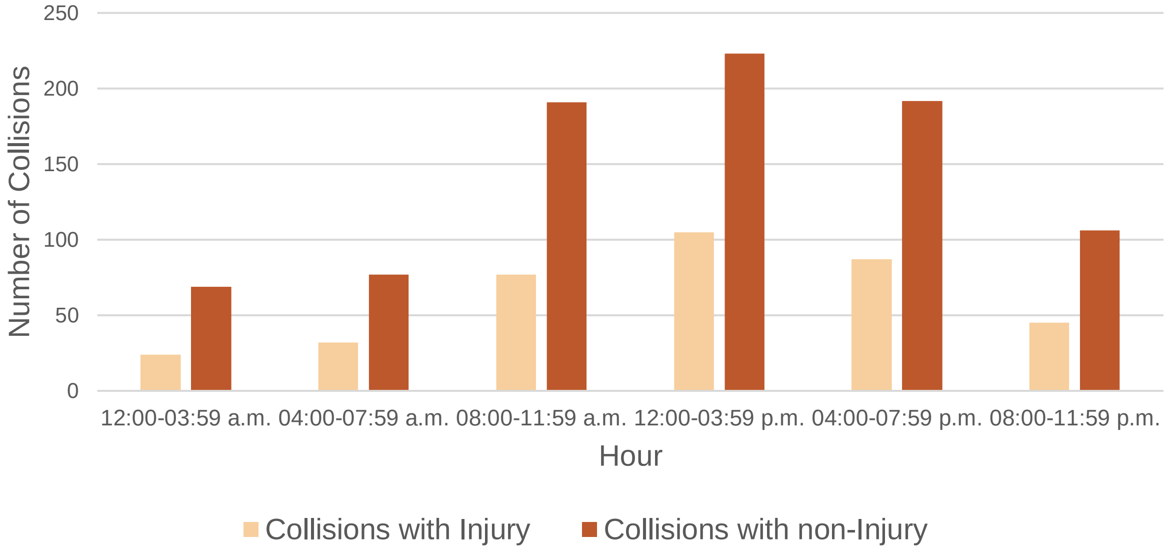
Distribution of Collisions in Different Hours and Days





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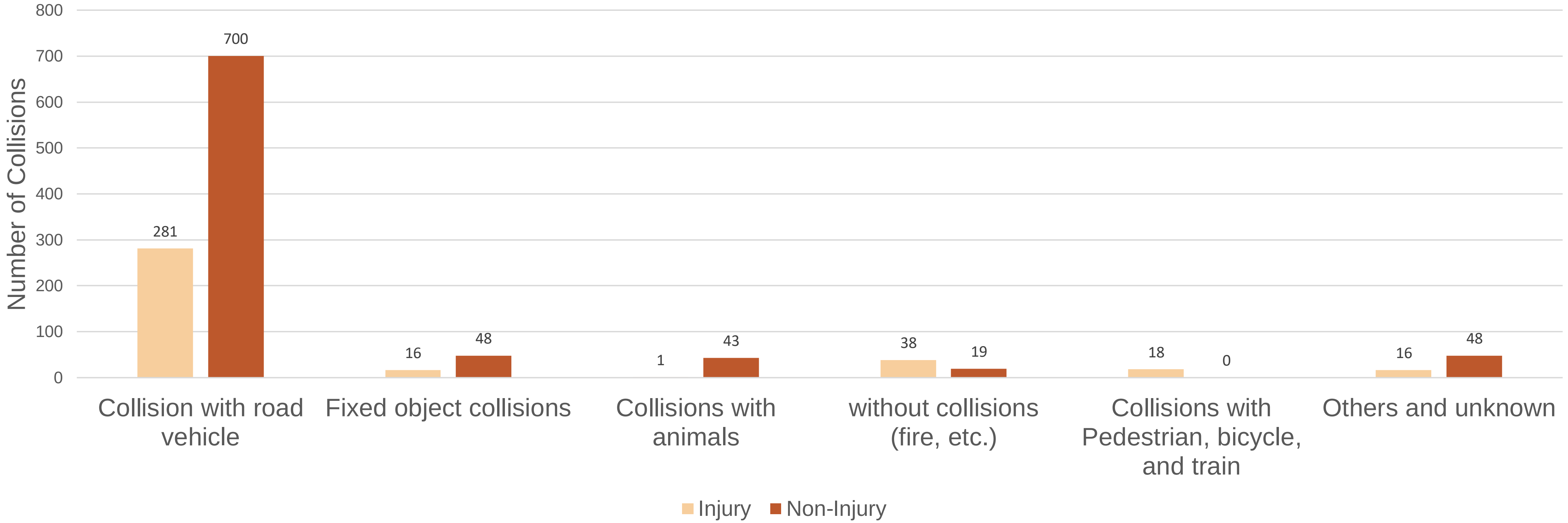
Distribution of Different Type of Collisions



