Characteristics of Paramedics' Collisions in a Metropolitan Area of Quebec: a Bayesian Network Analysis

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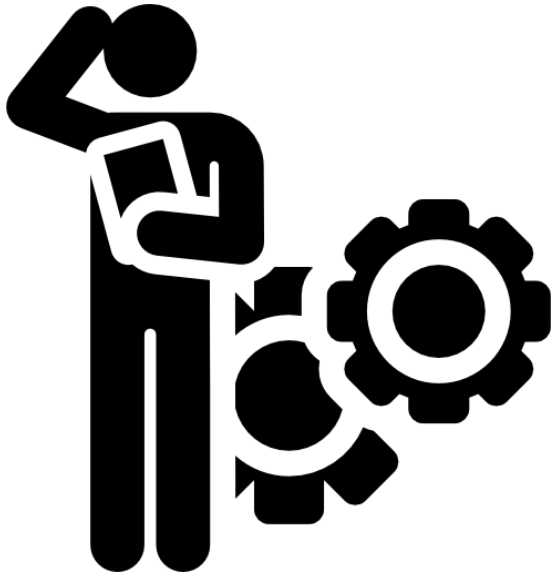

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Problematics

Paramedics' Collisions

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Road Collision Statistics

- Canadian Motor Vehicle Mortalities = 1,762 in 2019 (9.1% reduction from 2018 (1,939))
- 2% of all workers involved in road collisions lead to 25%-30% of total mortalities from 2000 to 2008 in Quebec workplaces. 25–35-year-old workers exhibited 28% of these total cases.
- The risks for paramedics are five times higher than for other drivers.
- Paramedics' Collisions in Montreal resulted in 64 injuries and 1402 non-injuries between 2010 and 2012.

- References:
- Transport Canada. *Canadian Motor Vehicle Traffic Collision Statistics*. 2018
- Bellavance, F., Duguay, P, pignatelli, S., *Road Accidents at Work - an overview*. 2016: Quebec.
- Société de l'assurance automobile du Québec. *ROAD SAFETY RECORD*. 2020

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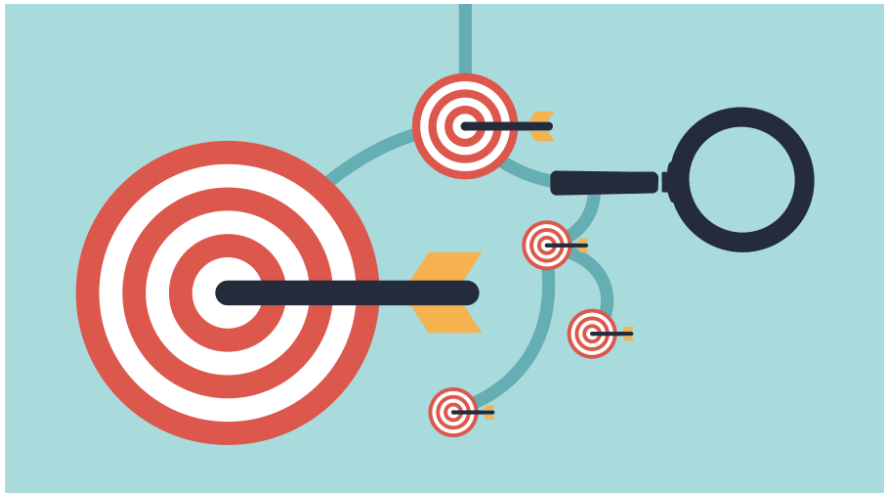

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Objectives

Characteristics of Paramedics' Collisions; paramedics' experience, gender, age. Bayesian Network (BN) analysis and Retrospective study, between 2010 to 2012.

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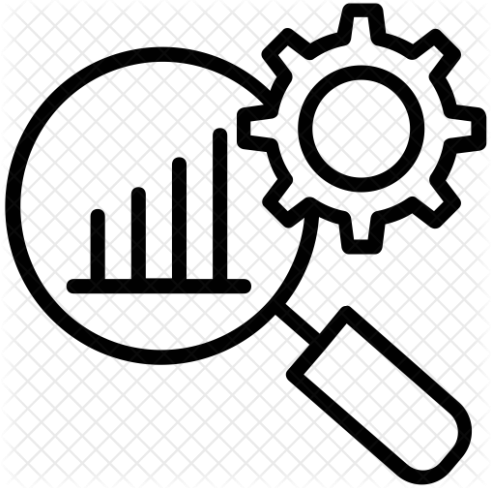

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Methodology

Data Collection, Preparation and Descriptive Analysis

Bayesian Network Modeling

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Data

Collisions collected from U-s and SAAQ - Montréal, Canada, from 2010 to 2012.

