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Estimating the number of seriously injured road users using the national hospital data, France, 2010-2019



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Introduction : estimating the number of seriously injured road users

- Many countries use national hospital discharge data :
- Hospitalised patients, diagnosis coded with ICD-10 (International Classification of Diseases)
- Codes S, T = type of injury (fracture of the radius, liver injury, etc)
- Codes V, W, X, Y= external cause (intentional/accidental : home and leisure injury, occupational injury, road injury...)
- In France (PMSI): external cause is missing at 70%

Method :

Is external cause completed ? Yes/no

- Among all hospitalized with a traumatic injury (codes S00-T88)
- whatever the cause ; including unknown
- **We model the probability that the external cause is completed**
- Response variable : Y (yes/no)
- Logistic model
- **Covariates :**
 - Hospital's characteristics (public/private, size, spread of activities...)
 - Patients' characteristics (gender, age, type of injury, length of stay ...)
- => **predicted probabilities** of having a documented external cause
- Inverse estimated probabilities : used as **weights**
- On the hospitalized whose external cause = road crash
- => weighed sum= **estimated total number of hospitalized from road crashes**

Method :

ICD 10 codes => AIS severity

Serious road traffic casualties = with at least an AIS3+ injury score

→ Conversion map :

for each ICD-10 injury code, assignment of an AIS \geq 3 score (yes/no/unknown)

→ About 40-50% unknown

→ For these, imputation by regression

Prob (AIS 3+/ AIS 1-2) according to hospital and patient characteristics

Results

| Year | Hospitalized | MAIS3+ injuries | MAIS3+/ hospitalized | Hospitalized incidence (per 100 000 inhabitants) | MAIS3+ incidence (per 100 000 inhabitants) |
|---------|---------------------|------------------------|-------------------------|--|---|
| 2010 | 104 887 | 18 070 | 17,2% | 167,1 | 28,8 |
| 2011 | 105 841 | 18 178 | 17,2% | 167,8 | 28,8 |
| 2012 | 100 318 | 16 904 | 16,9% | 158,3 | 26,7 |
| 2013 | 100 681 | 16 970 | 16,9% | 158,1 | 26,6 |
| 2014 | 104 134 | 17 903 | 17,2% | 162,6 | 28,0 |
| 2015 | 101 770 | 17 723 | 17,4% | 158,3 | 27,6 |
| 2016 | 102 154 | 18 482 | 18,1% | 158,5 | 28,7 |
| 2017 | 104 424 | 19 691 | 18,9% | 161,5 | 30,5 |
| 2018 | 102 819 | 19 225 | 18,5% | 160,6 | 29,7 |
| 2019 | 103 978 | 19 798 | 19,0% | 160,4 | 30,5 |
| Average | 103 216 | 18 294 | 17,7% | 161,3 | 28,6 |

Checking validity, on the Rhône county: registry vs PMSI, inhabitants of Rhône

| Rhône Road trauma Registry (Rhône= crash location) | | | PMSI=hospitalized (Rhône=hospital location) | |
|---|----------------|---------------------|--|---------------------|
| Year | (hosp.) MAIS3+ | MAIS3+/hospitalized | (hops.) MAIS3+ | MAIS3+/hospitalized |
| 2010 | 343 | 35,1% | 319 | 16,5% |
| 2011 | 348 | 37,2% | 323 | 16,1% |
| 2012 | 323 | 35,7% | 367 | 19,0% |
| 2013 | 343 | 40,4% | 362 | 18,5% |
| 2014 | 346 | 36,5% | 480 | 12,3% |
| 2015 | 337 | 34,7% | 474 | 20,2% |
| 2016 | 324 | 35,7% | 427 | 20,6% |
| 2017 | 352 | 34,4% | 430 | 18,8% |
| 2018 | 368 | 33,4% | 492 | 19,9% |
| 2019 | 434 | 33,8% | 545 | 21,1% |
| Average | 352 | 35,5% | 422 | 17,7% |

National estimates: hospitalized, MAIS 3+ by mode of transport

Mode of transport : many unknown

Documented external cause: still 30% with unknown/unspecified mode (pedestrian, cyclists, etc)

Imputation of mode :

by multinomial regression, according to age, sex, and type of injury (11 categories)

E-scooters ?

