Disparités d'accès à la revascularisation en zones rurales

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Dijon

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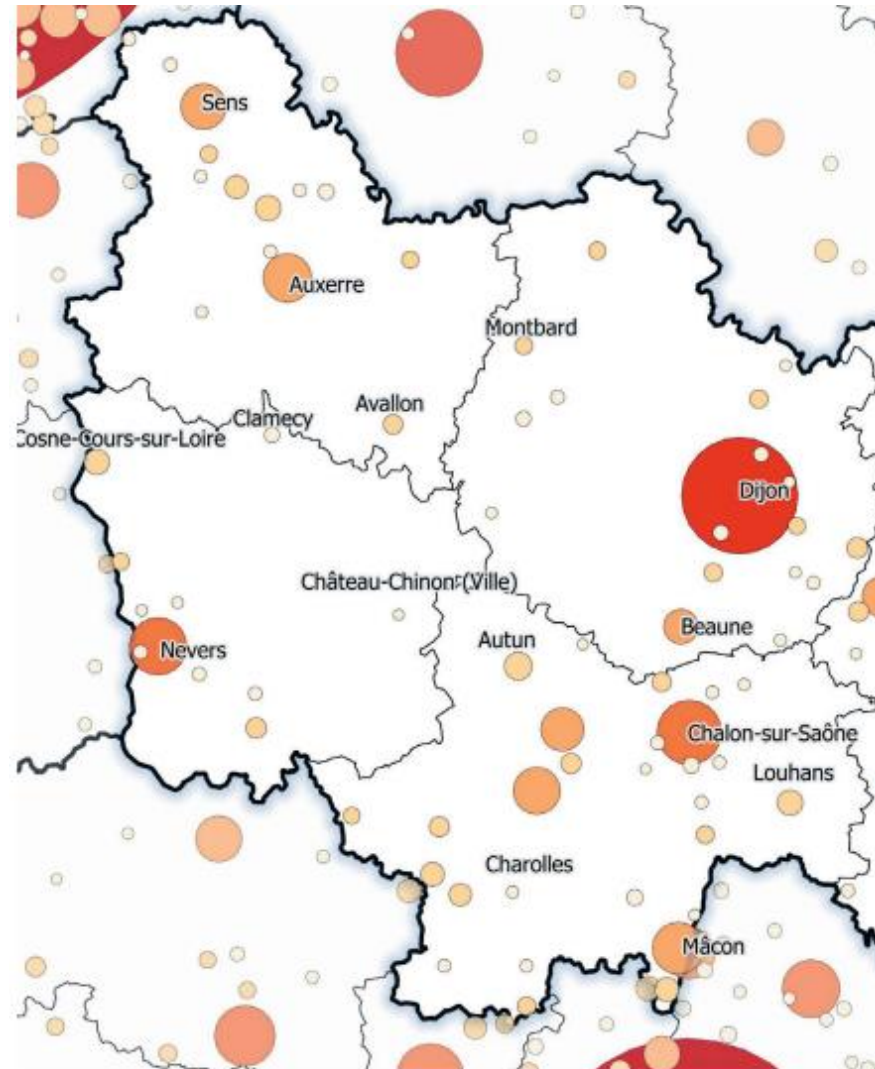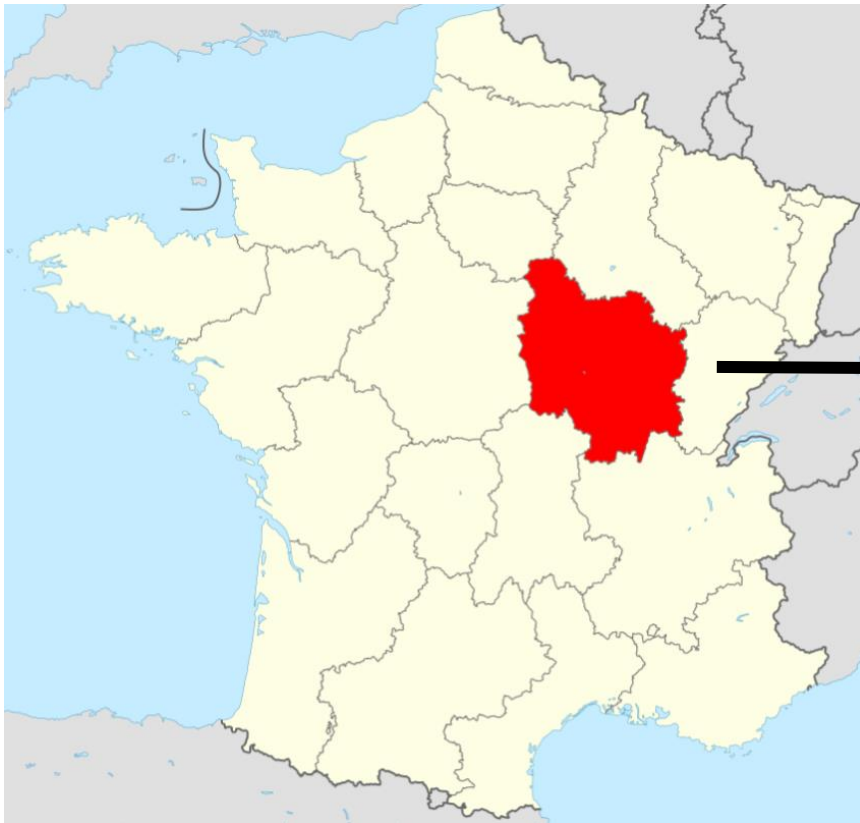
Registre Dijonnais des AVC – EA7460

