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Emmanuelle Amoros, Grégory Soler, Léa Pascal, Jean-Louis Martin, Amina Ndiaye, Blandine Gadegbeku, B. Laumon

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Estimation of the number of seriously injured road users, France 2006-2014

E. Amoros, G. Soler, L. Pascal, JL Martin, A. Ndiaye, B. Gadegbeku, B. Laumon, UMRESTTE, IFSTTAR France, University of Lyon, France

Request from EU : how many seriously injured (MAIS3+) road users ?

Available data

National Police data : incomplete, biased (least reported = the slightly injured, injured on M2W or bicycle, injured in single-vehicle accident, ...)

Rhône road trauma registry : almost complete, unbiased

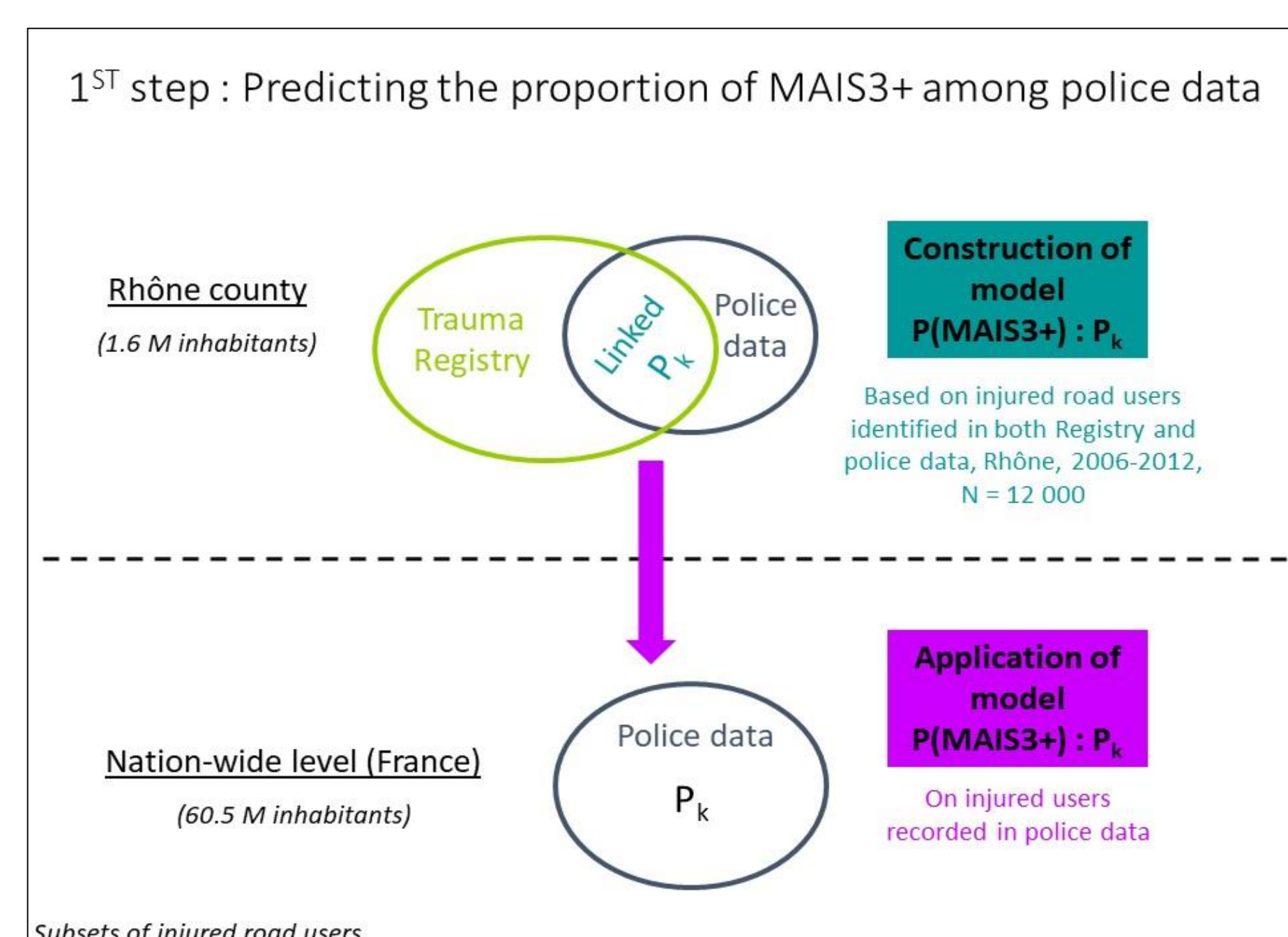
Based on 250 public and private hospital units: from pre-emergency care, resuscitation, surgery, ... to rehabilitation ; includes hospitalised or only treated at emergency departments.