In ICD 10 CM (USA): new code V00

In France :

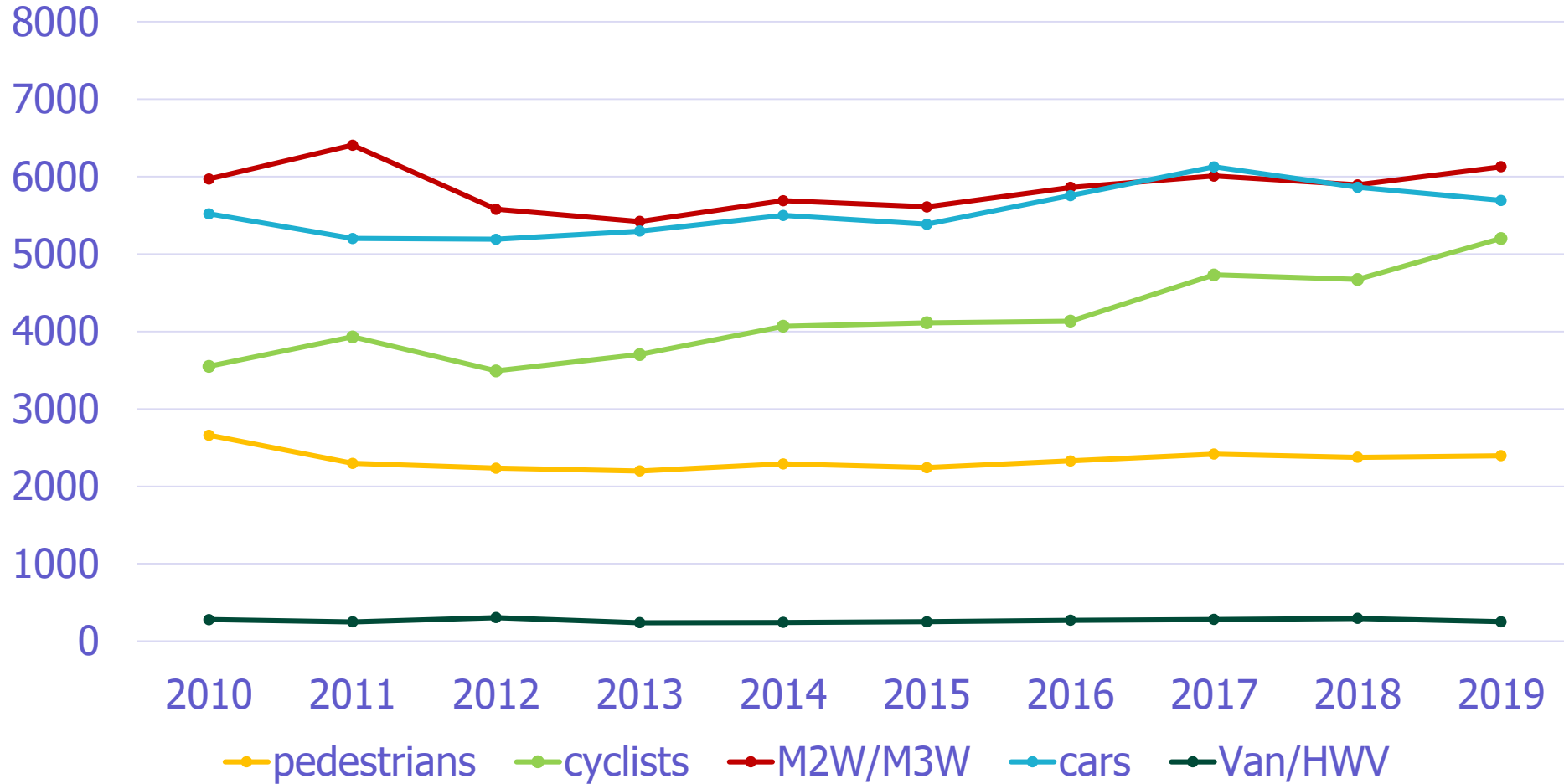
- no new code
- « scooter » is listed in pedestrian definition
- E-scooter = ?

How does the hospital staff code them ? As Pedestrians? Other ? unspecified?

Other European countries ?