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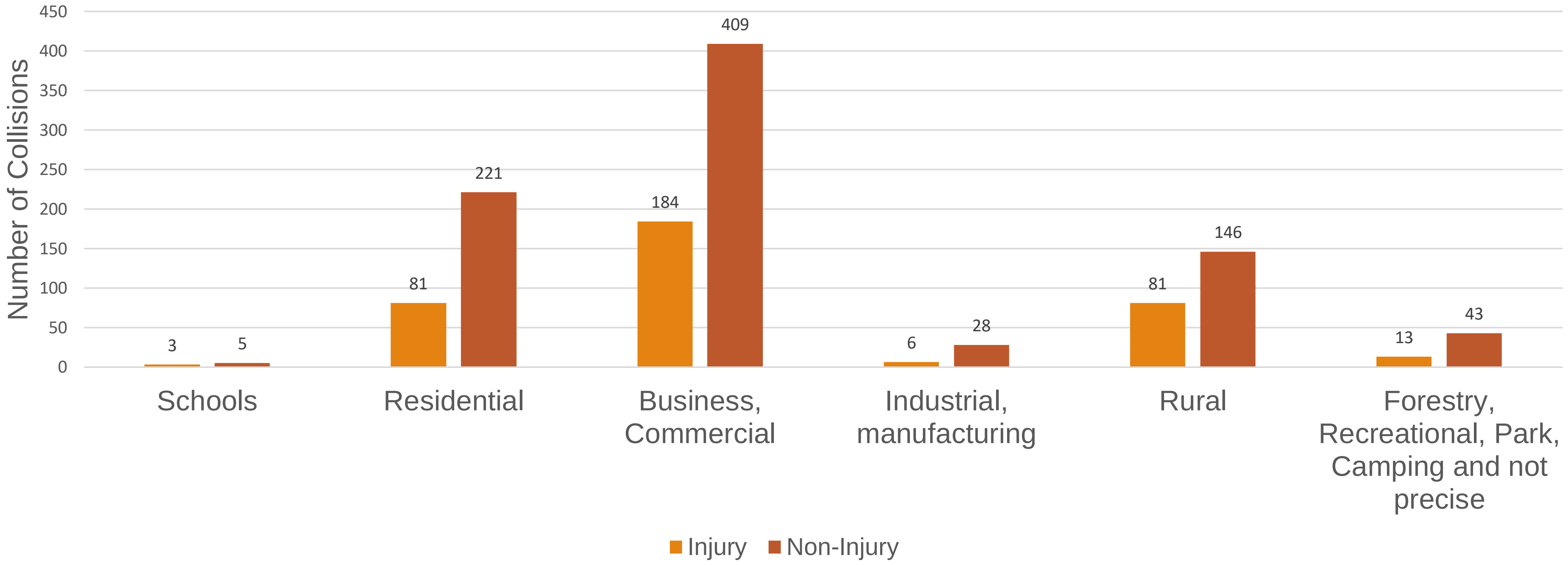
Collisions in Different Environment



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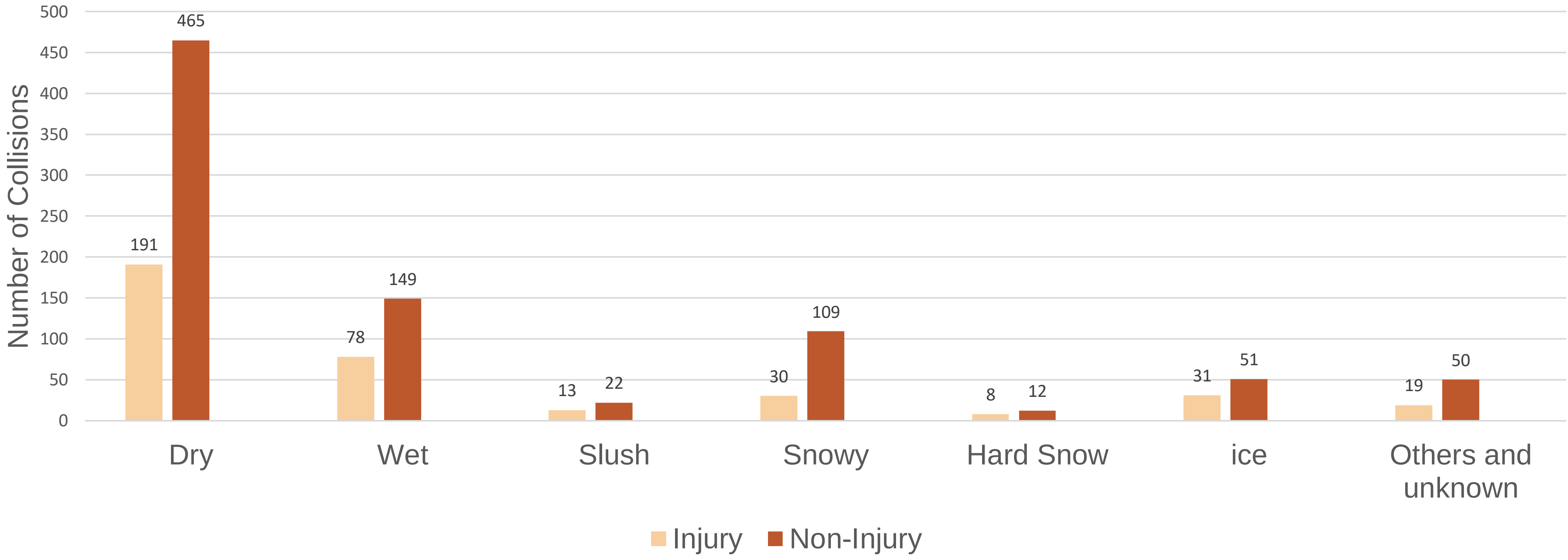
Collisions in Different Surface State



