



LABORATORY OF ACCIDENTOLOGY, BIOMECHANICS AND  
HUMAN BEHAVIOR

FRONTAL COLLISION – M1: ACCIDENTOLOGY OF  
REAR ROWS VERSUS FRONT ROW




MACROSCOPIC SITUATION  
EQOP TF4

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# RESEARCH QUESTIONS

- Front collision \_ M1: evolution of accidentology for occupants in rear seats versus front seats?
  - Occupation ratio? 
  - Severity
    - Overall 
    - Fatalities 
  - Model year effect? (to be done)

# METHODOLOGY

- French national accident database: **BAAC 2015 – 2024**
  - Distinction 2015-2019 / 2020-2024 to check any lockdown effect on habit evolution.
- Filtering
  - **All M1 involved in front collision** against another vehicle, excluding VRU.
  - **Belted** occupants aged  $\geq 10$  y.o.
  - **Severities:** fatalities / in-patient injured (seriously injured) / ou-patient injured (slightly injured) / not injured
  - **All model years**

# FRONT COLLISIONS: OCCUPANCY RATIO

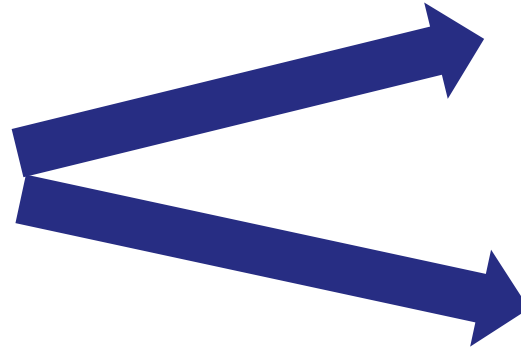
## BAAC 2015 – 2024

- Occupancy rate in vehicle = 1,4
  - Number of M1 vehicles: 136 026
  - Number of belted occupants: 183 656

## ➤ Occupancy ratio of rows/seats

2015-2024		occupation %
Driver seat	136 026	100
Front right seat	32827	24,1%
Front middle seat	125	0,1%
Rear left seat	6158	4,5%
Rear centre seat	1787	1,3%
Rear right seat	6733	4,9%
<b>All rear seats</b>	<b>14678</b>	<b>10,8%</b>

NB: 136026 vehicles / 183656 occupants



2015-2019		occupation %
Driver seat	72282	100
Front right seat	16953	23,4
Front middle seat	68	0,1
Rear left seat	2983	4,1
Rear centre seat	994	1,4
Rear right seat	3458	4,8
<b>All rear seats</b>	<b>7435</b>	<b>10,3</b>

NB: 72282 vehicles / 96738 occupants

2020-2024		occupation %
Driver seat	63744	100
Front right seat	15874	24,9
Front middle seat	57	0,1
Rear left seat	3175	5,0
Rear centre seat	793	1,2
Rear right seat	3275	5,1
<b>All rear seats</b>	<b>7243</b>	<b>11,4%</b>

NB: 63744 vehicles / 86918 occupants

- Overall, **11% of occupants in rear seats**
  - No big difference before and after lockdown
  - No change compared to 2014 study / BAAC 2012 (see report Dec. 2014)

Parmi les 22 890 passagers de VP ceinturés, 2 591 (11.3%) sont des passagers arrière.

\*Assumptions

# ANNEX\_OCCUPANCY RATIO OF REAR SEATS

EVOLUTION OVER TIME: 2012 - 2024

BAAC 2012 (2014 LAB study, extract)