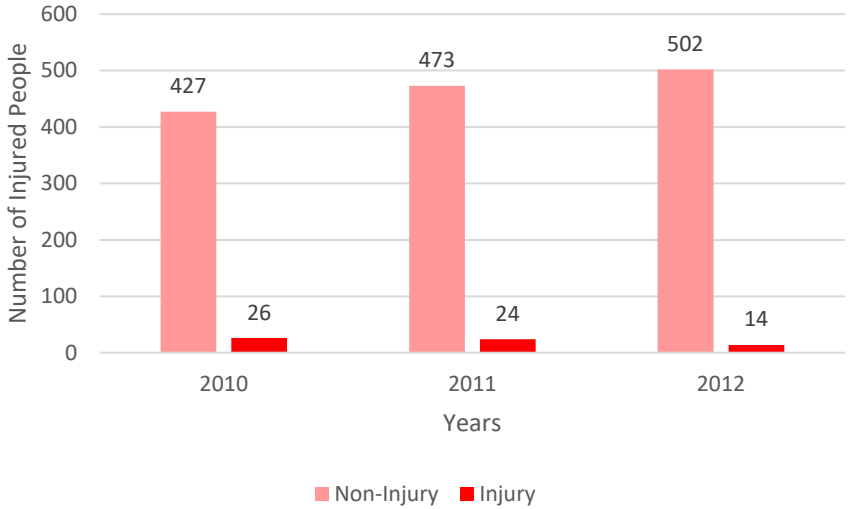

Fig 1: Number of Injury and Non-Injury

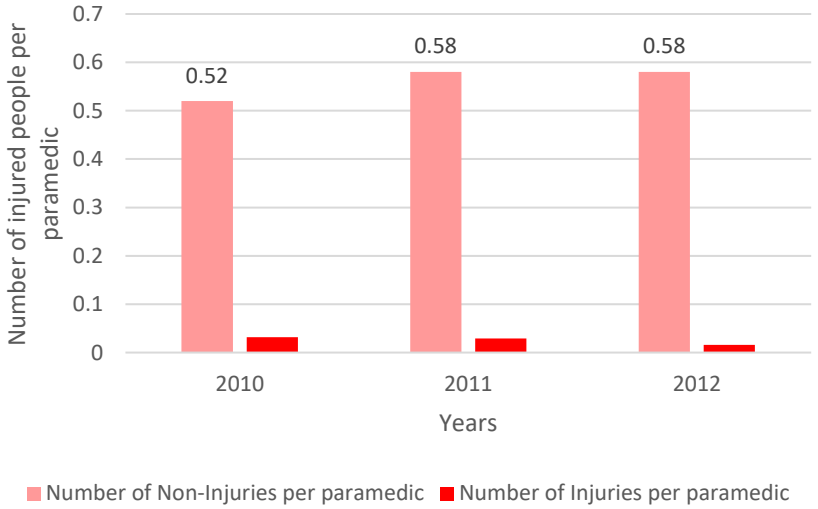

Fig 2: Incidence of Injury and Non-Injury

Comparison of U-s data to SAAQ:

Number of Injuries Reported equal to SAAQ = 11 (out of 64)
Number of Injuries Reported less than SAAQ = 32 (out of 64)
Number of Injuries Not Reported = 15 (out of 64)
Less interesting Categories = 6 (out of 64)