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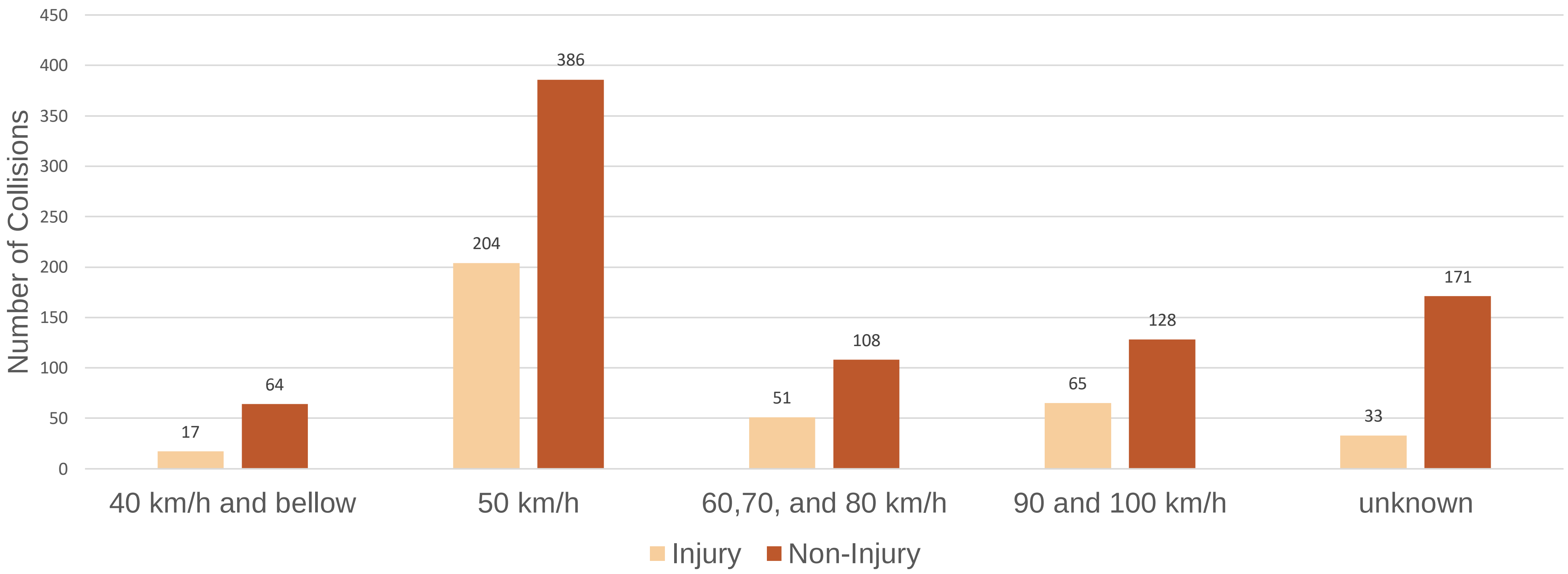
Collisions in Different Speed Limit Zones