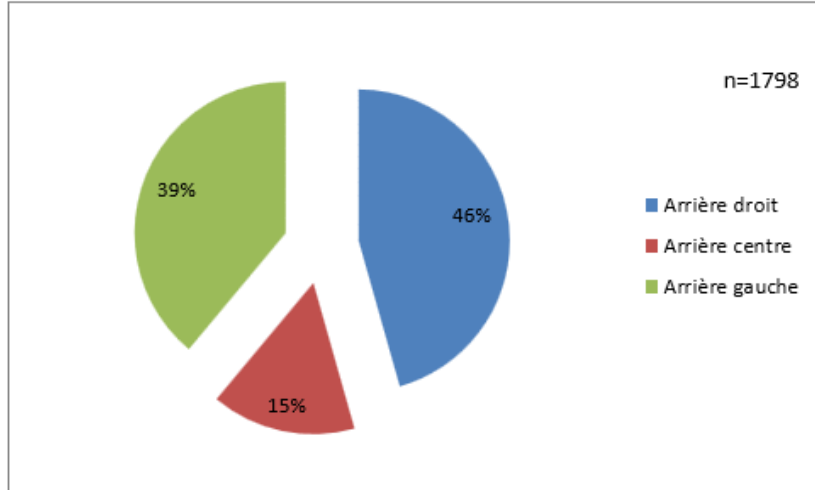
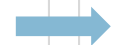
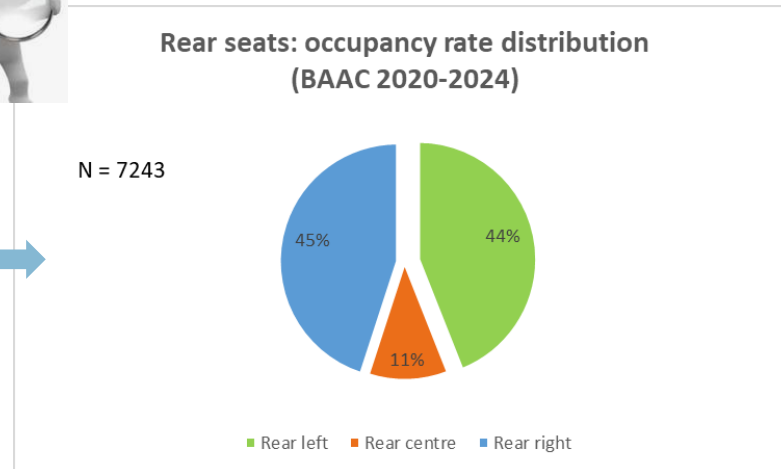
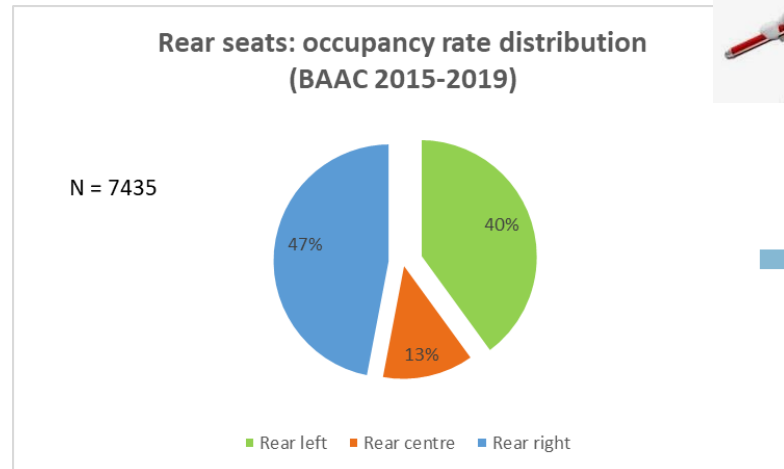
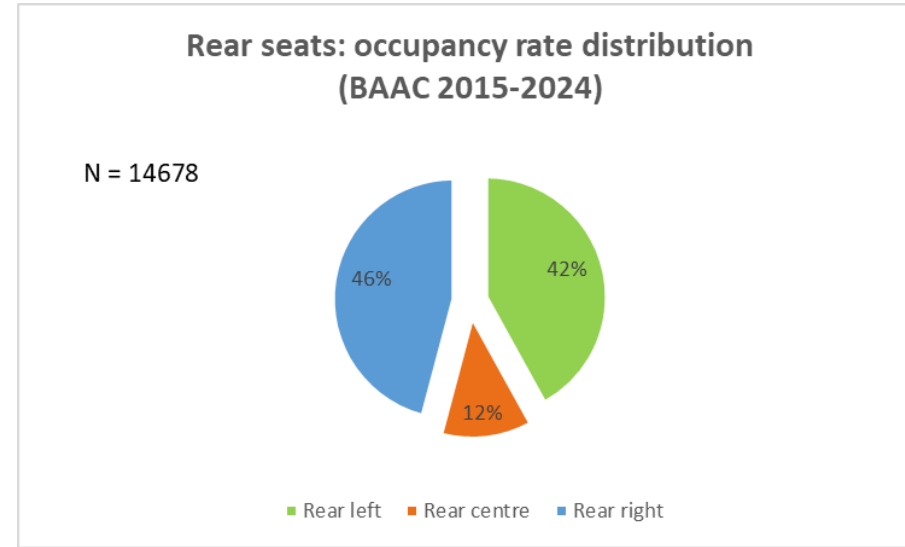
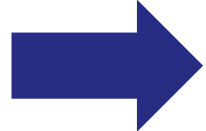