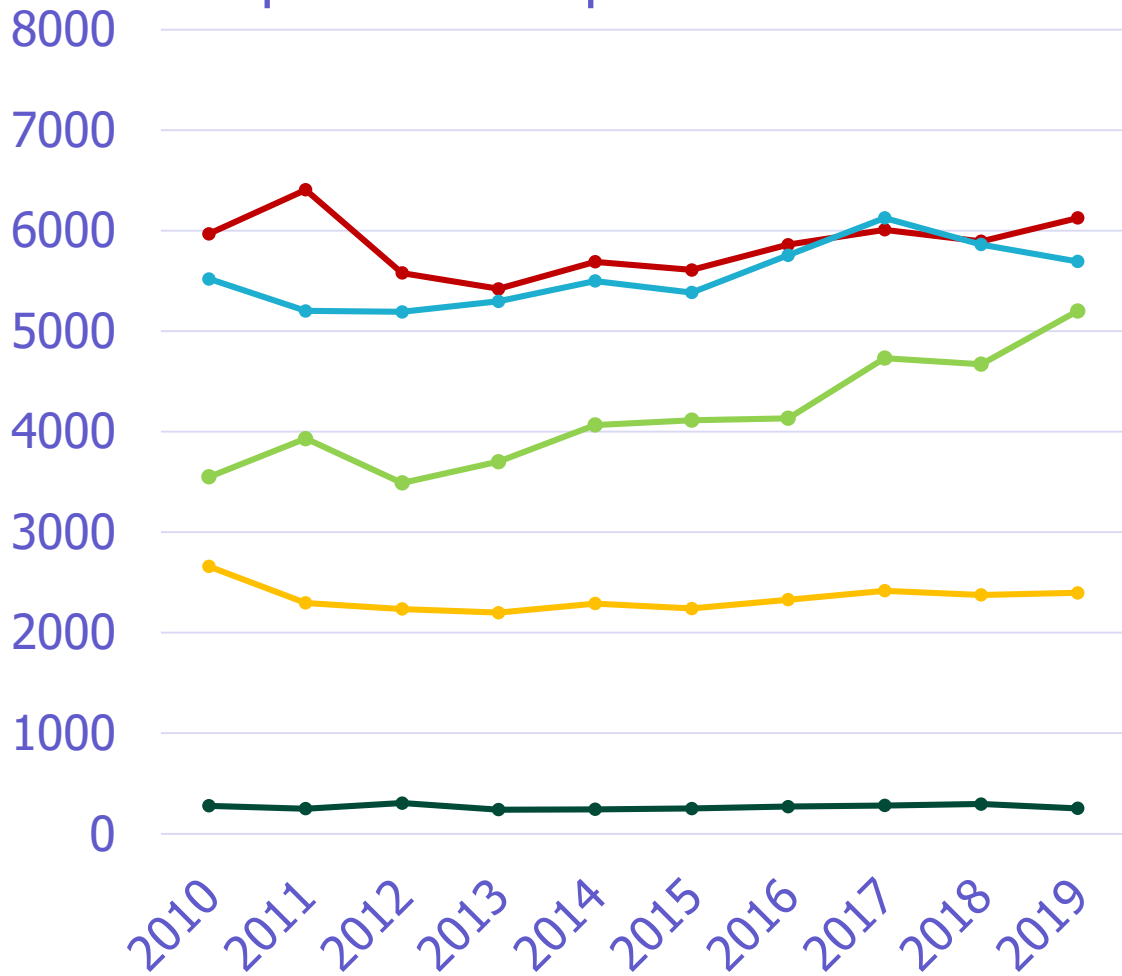
National estimates, hosp. and MAIS 3+ by mode of transport