Liens d'intérêt

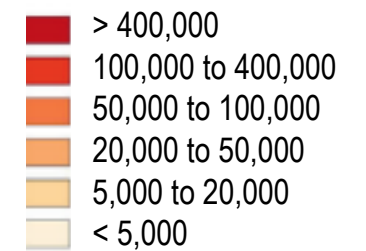Consulting Fees/Honoraria: BMS, Pfizer, Medtronic, Servier, Amgen, Novo Nordisk

Région Bourgogne

- 1.63 million habitants (2.5% population française)
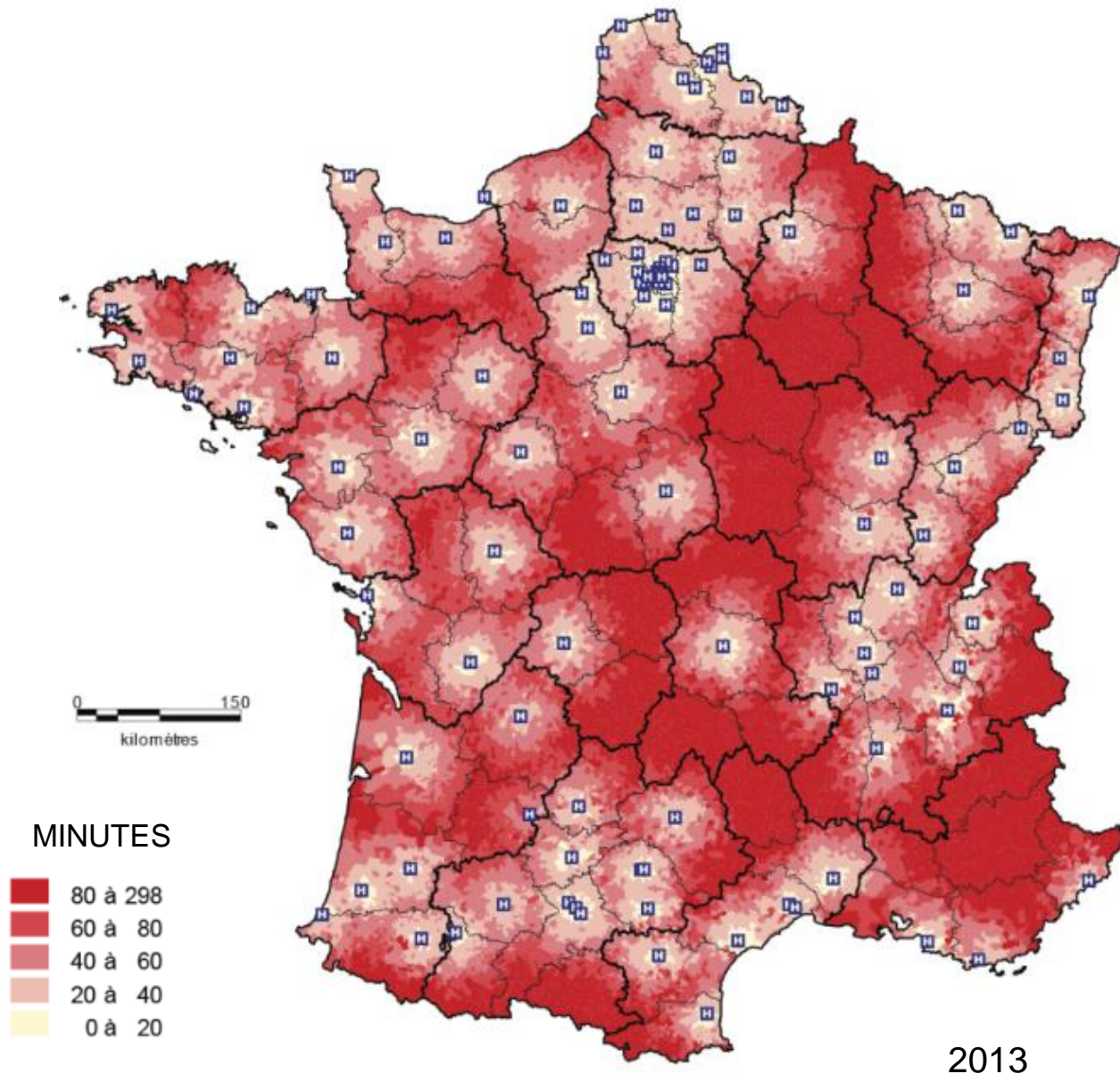- 31,600 Km^2 (5.7% France) = Belgique