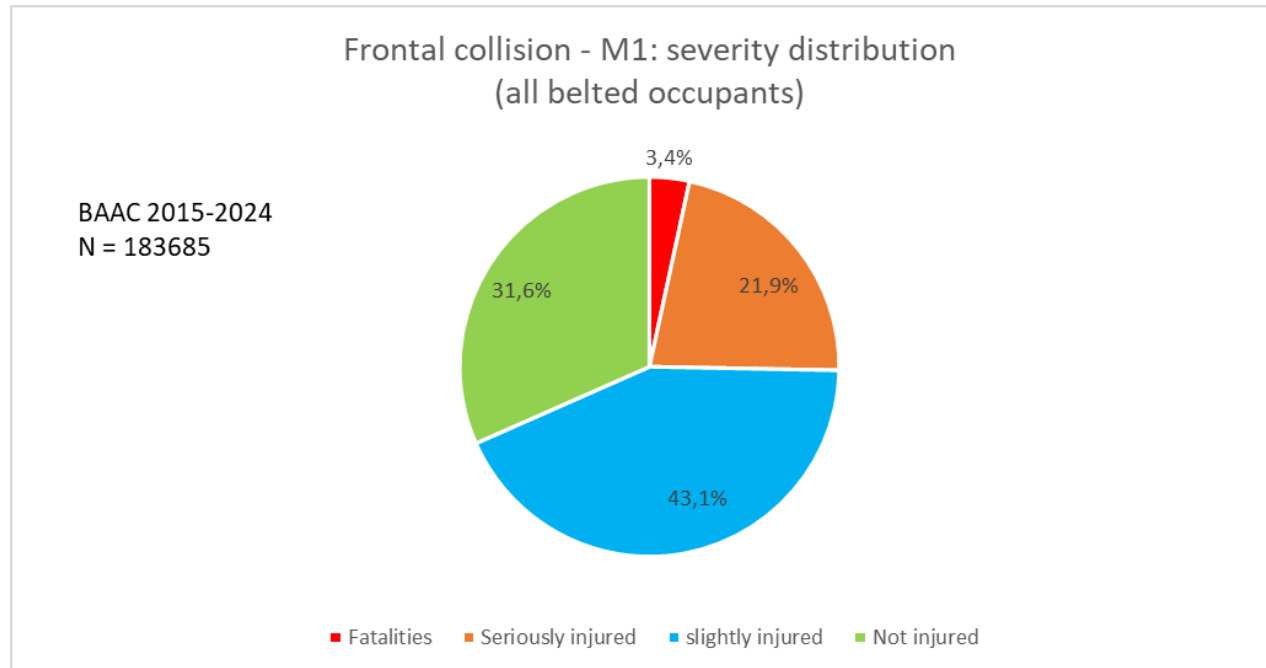
Figure 12 : Répartition de la place occupée à l'arrière pour les occupants de VP ceinturés