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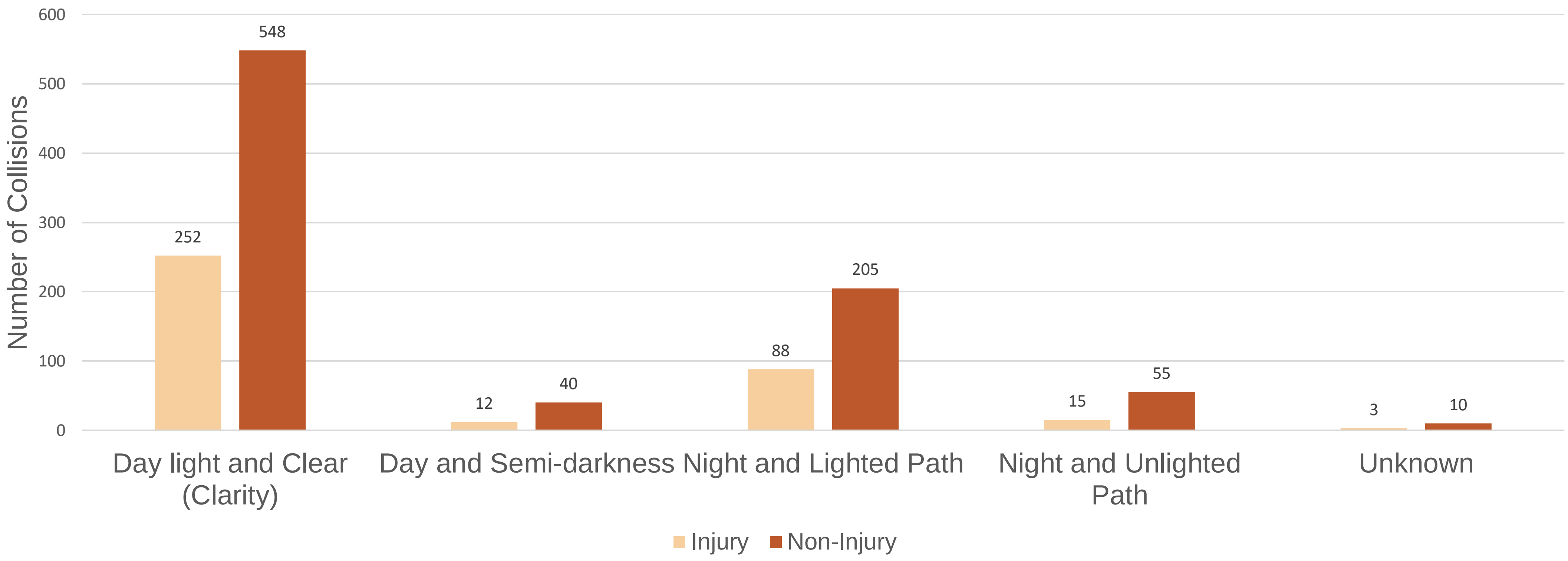
Collisions in Different Light Conditions