Number of inhabitants by areas

- > 400,000
- 100,000 to 400,000
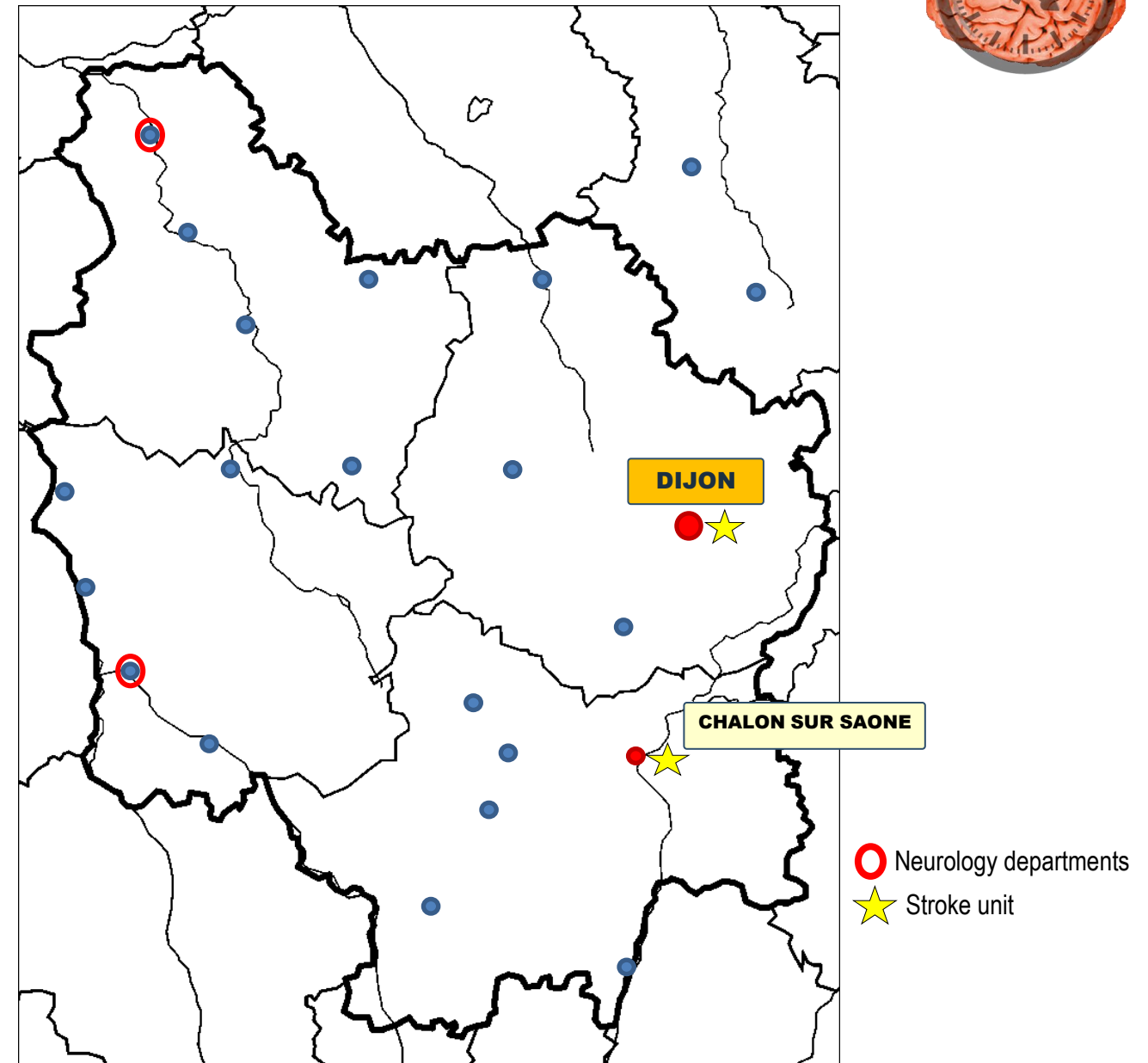- 50,000 to 100,000
- 20,000 to 50,000
- 5,000 to 20,000
- < 5,000