Overall since 2012:

- Rear right more occupied (~46%)
- Rear left ~ 40%
- Rear centre stable over time (~12%)
- Tendency 2020-2024: balance between right and left; less in centre

# SEVERITY / M1 IN FRONT COLLISIONS (ALL OCCUPANTS) OVERALL 2015-2024

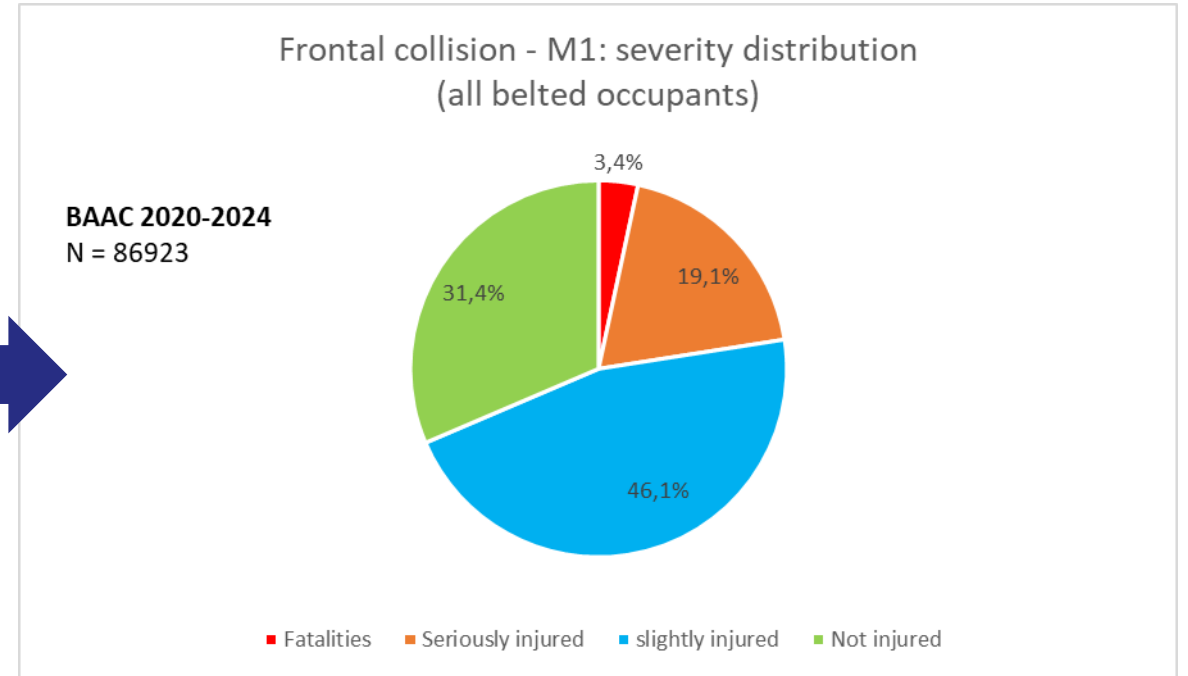
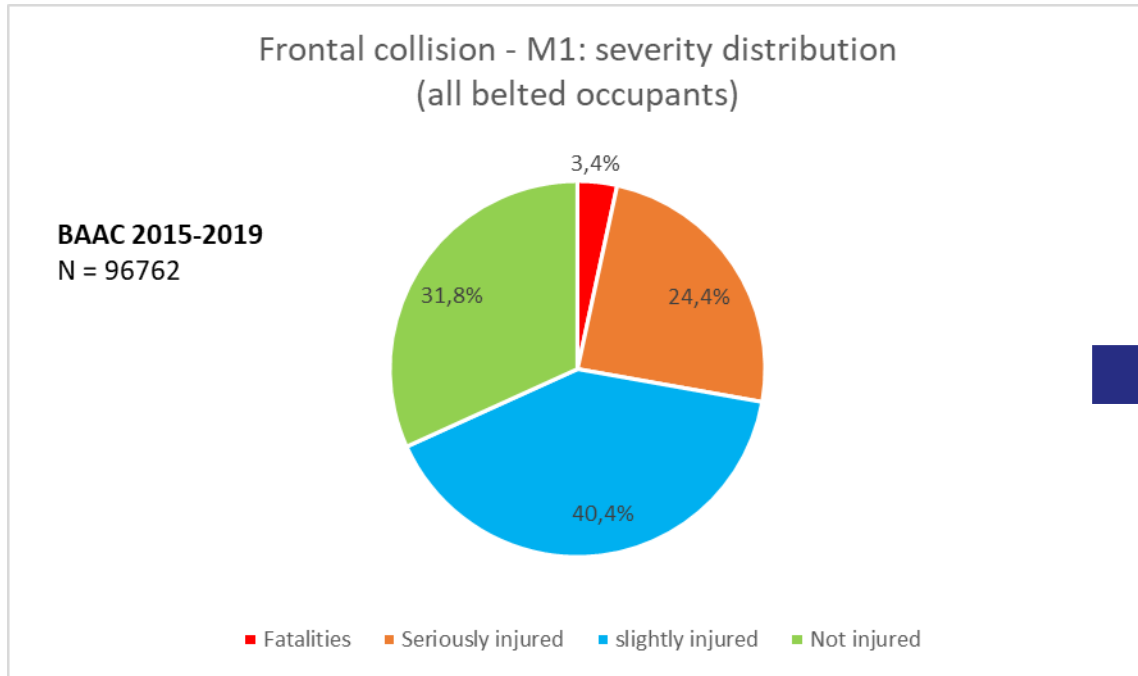