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Data Description

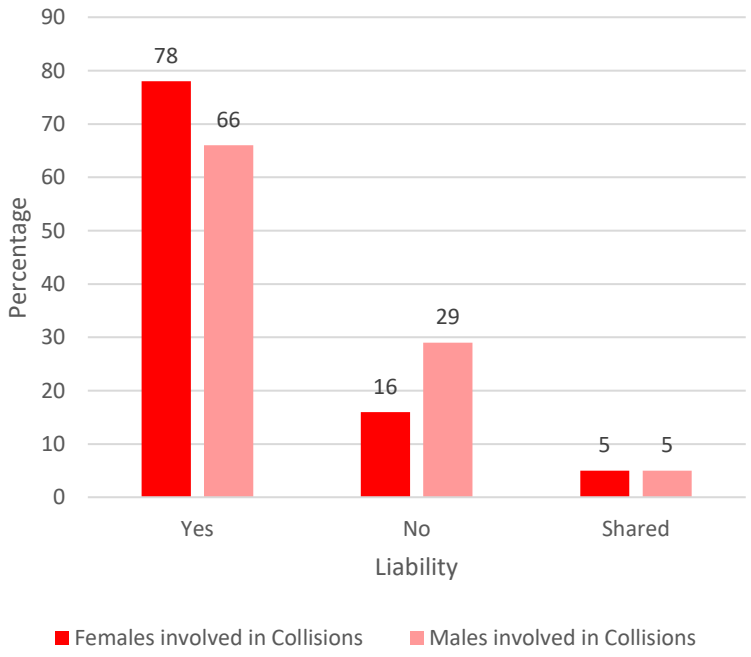

Fig 3: Percentage of Females and Males vs Categories of Liability

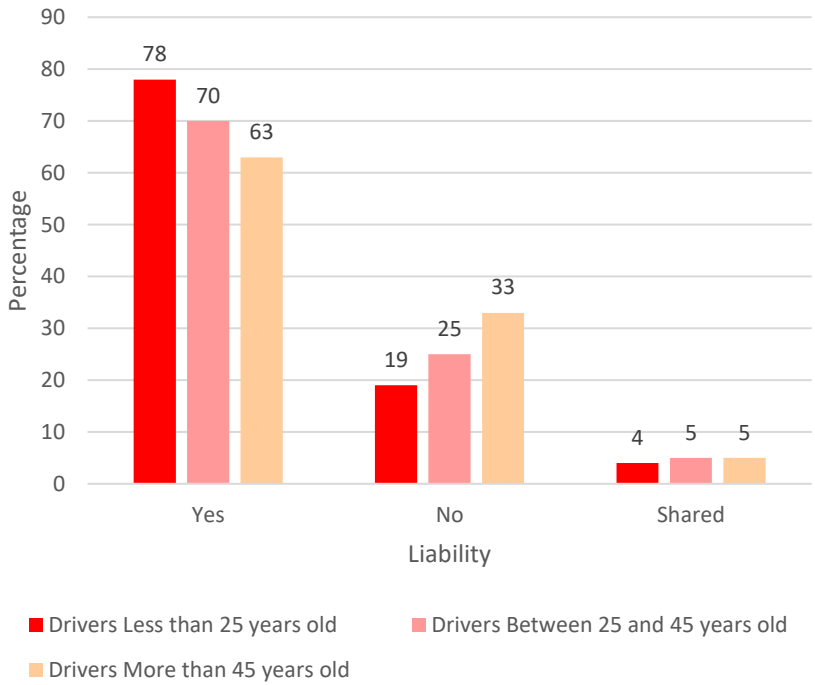

Fig 4: Percentage of Drivers in Different Ages vs Categories of Liability

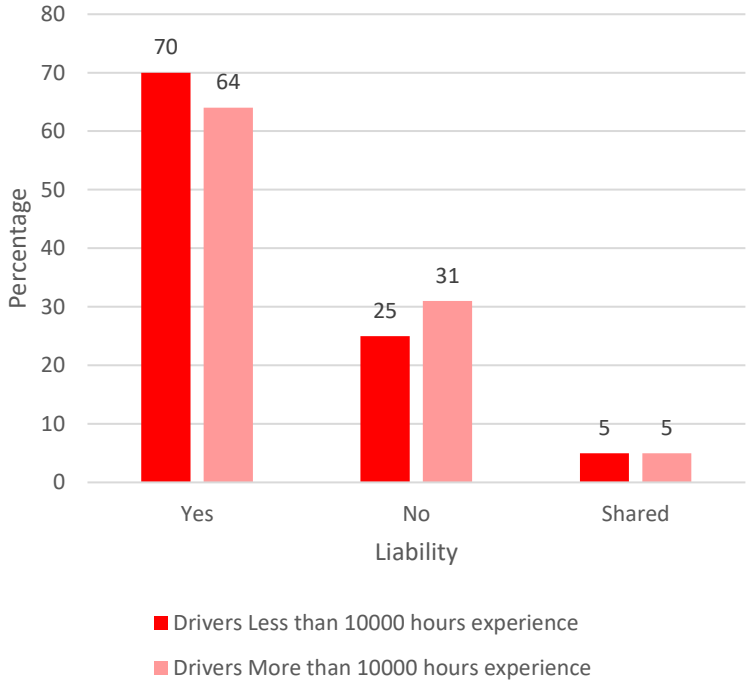