All injuries coded in AIS (Abbreviated Injury Scale); AIS score: 1=minor severity, 2=moderate, 3=serious, 4=severe, 5= critical, 6=beyond treatment

MAIS= Maximum AIS score if multiple injuries. MAIS3+ = seriously injured.

Method

Police and registry data are linked (probabilistic linkage)



1st step : predicting the proportion of MAIS3+ among injured, all severities

a) Construct multivariate model on Rhône linked data accounting for k factors, influencing MAIS severity = crash severity (fatal or not), hospitalised (yes/no), road user type (car, bicycle...), crash opponent (yes/no), type of crash opponent (car, bicycle...), age, gender, type of police force, in/out of town, b) Apply model on national police data.

Results 2014

291 693 injured, all severities (vs. 73 048 from police data)

Incidence is 455 /100 000 inhabitants

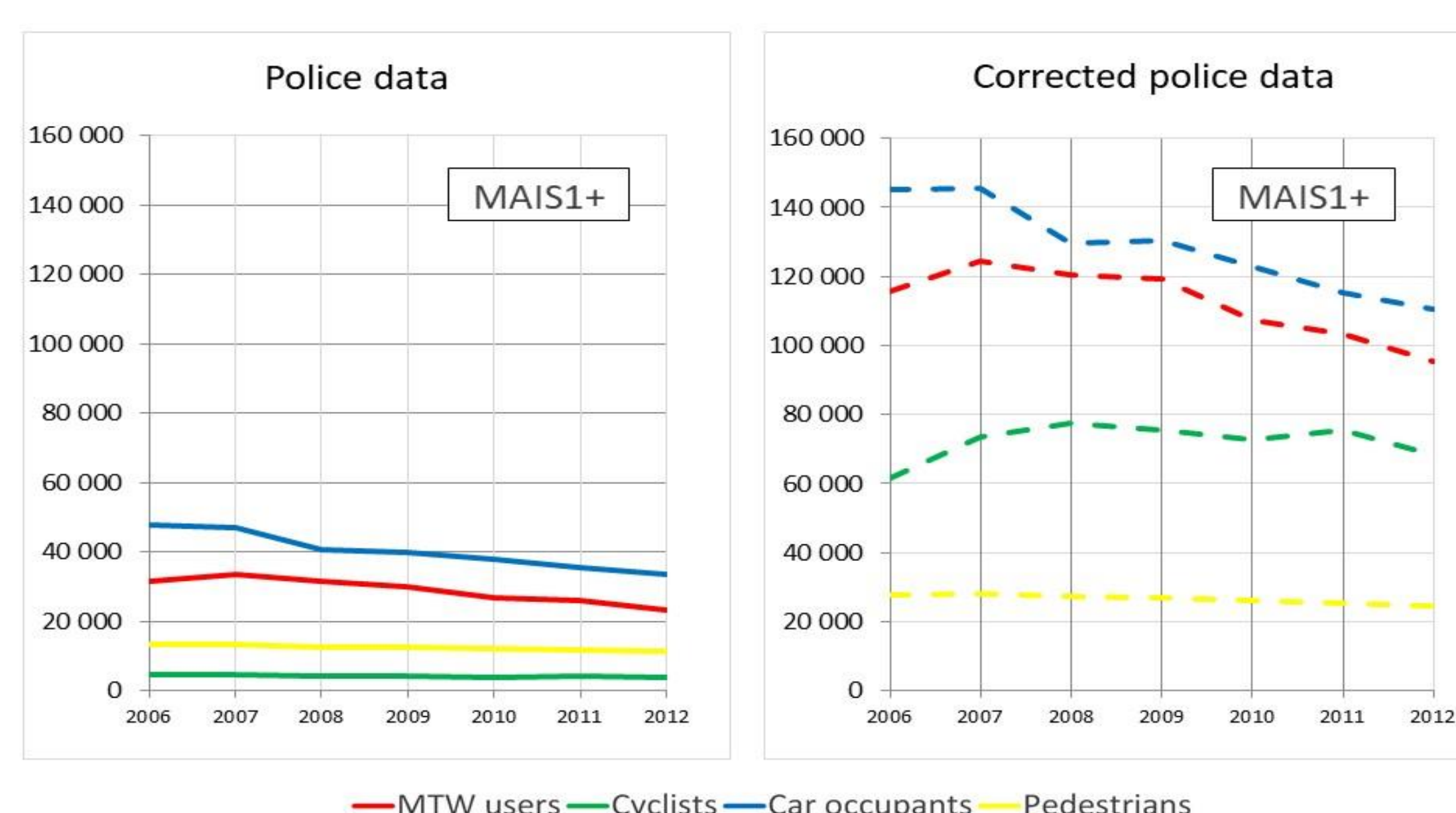
24 592 seriously (MAIS3+) injured ; incidence is 38.4 /100 000 inhabitants