## Over the last 10 years (2015-2024):

- 3% of fatalities
  - 22% of seriously injured
  - 43% of slightly injured / 32% not injured

# SEVERITY / M1 IN FRONT COLLISIONS (ALL OCCUPANTS)

## 2015-2019 AND 2020-2024



### Tendency after lockdown ( $\geq 2020$ ):

\*No change in fatalities (3%) and not injured (~31%)

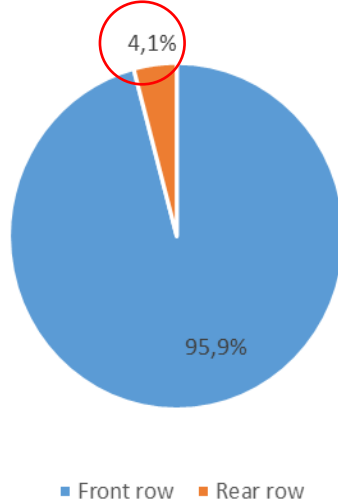
\*Less seriously injured (-22%), more slightly injured (+14%),

# SEVERITY / M1 IN FRONT COLLISIONS

## FATALITIES: FRONT VERSUS REAR OCCUPANTS

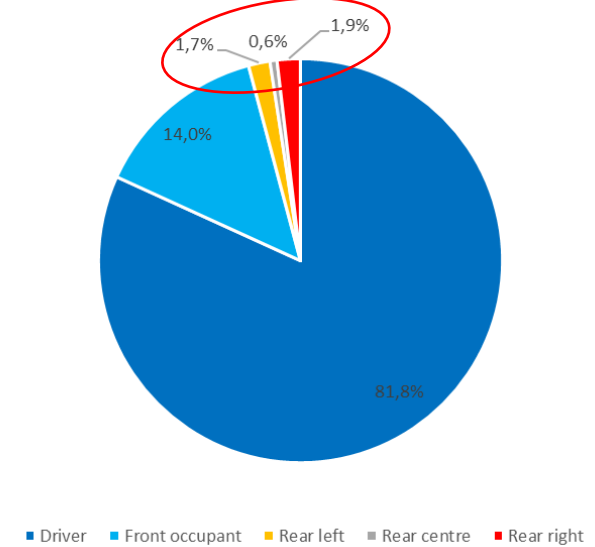
Frontal collision - M1: distribution of fatalities as per front/rear rows  
(All belted occupants)