Fig 5: Percentage of Drivers in Different Experiences vs Categories of Liability

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Data Description

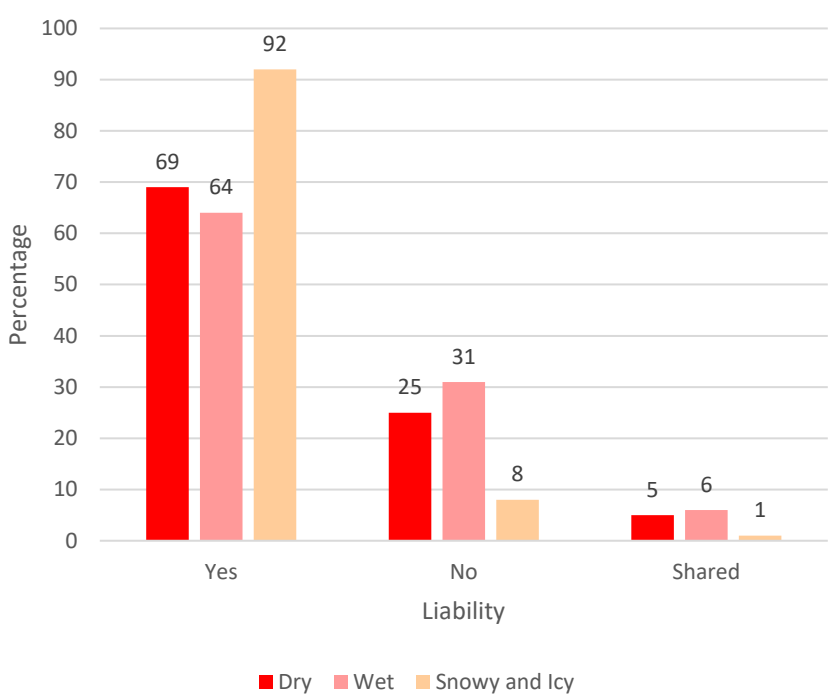

Fig 6: Percentage of Different Road Surface States vs Categories of Liability

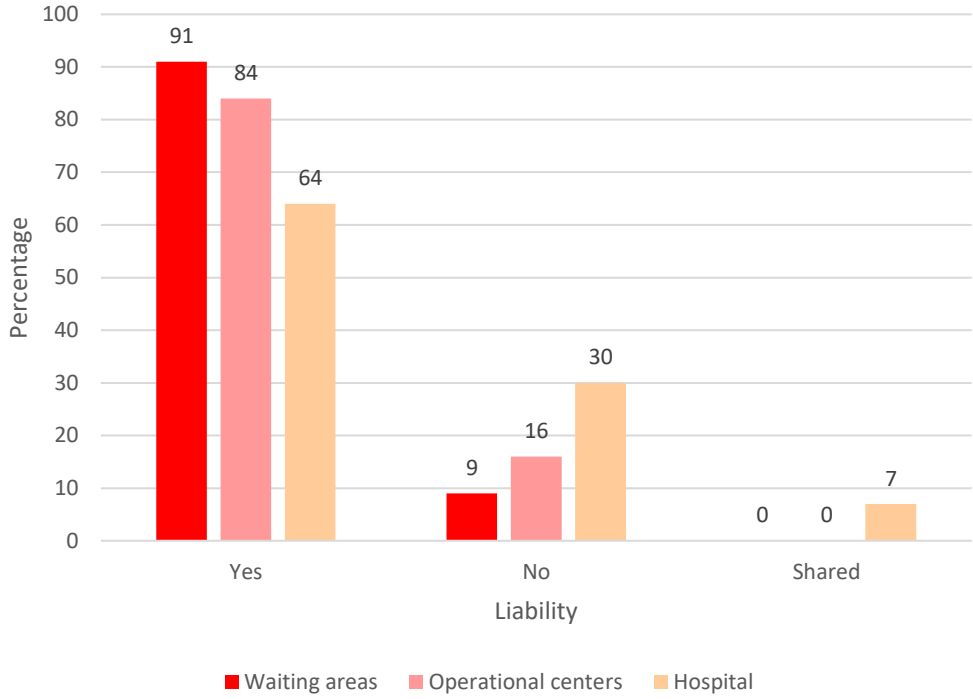

Fig 7: Percentage of Different Collision Locations vs Categories of Liability