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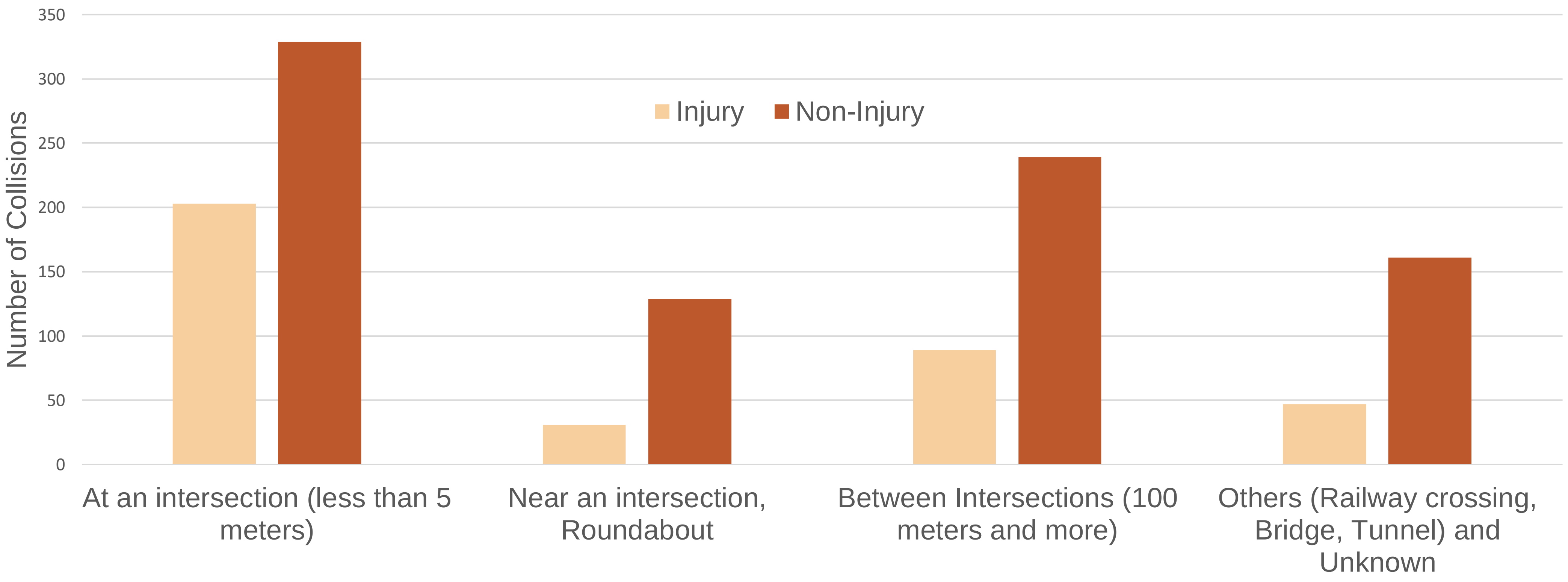
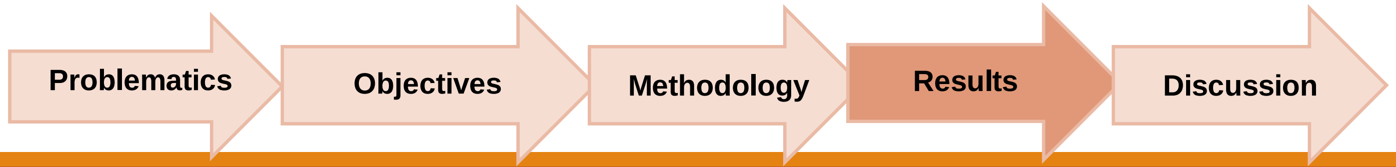
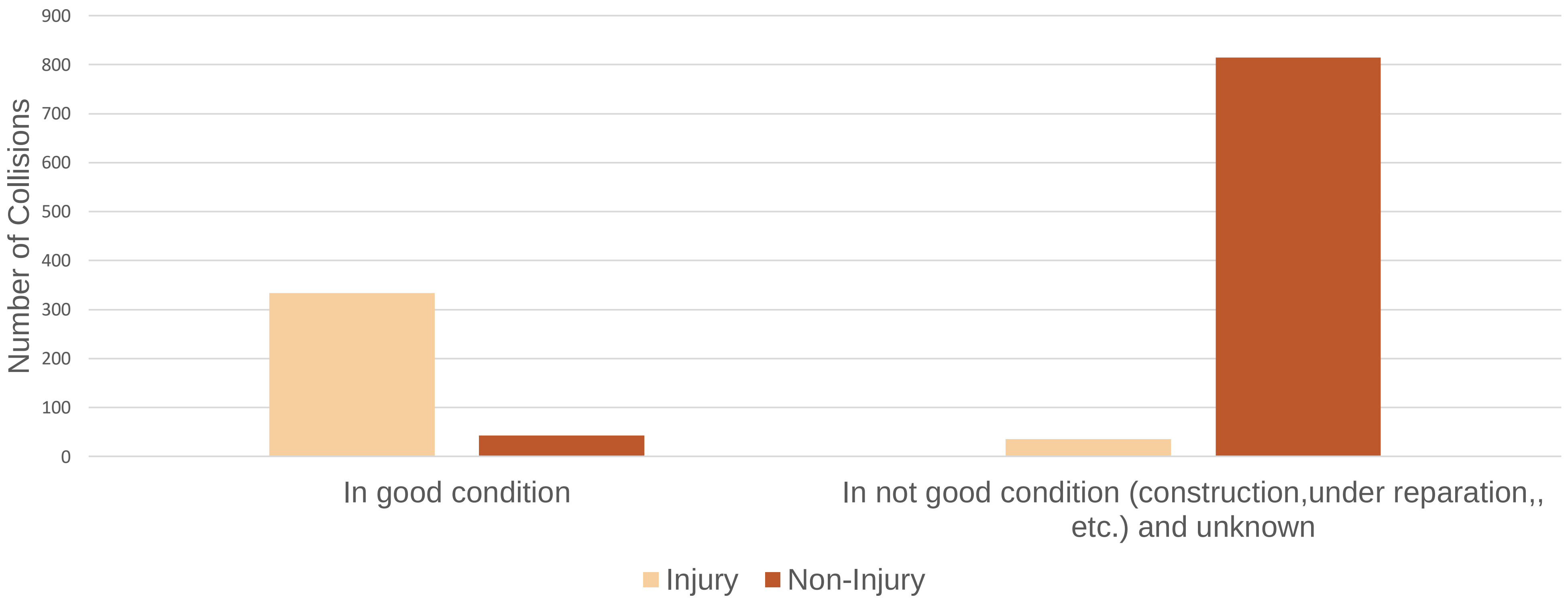
Collisions in Different Locations