BAAC 2015-2024  
N= 6223



Frontal collision - M1: distribution of fatalities as per front/rear seats  
(All belted occupants)

BAAC 2015-2024  
N= 6223



- ➔ 96% of fatalities in **Front row**
- ➔ 4% of fatalities in **Rear rows**

### Rear rows: details

- ➔ Right and left seats: ~ same % of fatalities  
(1,9%) (1,7%)
- ➔ Centre seat: 0,6%

# SEVERITY / M1 IN FRONT COLLISIONS

## ALL SEVERITIES: FRONT VERSUS REAR OCCUPANTS

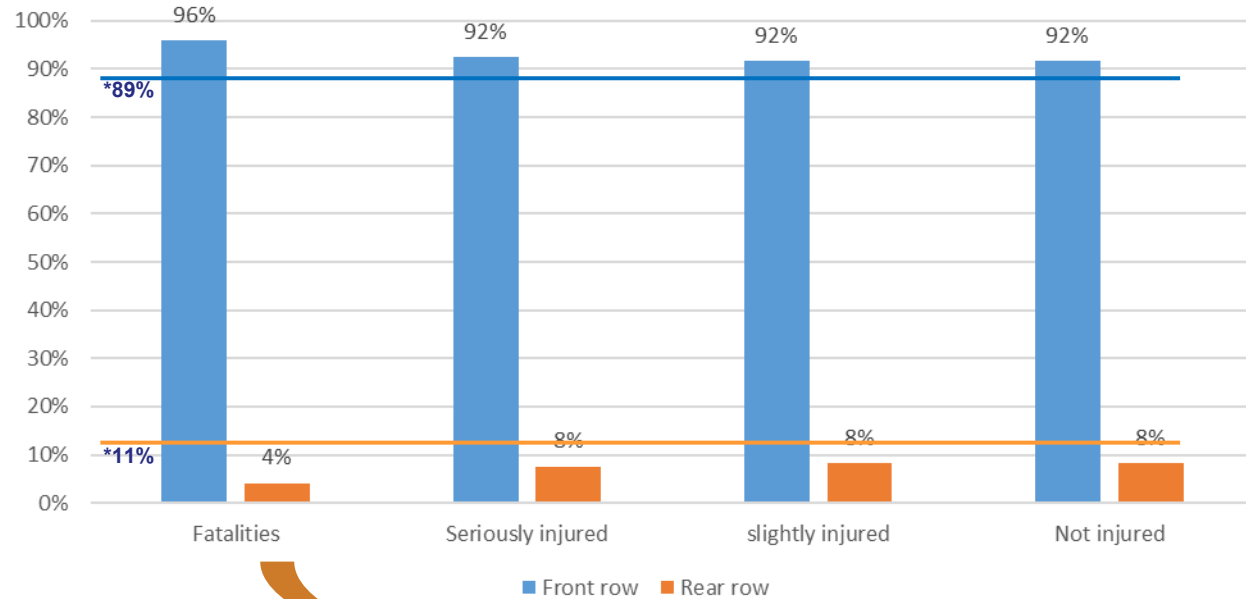
BAAC 2015-2024

N= 183684

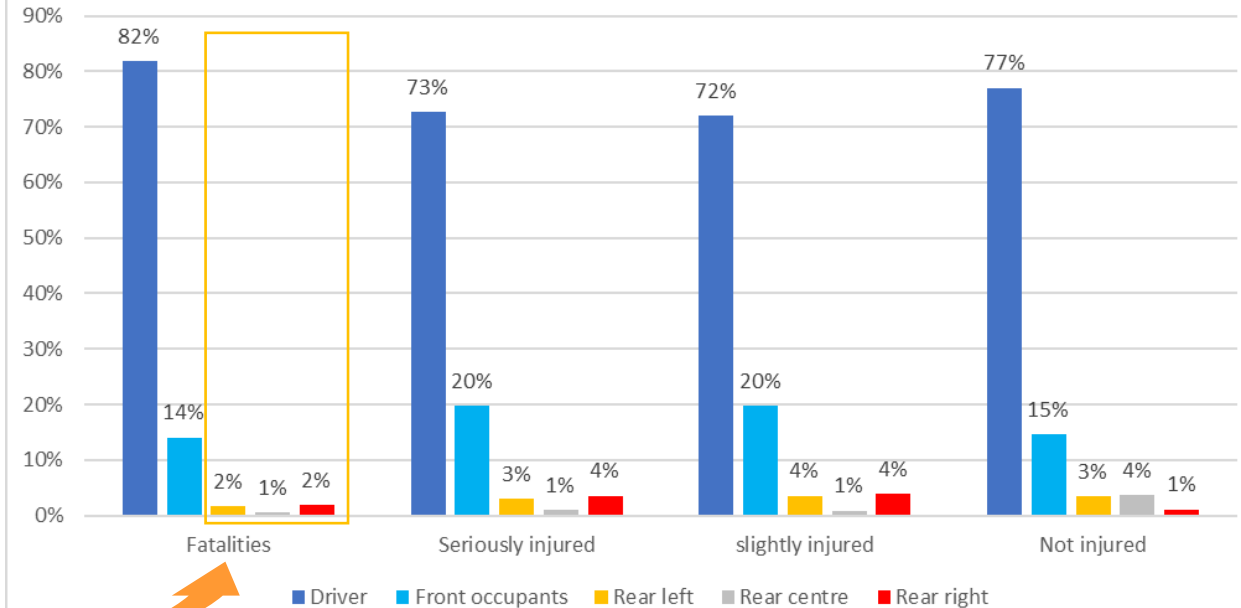
N<sub>front</sub> = 169002

N<sub>rear</sub> = 14678

Frontal collision - M1: severity distribution as per front/rear rows  
(All belted occupants)



Frontal collision - M1: severity distribution as per front/rear seats  
(All belted occupants)



- Casualties in rear rows/seats, especially severe ones (KSI) represent very low % compared to the front casualties.
- Referring to the respective occupancy ratio, rear row/seats appear less risky compared to the front row.

# SEVERITY / M1 IN FRONT COLLISIONS

## SEVERITY DISTRIBUTION: COMPARISON BETWEEN FRONT AND REAR ROWS

EVOLUTION OVER TIME: 2012 - 2024

BAAC 2012 (2014 LAB study, extract)