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Data Description

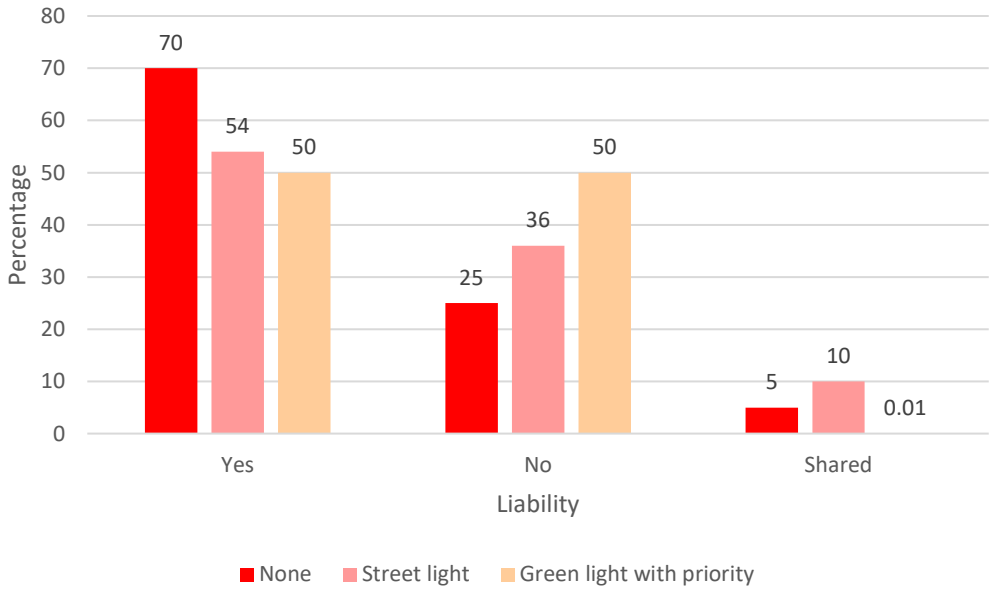

Fig 8: Percentage of Different Signalization vs Categories of Liability

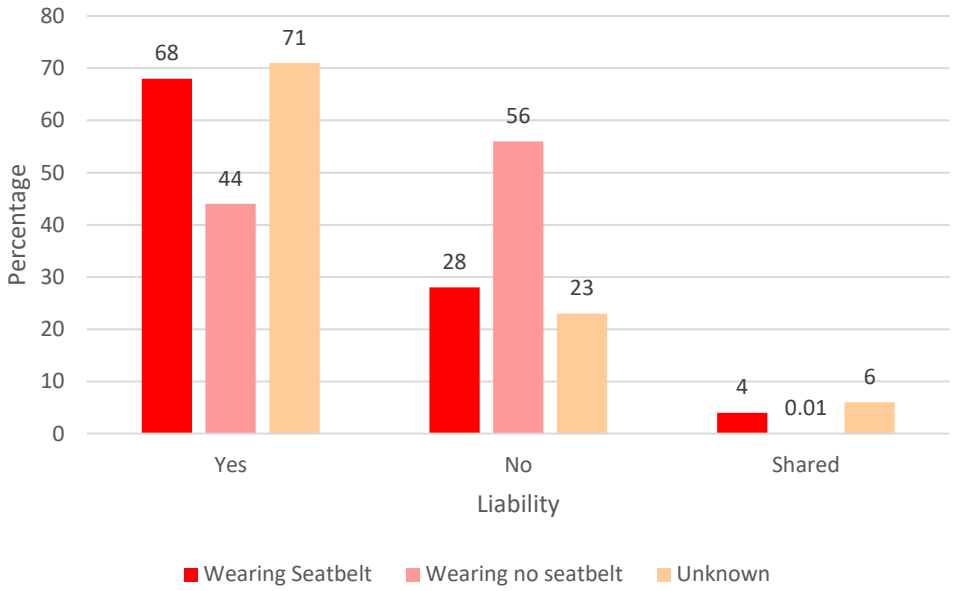

Fig 9: Percentage of Seatbelt Usage vs Categories of Liability

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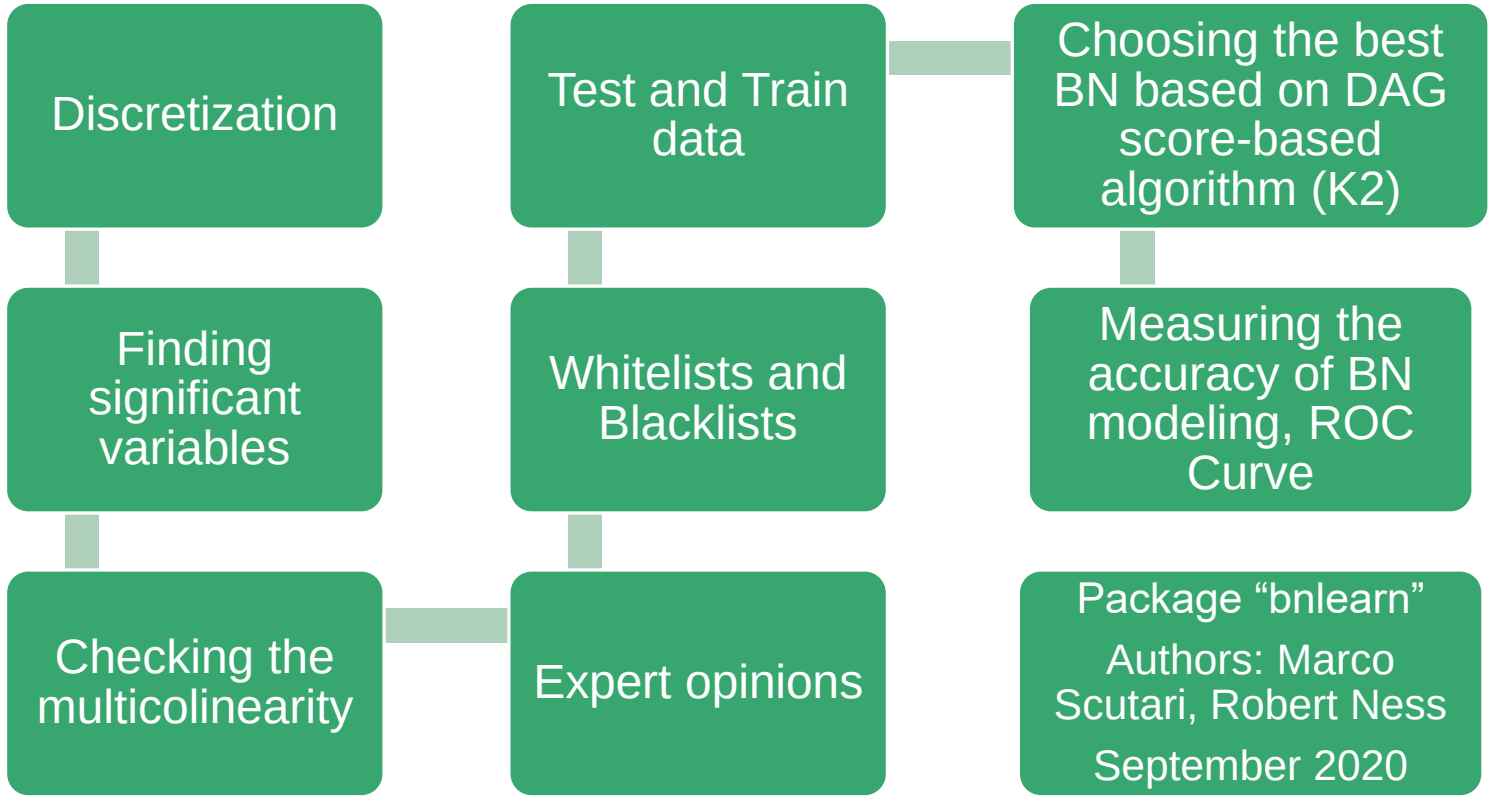
Bayesian Network Procedure



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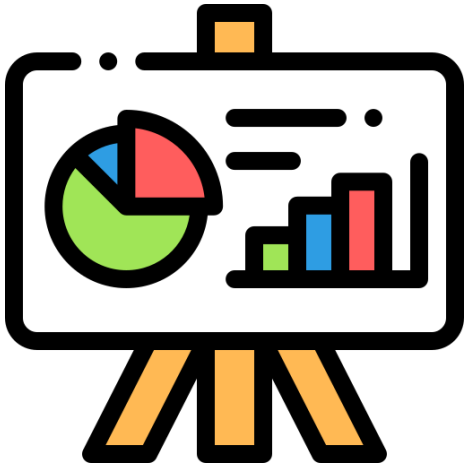

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Results

Directed Acyclic Graph

Inference Probability

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Directed Acyclic Graph (DAG)