Source : Insee, recensement de la population 2014

Disparités d'accès aux USINV

Temps d'accès à l'USINV la plus proche

MINUTES

- 80 à 298
- 60 à 80
- 40 à 60
- 20 à 40
- 0 à 20

2013

Offre de soins en Bourgogne
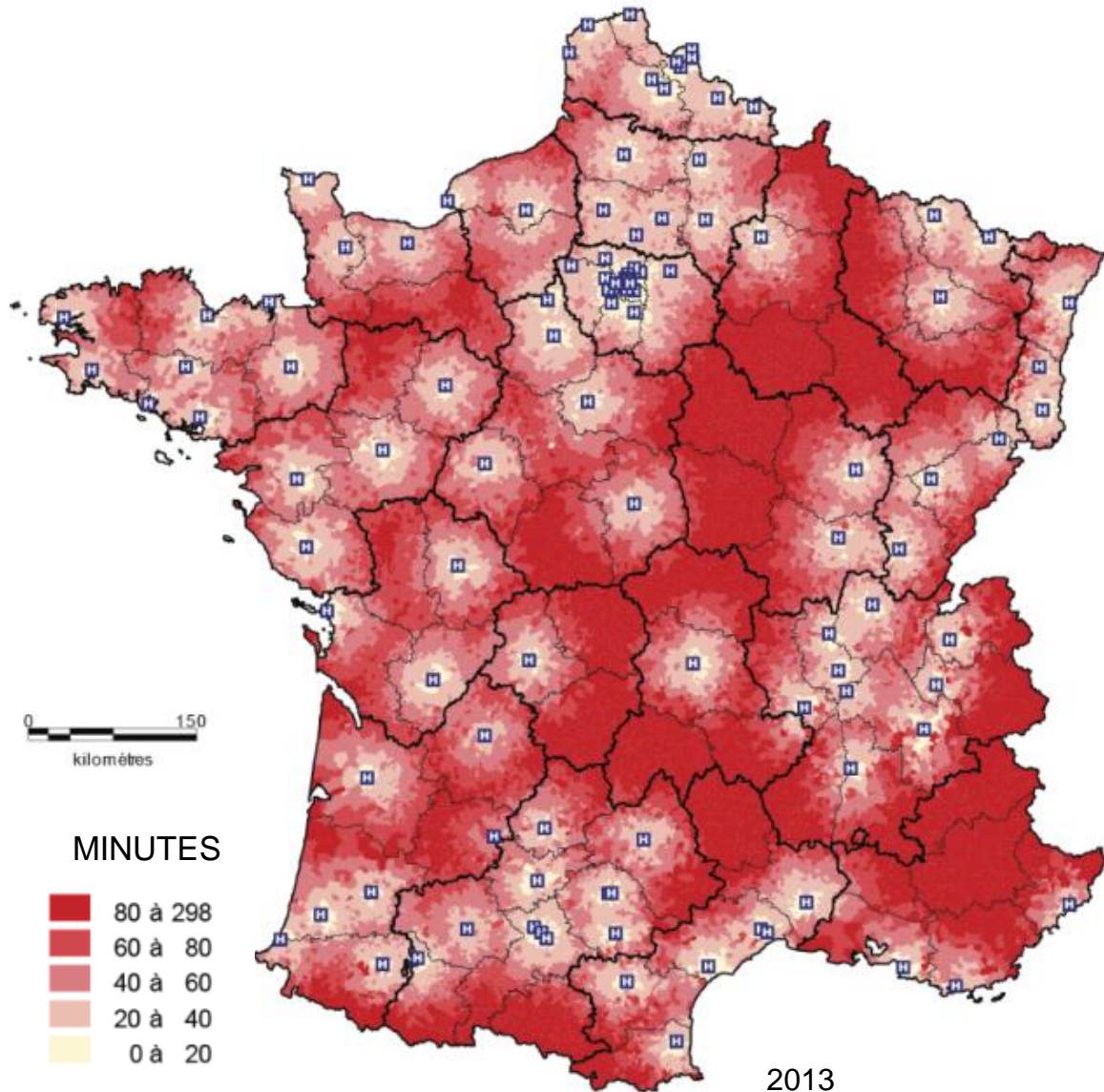

DIJON

CHALON SUR SAONE

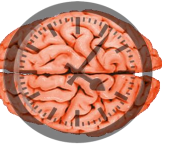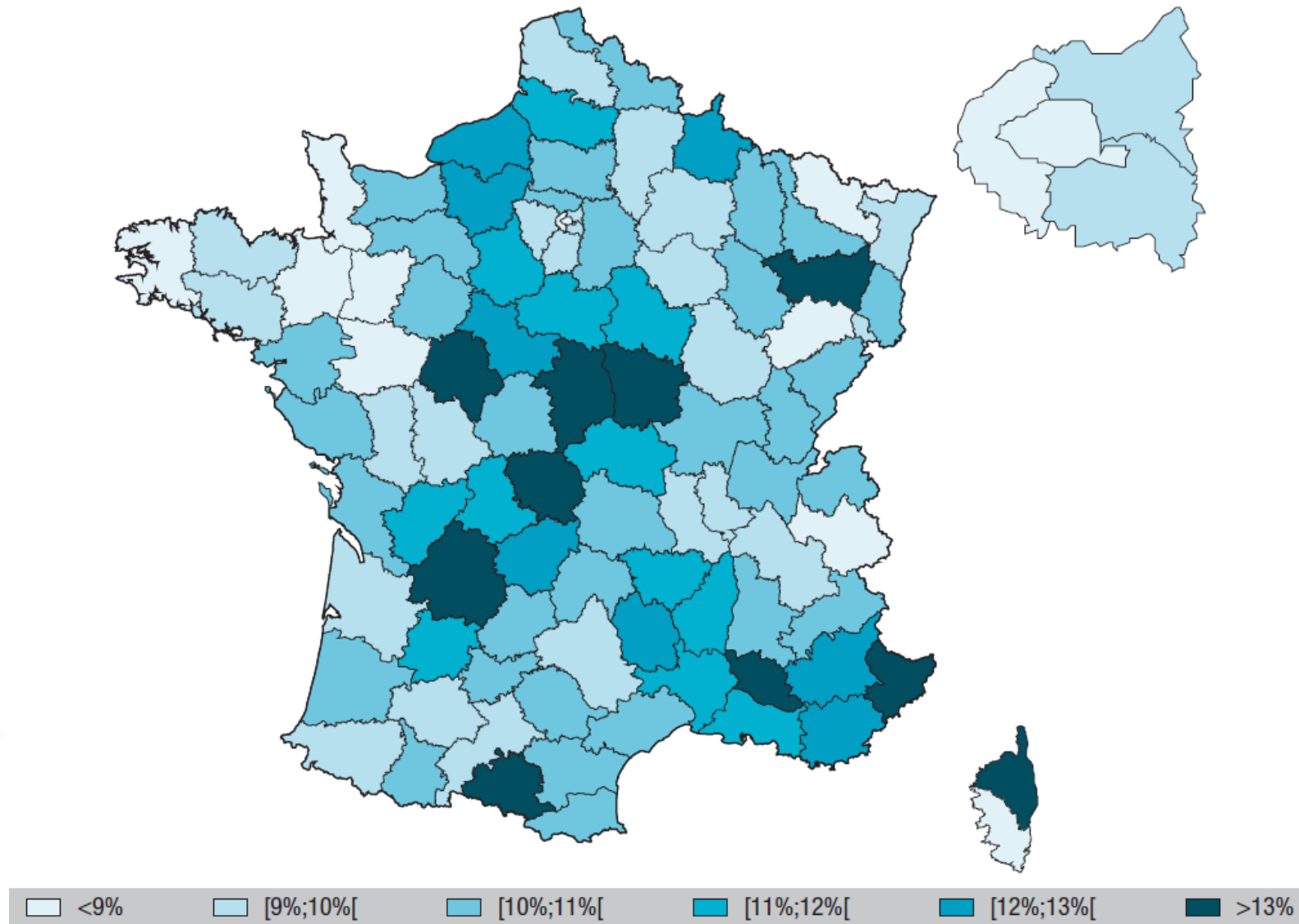○ Neurology departments