External validation : Firemen national data :

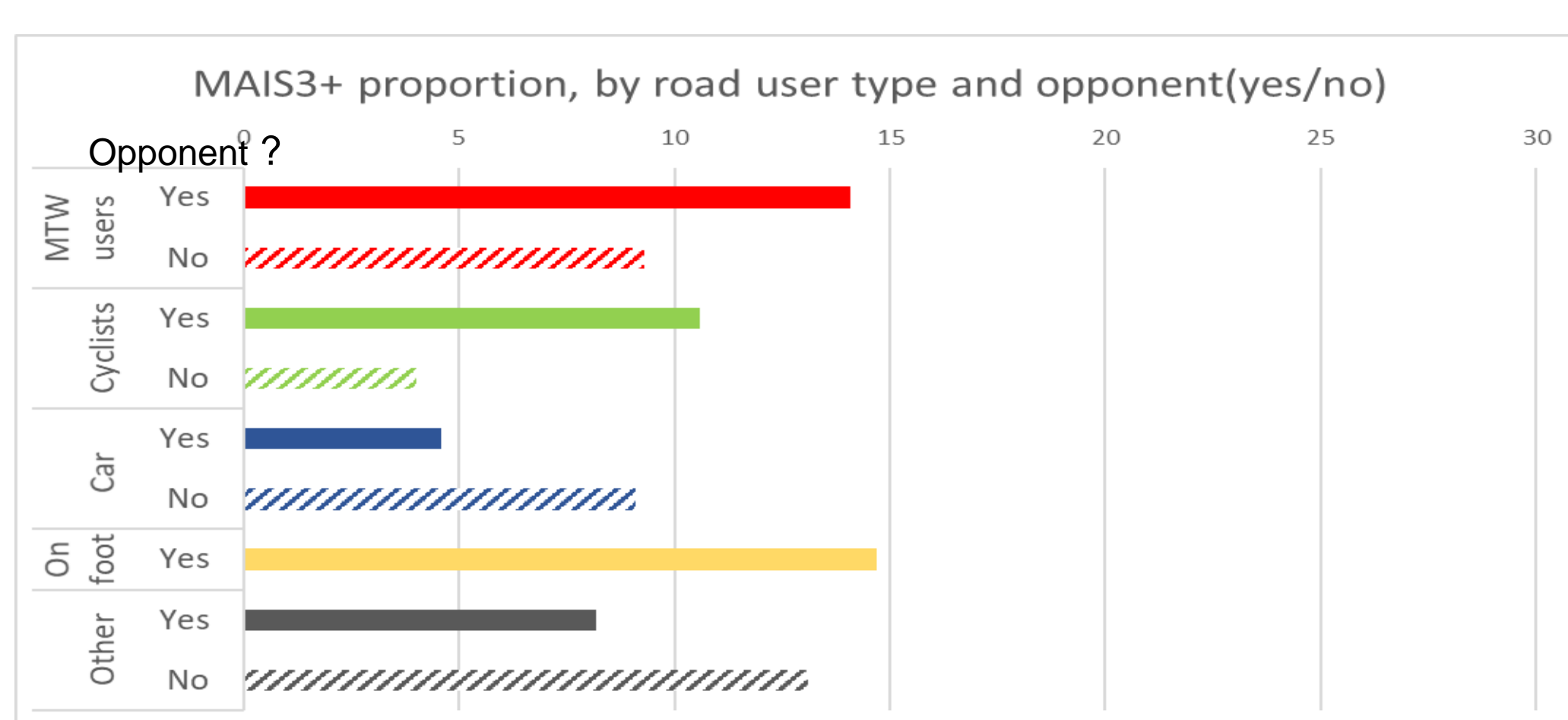
270 000 injured from firemen data in 2012, versus