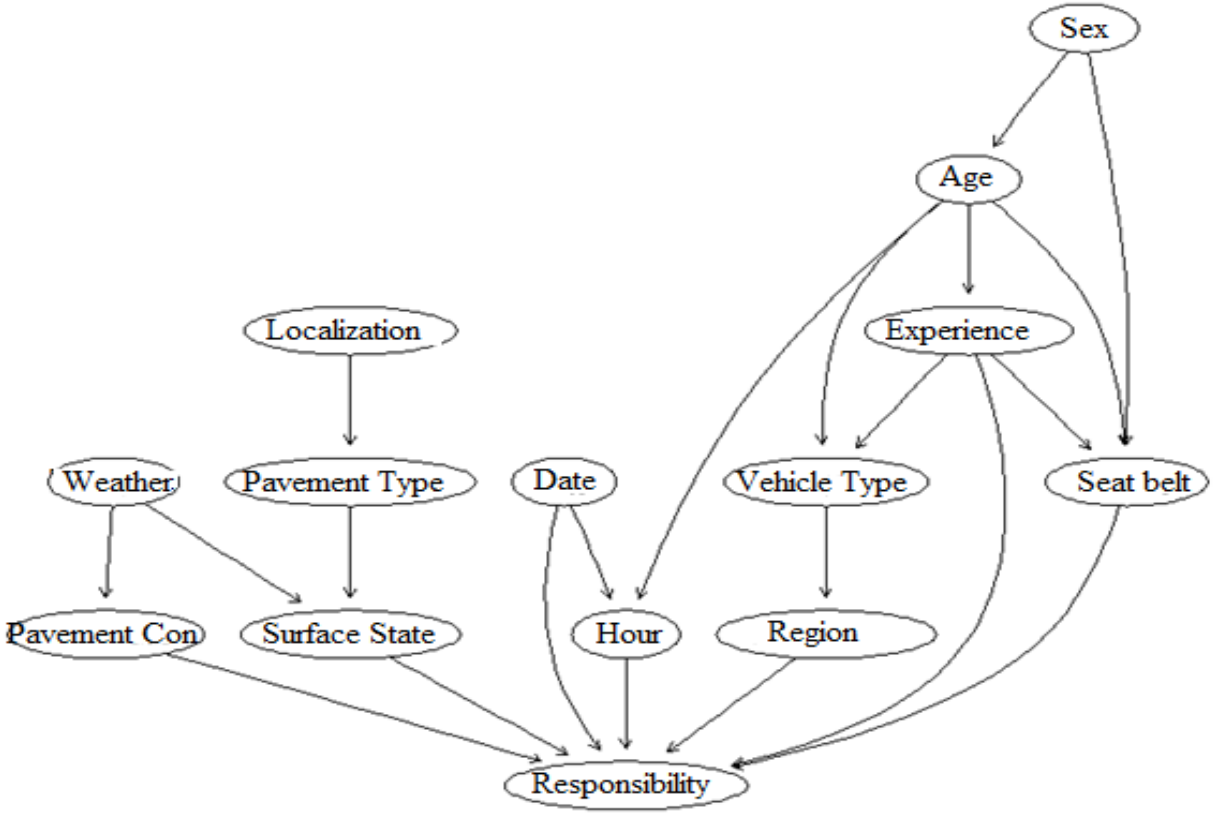

Fig 10: The Bayesian Network DAG for the Paramedics' collisions, 2010-2012

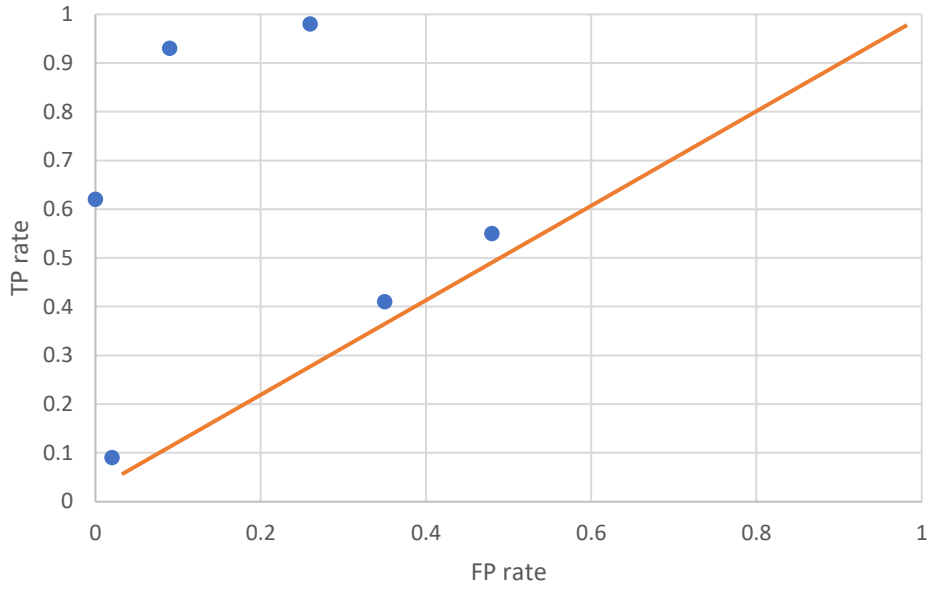

Fig 11: ROC curve for categories of responsibility

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Inference in Bayesian Network