Collisions in Different Asphalt Conditions



Problematics → Objectives → Methodology → **Results** → Discussion

Logit Regression_Quebec

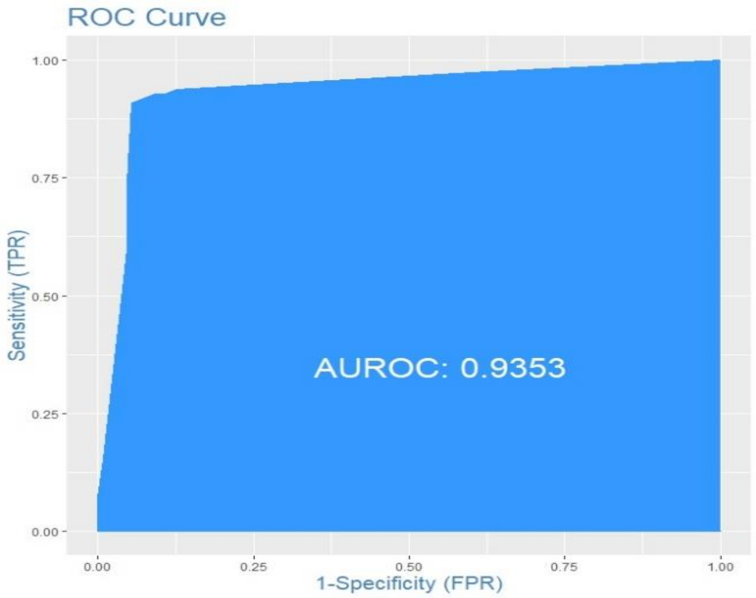
- Accidents like fire, which do not include traffic collisions, are associated with an increase in the odds ratio (15.31).
- Areas between intersections (100 meters and more) result in a decrease in the odds ratio (0.36)
- Bad conditions of asphalt result in a decrease in the odds ratio (0.004)

Problematics → Objectives → Methodology → **Results** → Discussion

Variance Inflation Factor and Accuracy of Model

Variable	GVIF	DF	GVIF^(1/(2*Df))
Collision Type	1.49	5	1.04
Asphalt condition	1.27	1	1.13
Location of collisions	1.49	3	1.07

Prediction \ Reference	0	1
0	246	14
1	10	100



Logit Regression_ Montréal and Montérégie

Montréal (06):

- Incidents without traffic collisions, like fire, can increase the odds of severity (137.88)
- Collisions with fixed objects can increase the odds (23.8)
- Collisions at intersections can lead to an increase in the odds (4.48)
- Highway construction or other asphalt operations can decrease the odds ratio (0.01)

Montérégie (16):

- Asphalt operations can decrease the odds ratio of severe collisions (0.003)
- Slush surface can result in an increase in odds ratio (4.24)

Problematics → Objectives → Methodology → **Results** → Discussion

Discussion

- Montréal (5.66) and Montérégie (3.05) are not in the top regions respecting injury collisions rate.
- Collisions at intersections (maybe due to yielding the right of way) increase the odds in Montréal, but areas between intersections decrease the odds in Quebec (0.36).
- Zones, with a 50 km/h speed limit, led to 48.08% of collisions while zones with more than 50 km/h have 18.69% of total collisions.
- Types of environments like commercial and residential areas can impact the severity of ambulance collisions.

Problematics → Objectives → Methodology → **Results** → Discussion

Discussion

- Most collisions happened in clear weather and on dry and wet surfaces in Quebec. But, the slush surface increased the odds in Montérégie.
- Montréal and Montérégie show asphalt operations can lead to a reduction in the odds.
- Light vehicles, bicycles, and motorcycles are more involved in ambulance collisions compared to other modes.
- Accidents involving fire can result in increasing the odds.

Conclusion

- Ambulance drivers are facing more exposure and risk due to their job
- These analyses could lead to better-informed decisions on recommendations as follow:

I. Training and educational program,

II. Changing the policies and administration

III. Marketing campaigns,

IV. Using the in-vehicle monitoring system

Problematics → Objectives → Methodology → **Results** → Discussion

Thank you
Questions or Comments?