308 000 injured from extrapolated police data (2012)

Number of casualties all severities, by road user type, France, 2006-2012



Correction for under-reporting and bias multiplies the number of injured by 3.6 and leads to more injured cyclists than injured pedestrians.



The most seriously injured road users are pedestrians and users of motorised two-wheel in a crash with a motorised opponent.

Cyclists and users of M2W : less seriously injured in crashes on their own than in crashes with a crash opponent (motorised most of the times)

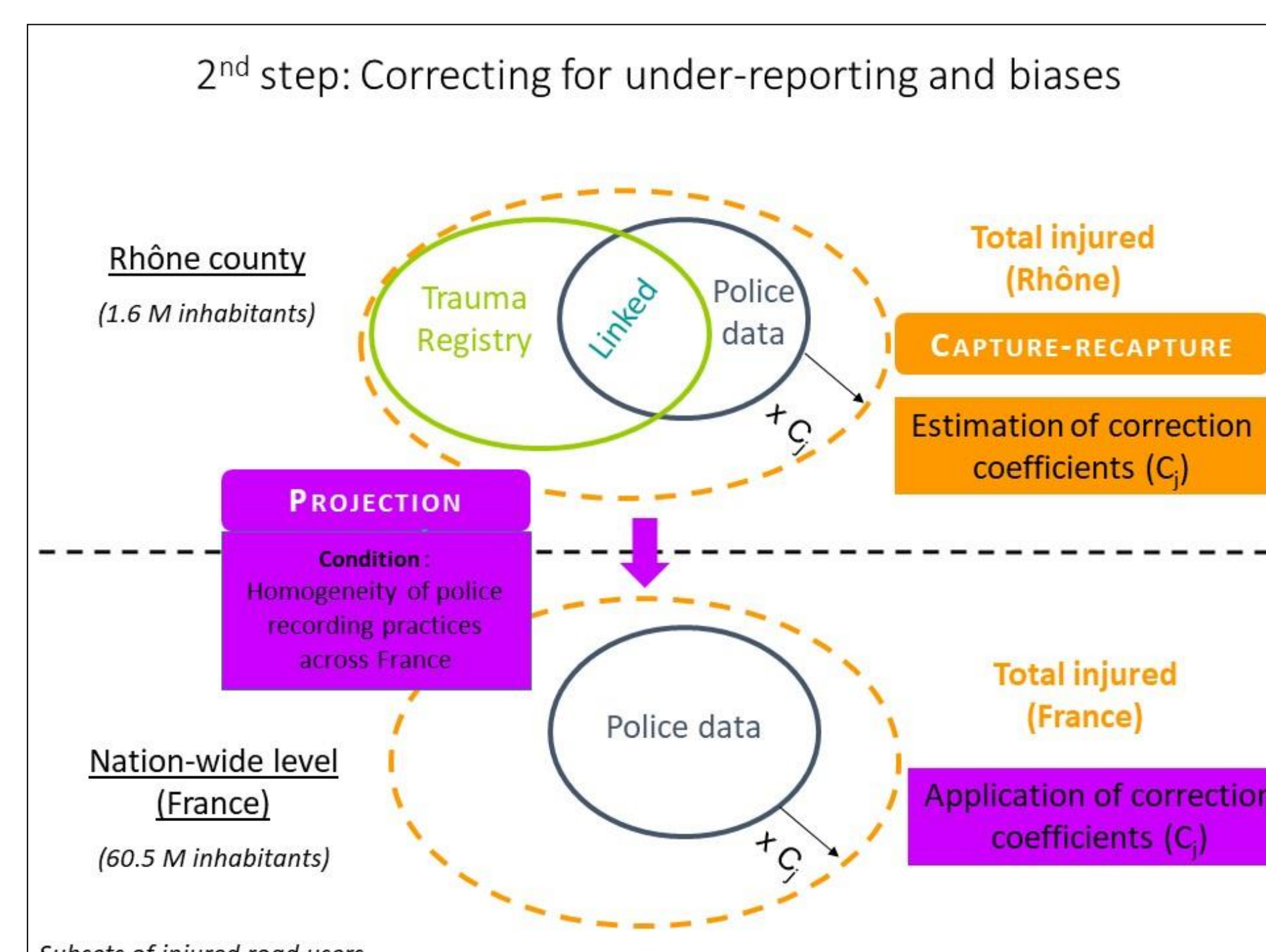
Car occupants and other users : more seriously injured in crashes on their own (mainly loss of control).

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Contact: emmanuelle.amoros@ifsttar.fr

Method (continued)



2nd step : Capture-recapture on the Rhône data :