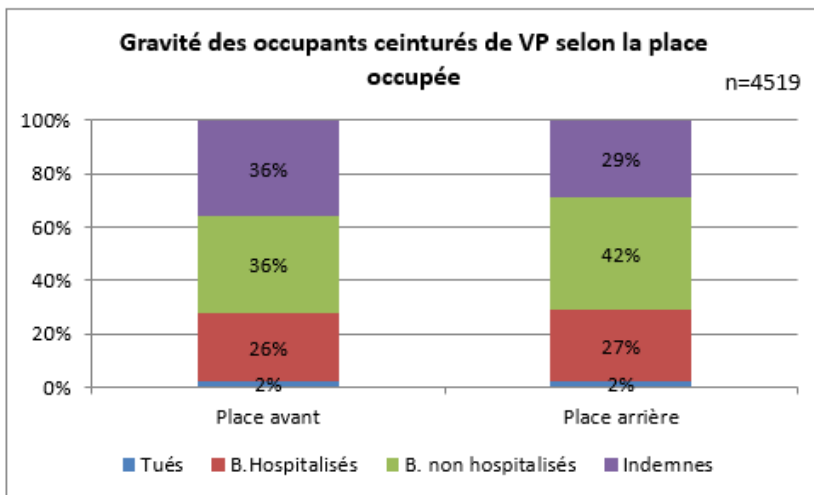
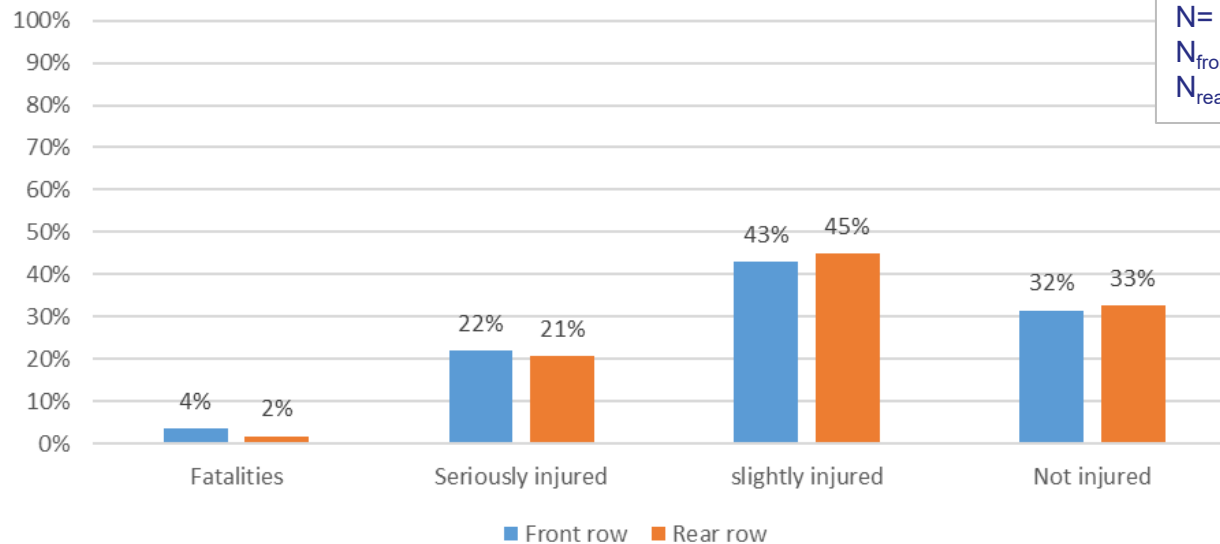


Figure 14 : Gravité des occupants ceinturés de VP selon la place occupée



### Front collision - M1: comparison of severity distribution front row vs rear row (All belted occupants)



BAAC 2015-2024  
N= 183684  
N<sub>front</sub> = 169002  
N<sub>rear</sub> = 14678

**Rear rows over time:** stable distribution, even improvement observed for seriously injured, not injured.

- Fatalities: factor 2 less in rear rows
- Seriously injured: same % (~20%) whatever the row ;
- Slightly injured and not injured: same % whatever the row

Rear rows/seats are not an issue compared to front row

# CONCLUSION

- Occupancy rate in vehicle: 1,4
- **Occupancy rate of rear rows: 11%**
- Occupancy rate between rear seats:
  - Rear right seat (46%) > rear left seat (40%) >> Rear centre seat (12%)
  - Since 2020, tendency of balance between right and left and slight decrease in rear centre (to be monitored)
- Severity: rear rows/seats are much less risky than front seats
  - **Fatalities: rear rows / seats (4%) / front row/seats (96%)**
  - Seriously injured: rear rows / seats (8%) / front row/seats (92%)
  - Slightly injured, same than not injured: rear rows / seats (8%) / front row/seats (92%)
  - Comparison of the severity distribution for front and for rear rows:
    - No difference - rear rows show any issue, especially for KSI
    - Recent years show an improvement for seriously injured (21% instead of 27% in 2012)