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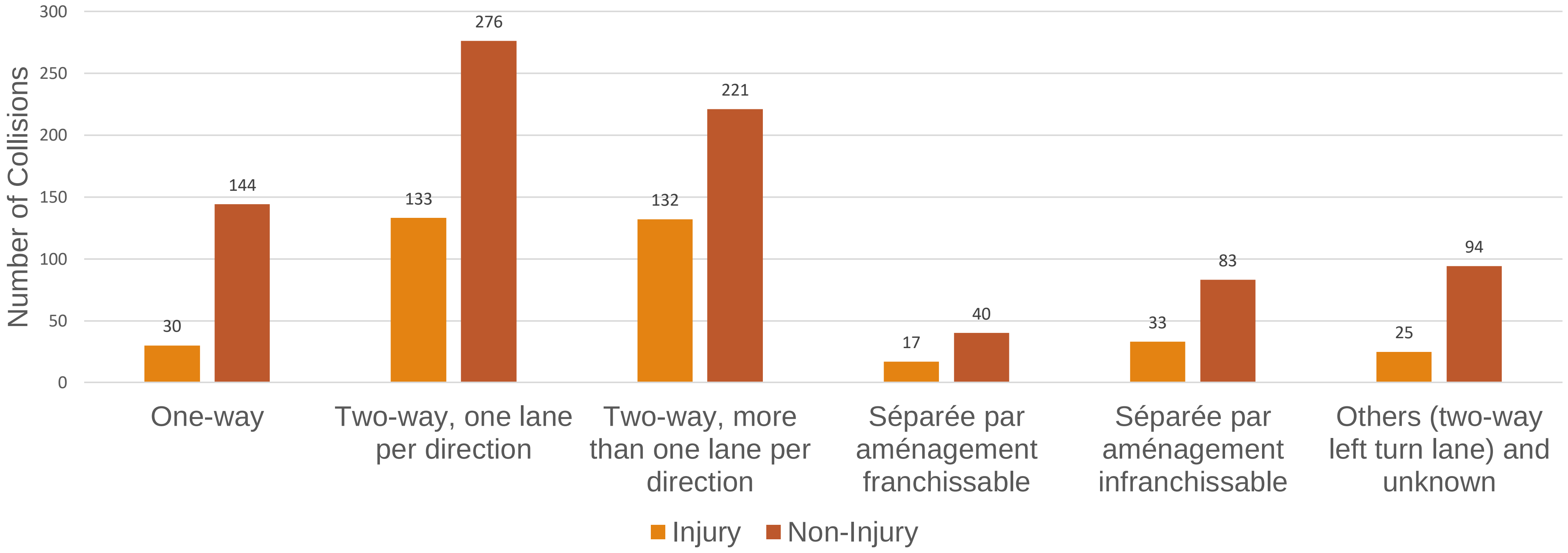
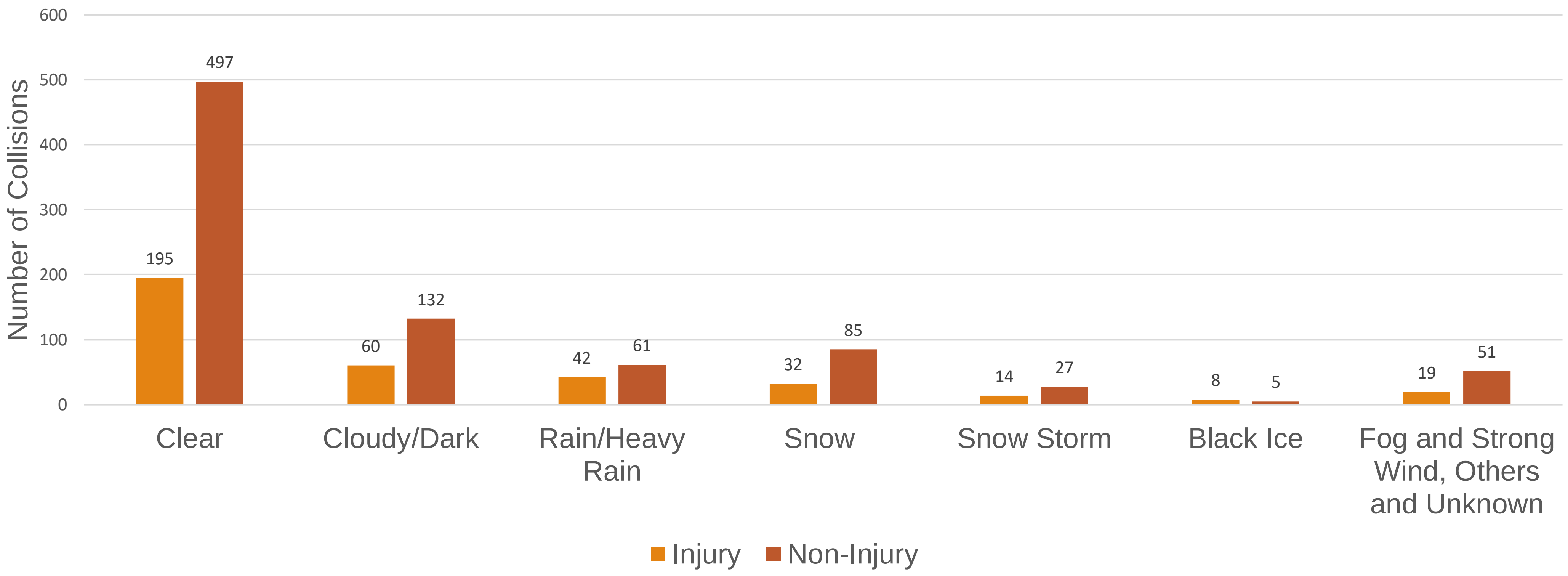
Ambulance Injury and non-Injury Collisions in different Road Configuration