Hospitalized and MAIS3+ road users, France

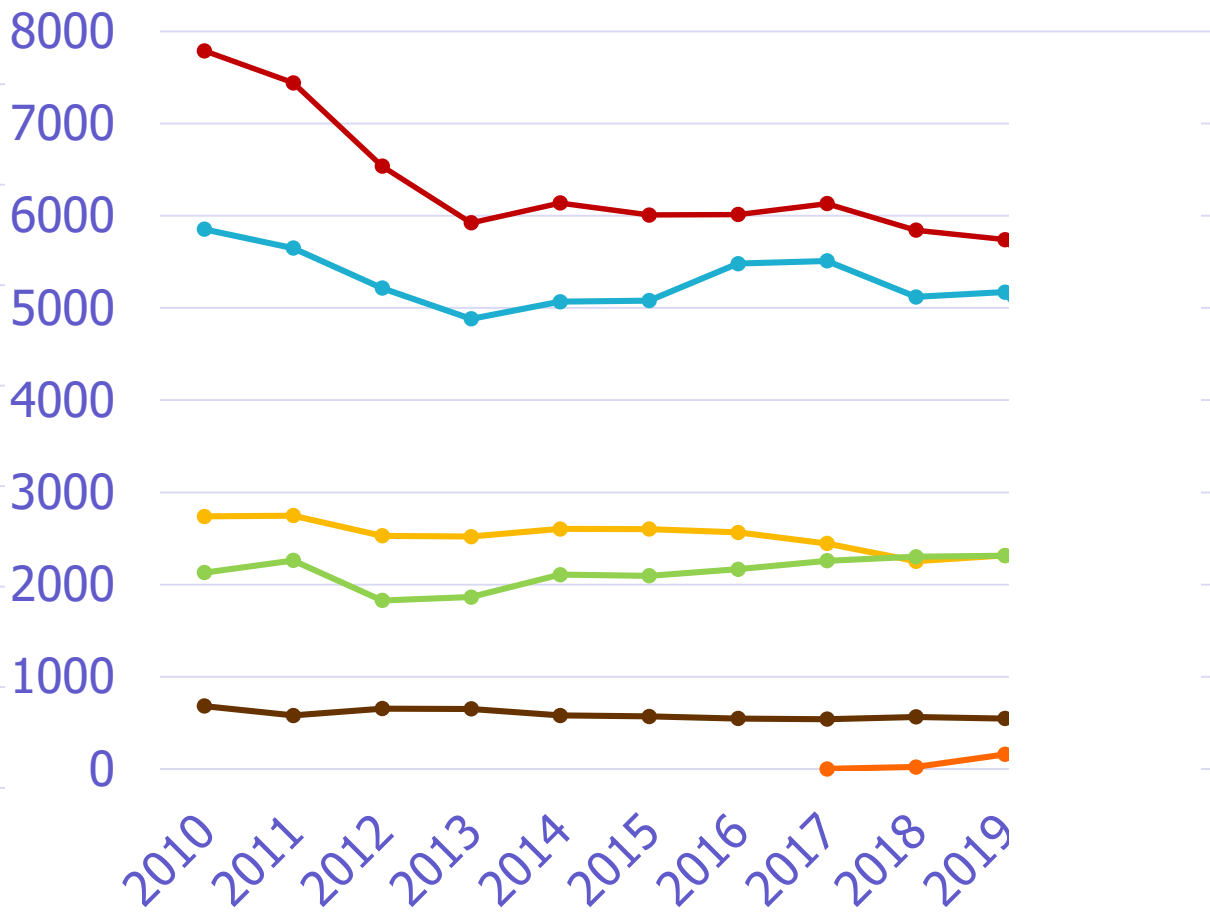


France, seriously injured road users, by mode

Hosp. data : hosp. and MAIS3+



Corrected police data, MAIS3+, France



- Pedestrians
- Cyclists
- E-scooters
- M2W/M3W
- Cars
- Other

Discussion / Conclusion

Ratio #MAIS3+/# killed

- 5.3 MAIS3+/killed in France
- 3-4 in Belgium, Italy, Portugal, Spain and Sweden (Safetycube),

No account for missing external cause (17 % in 2 countries, and ??% in the others)

- 13,2 and 11,9 in Netherlands and Switzerland: using capture-recapture and large amount of cyclists, whose ratio =24

Thank you for your attention

UMRESTTE

**UNITÉ MIXTE DE RECHERCHE
ÉPIDÉMIOLOGIQUE ET DE SURVEILLANCE
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Sous la co-tutelle de :