Table 1: BN probability inference per gender variable and driver responsibility

Gender \ Responsibility	Yes	No	Shared
Female	51%	28%	21%
Male	48%	29%	23%

Table 2: BN probability inference per age and driver responsibility

Age \ Responsibility	Yes	No	Shared
Less than 25	51%	27%	22%
Between 25 and 45	51%	28%	21%
More than 45	42%	32%	26%

Table 3: BN probability inference per experience and driver responsibility

Experience \ Responsibility	Yes	No	Shared
Less than 10000 hours	51%	28%	21%
More than 10000 hours	40%	33%	27%

Inference in Bayesian Network

Table 4: BN probability inference per localization and driver responsibility

Surface State \ Responsibility	Yes	No	Shared
Dry	53%	28%	20%
Wet	38%	33%	30%
Snowy and Icy	43%	31%	27%

Table 5: BN probability inference per seatbelt and driver responsibility

Seatbelt \ Responsibility	Yes	No	Shared
Yes	36%	33%	30%
No	46%	31%	24%
Unknown	52%	28%	21%

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Inference in Bayesian Network

Table 6: BN probability inference per day of the week and driver responsibility

Days of week \ Responsibility	Yes	No	Shared
Saturday	51%	27%	22%
Sunday	42%	31%	27%
Monday	44%	31%	26%
Tuesday	52%	28%	20%
Wednesday	44%	33%	23%
Thursday	48%	31%	21%
Friday	55%	25%	20%

Table 7: BN probability inference per period of the day and driver responsibility

Periods \ Responsibility	Yes	No	Shared
12:00 a.m. - 03:59 a.m.	44%	29%	26%
04:00 a.m. - 07:59 a.m.	43%	30%	27%
08:00 a.m. - 11:59 a.m.	43%	35%	23%
12:00 p.m. - 03:59 p.m.	53%	27%	21%
04:00 p.m. - 07:59 p.m.	51%	29%	20%
08:00 p.m. - 11:59 p.m.	50%	25%	25%

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Discussion

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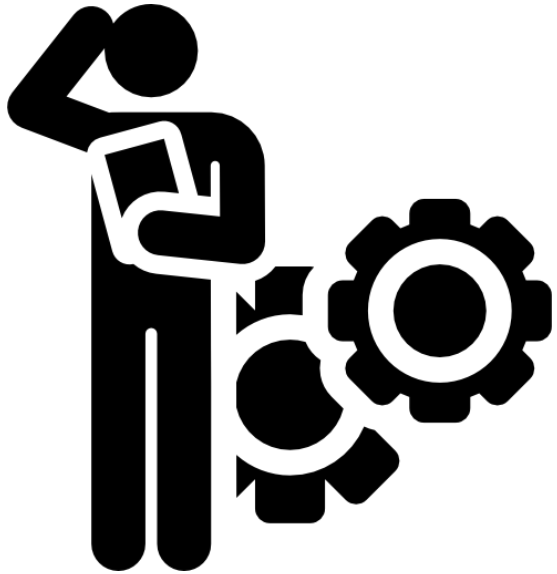
Let’s discuss

- The age and experience of drivers can increase the responsibility of emergency drivers.
- Potential higher staff count in the 25- to 45-year-old age group may increase collisions.
- Males were more involved in collisions than females, while the percentage of responsibility of females is higher than males.
- BN shows that there is no significant difference between paramedics’ responsibilities gender-wise.

Let’s discuss

- Cases with unknown seatbelt usage have a higher probability of collision responsibility (52%), followed by those with no seatbelt (46%).
  - Specific interventions should be tailored to address this issue.
- Friday and Saturday as well as the time between 12:00 p.m. and 07:59 p.m. are riskier for paramedics. This may be due to more calls received by U-s.
- It should be mentioned that when an ambulance is involved in a collision while transporting a patient, it heavily increases the risk of having injuries/deaths.



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Conclusion

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Highlights

- Documented significant attributes affecting paramedics' responsibility in collisions with descriptive analysis.
- Identifying the underlying factors regarding responsibilities for paramedics' collisions with BN model.
- Proactive measures on younger drivers with little experience.
- Updating the policies and having training and educational programs.
- Driver-Assistance Systems

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Thank you
Questions or Comments?

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