Problematics | **Objectives** | **Methodology** | **Results** | **Discussion**

Ambulance Injury and non-Injury Collisions in different Weather Condition



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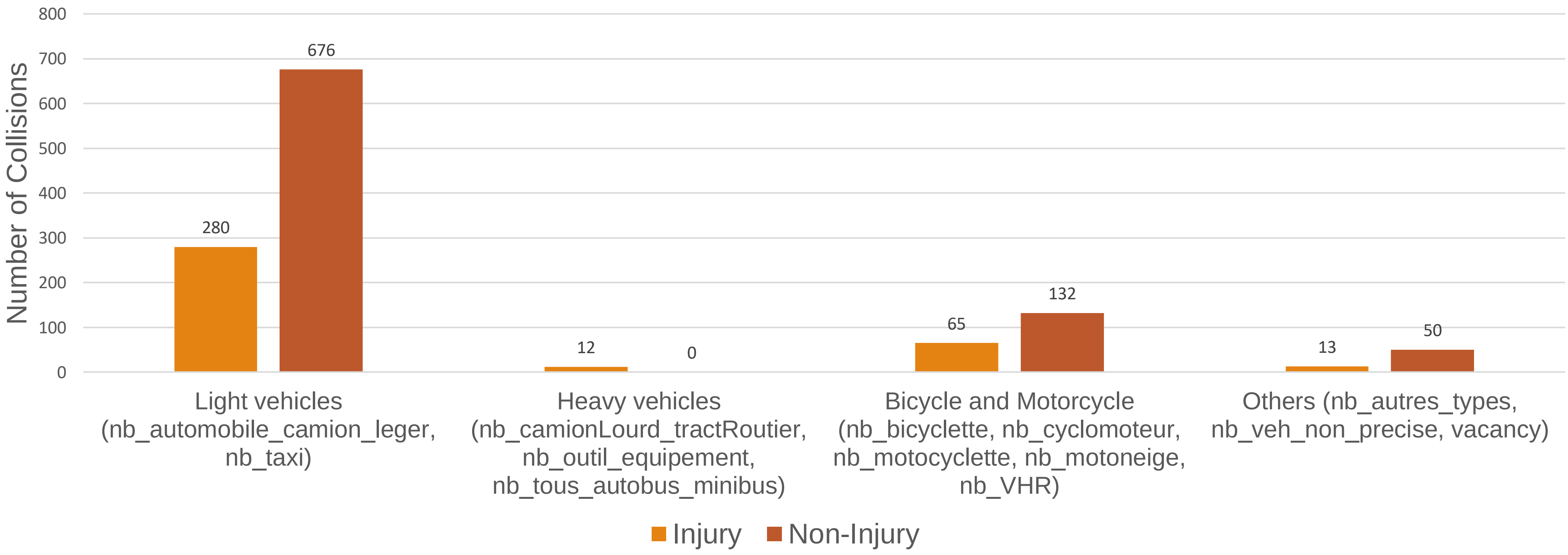
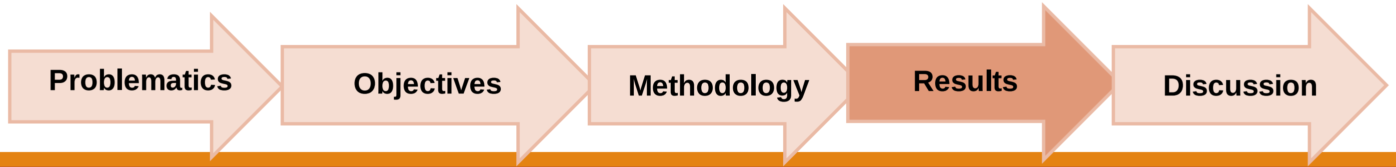
Ambulance Injury and non-Injury Collisions in different Transportation Mode





Variance Inflation Factor (VIF)

Variance Inflation Factor (VIF) values for variables used in the model of Montréal region

Variable	GVIF	DF	GVIF^(1/(2*Df))
Collision type	2.94	4	1.14
Asphalt condition	1.47	1	1.21
Location of collisions	1.67	3	1.09
Weather condition	2.29	6	1.07

Variance Inflation Factor (VIF) values for variables used in the model of Montérégie region

Variable	GVIF	DF	GVIF^(1/(2*Df))
Surface condition	1.45	6	1.03
Asphalt condition	1.45	1	1.21