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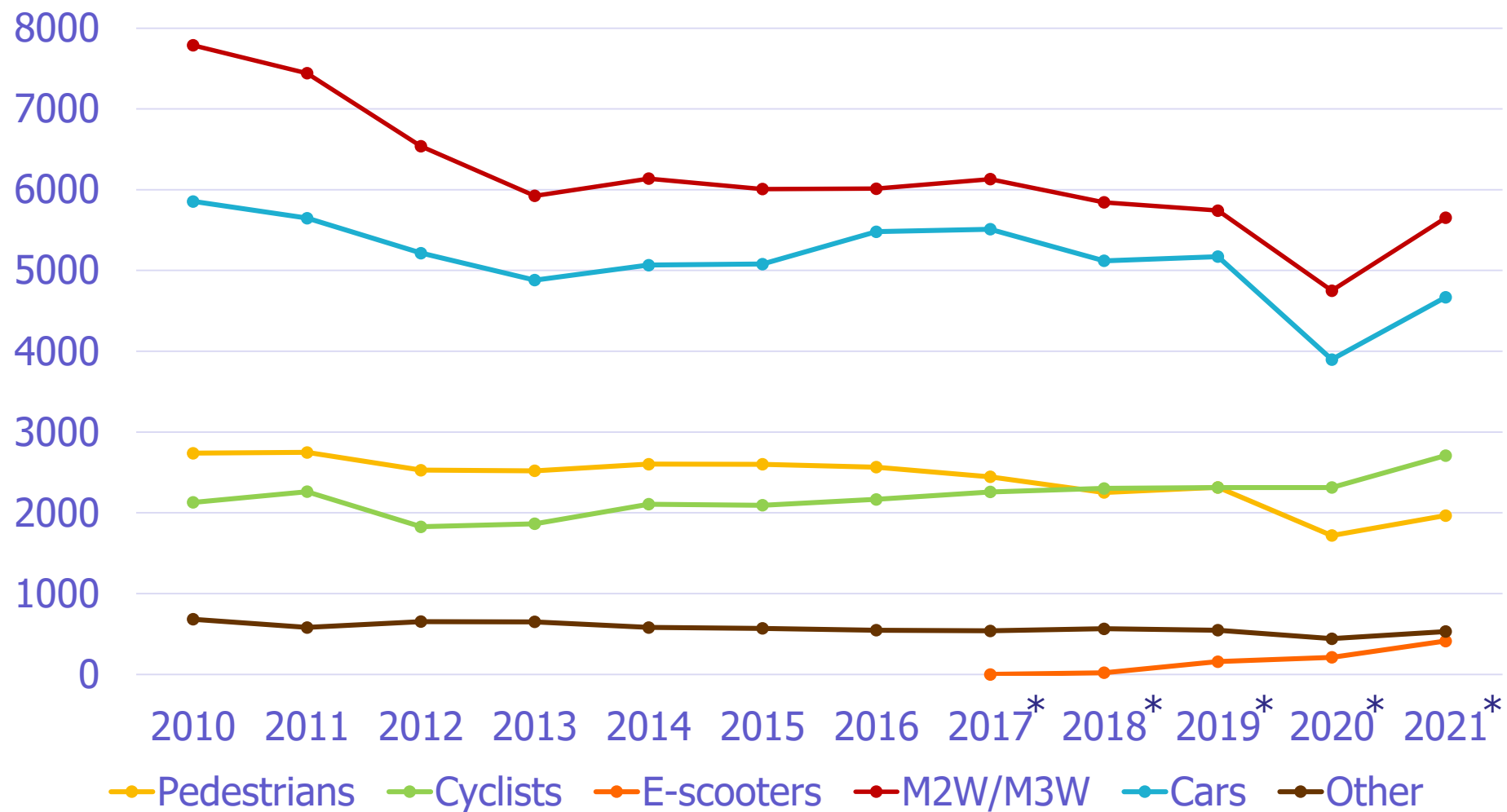
Additional slides



| Year | Pedestrian | Cyclist | Motorized two-wheels | Car occupants | Van/Heavy vehicle occupants | Total |
|---------|------------|---------|----------------------|---------------|-----------------------------|--------|
| 2010 | 2660 | 3550 | 5969 | 5521 | 278 | 17978 |
| 2011 | 2297 | 3931 | 6406 | 5201 | 249 | 18085 |
| 2012 | 2235 | 3491 | 5579 | 5191 | 305 | 16802 |
| 2013 | 2199 | 3702 | 5421 | 5297 | 239 | 16858 |
| 2014 | 2289 | 4067 | 5690 | 5499 | 242 | 17788 |
| 2015 | 2241 | 4114 | 5610 | 5385 | 252 | 17601 |
| 2016 | 2328 | 4133 | 5861 | 5755 | 271 | 18348 |
| 2017 | 2417 | 4731 | 6009 | 6126 | 281 | 19564 |
| 2018 | 2375 | 4671 | 5894 | 5862 | 295 | 19097 |
| 2019 | 2397 | 5201 | 6127 | 5693 | 252 | 19670 |
| Total | 23438 | 41592 | 58567 | 55530 | 2664 | 181791 |
| Average | 2344 | 4159 | 5857 | 5553 | 266 | 18179 |

Estimation with correction of the police data MAIS3+ by mode of transport

MAIS3+ road users, France



Method and data : selection of hospital stays

- France
- with ≥ 1 diagnostic of injury (ICD-10 : S00-T88)
- 2010-2019
- On average, every year :