1st capture = medical registry , 2nd capture = police data

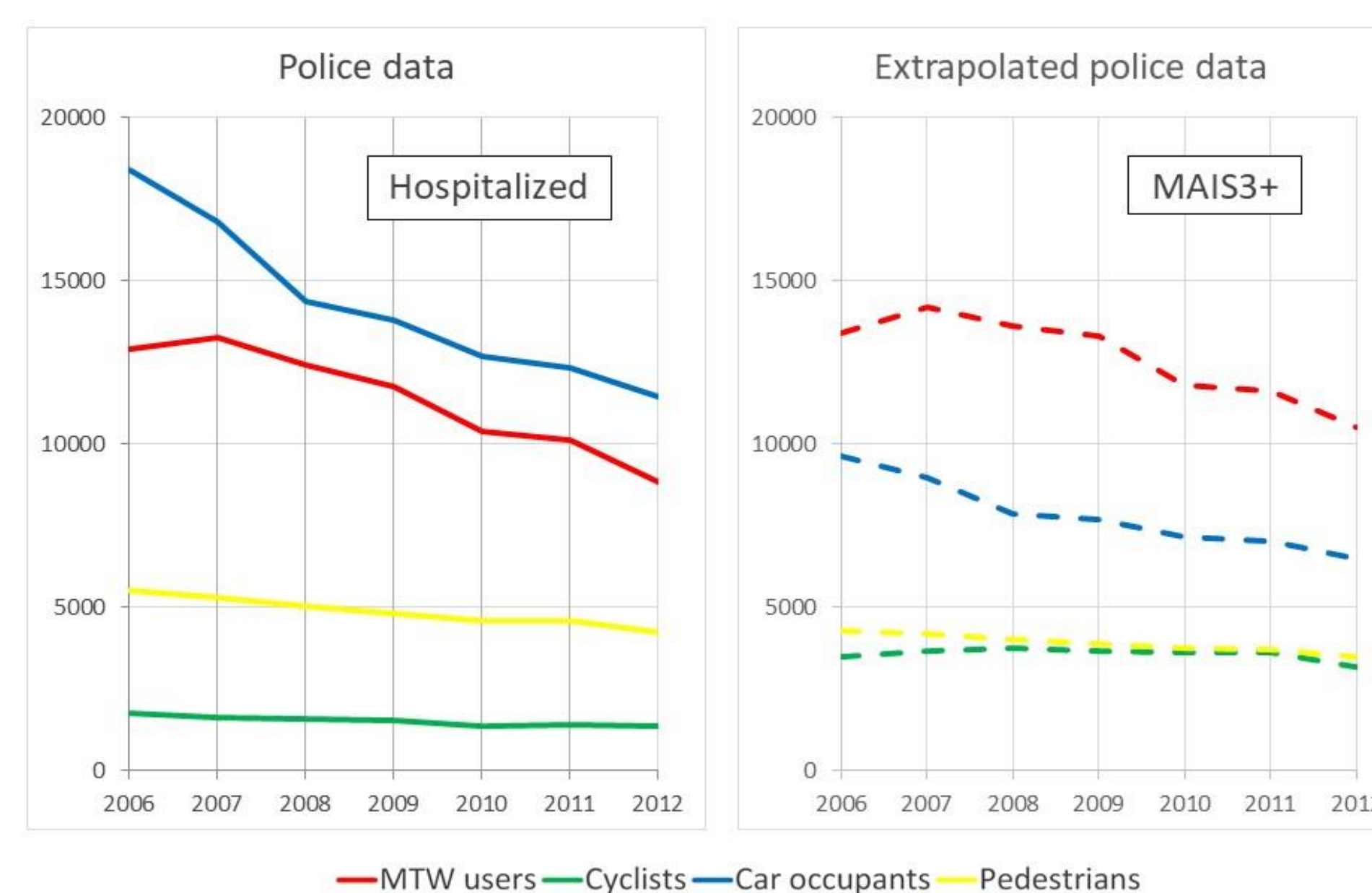
Modelisation to account for factors influencing police reporting: crash severity, user severity (MAIS), hospitalised (yes/no), road user type, single vs multi vehicle crash, type of police force, road type

=> total number of injured road users in the Rhône + correction factors for police data (C_j)

=> projection: application of correction factors C_j to national police data (similar to indirect standardisation, on age and sex in general)

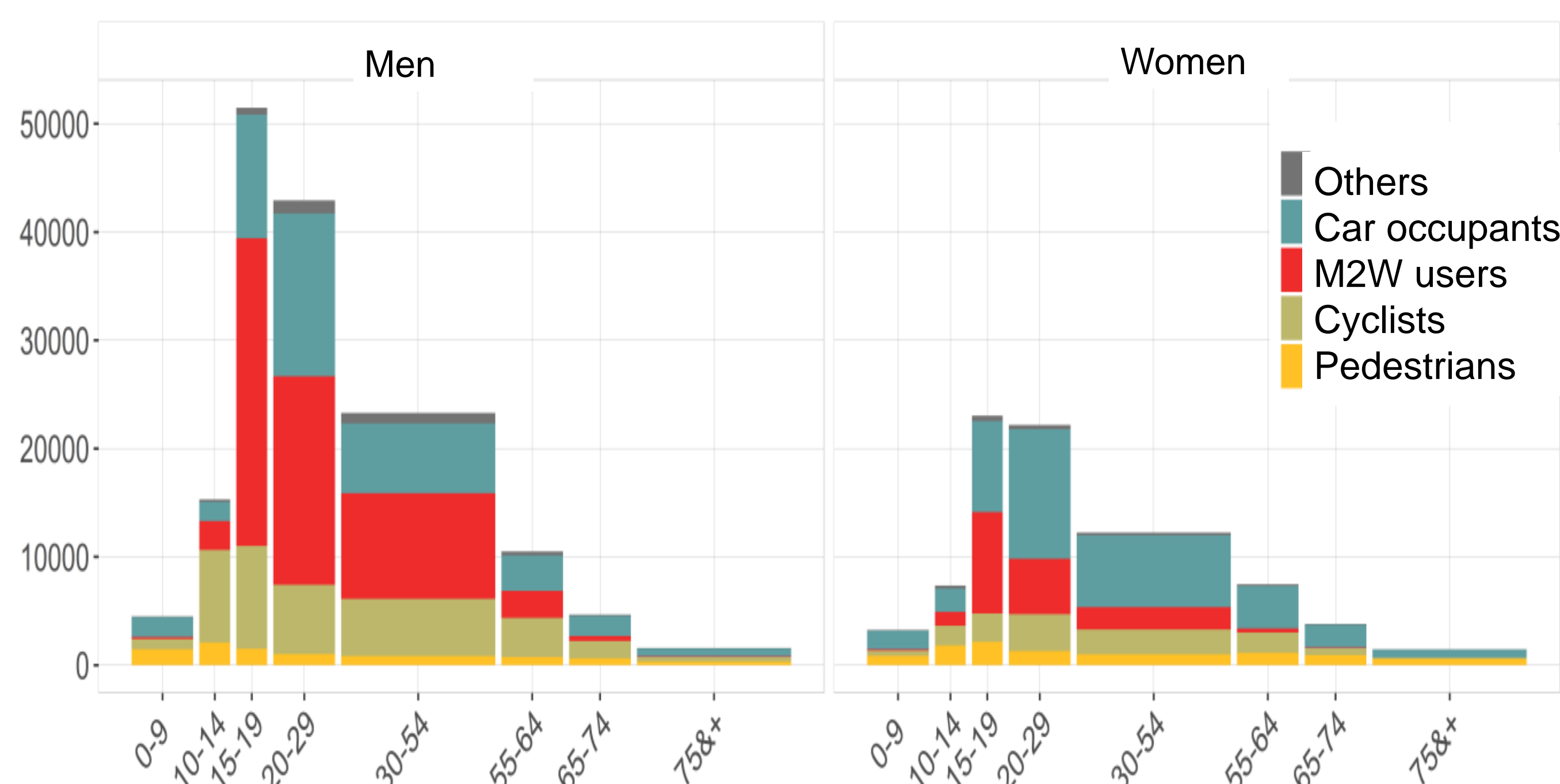
Results

Number of serious casualties, by road user type, France, 2006-2012



Correction for police reporting biases leads to more seriously injured M2TW users than car occupants (while they respectively represent 2% and 70% of traveled kilometres ; National Travel survey, 2008-2009). It also leads to seriously injured cyclists being as numerous as seriously injured pedestrians (while they respectively account for 2% and 23% of trips).

Frequencies of MAIS1+ injured road users, France, 2006-2012



Sex-ratio is 1.9 for injured road users while they travel the same (slightly more kilometers for men, but slightly more trips for women). The main difference is on injured cyclists and injured users of M2W (motorised two wheel)

Sex-ratio is 4.3 for M2W users, 2.6 for cyclists, 1.1 for a car occupants, 0.9 for pedestrians and 3.0 for others. It is even more marked for MAIS3+ casualties: 7.2 for M2W users, 5.3 for cyclists, 1.7 for car occupants, 1.0 for pedestrians and 4.5 for others.

Proportion of seriously injured increases with age, but with a peak at 16-19 years old (not shown).