★ Stroke unit

Disparités d'accès aux USINV

Temps d'accès à l'USINV la plus proche
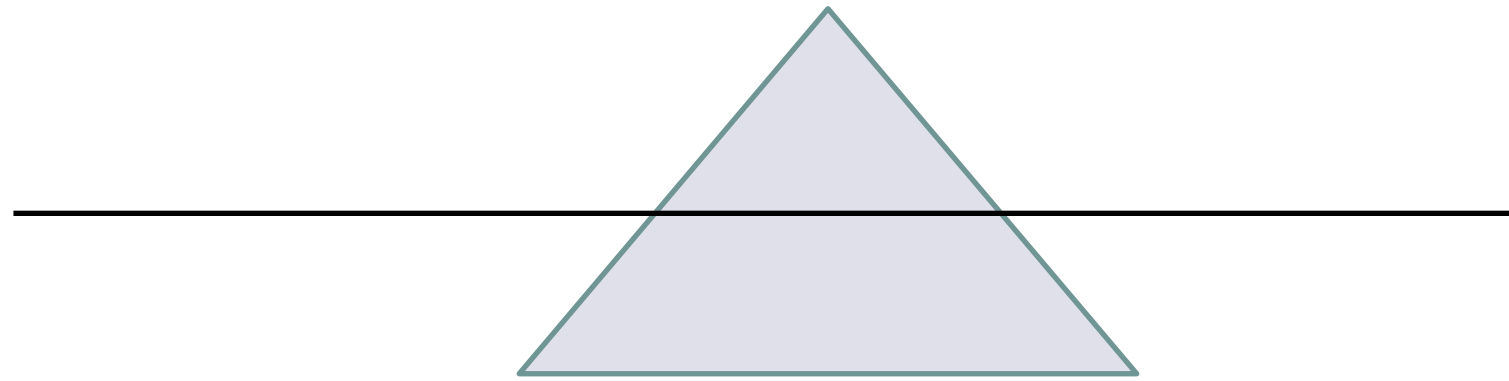
Létalité à 30 jours après hospitalisation pour AVC

Gabet A, Bull Epidémiol Hebd. 2019;(5):108-14.

MINUTES

- 80 à 298
- 60 à 80
- 40 à 60
- 20 à 40
- 0 à 20

2013

- <9%
- [9%;10%[
- [10%;11%[
- [11%;12%[
- [12%;13%[
- >13%

Mise en place du Réseau Télé-AVC Bourgogne

Extension progressive de 2011 à 2016

Organisation régionales
- Activité télé-AVC structure autour des 2 USINV de la région
  - CHU Dijon: responsabilité Côte d'Or, Yonne, Nièvre et Sud Haut-Marnais
  - CH Chalon-sur Saône: responsabilité Sâone-et-Loire

Mise en place de procédures locales de prise en charge
- Acheminement pré-hospitalier
- Priorisation prise en charge AVC dans les services d'urgence
- Mise en place accès imagerie cérébrale dans chaque service d'urgence (Angioscanner ou IRM)

Programme médical de formation
- Formation théorique et pratique des urgentistes (N=300)
- Formation des radiologues
- Mise en place locale
- Visites régulières sur site

Aspects techniques
- Dossier medical regional de télémédecine
  - Dossier données cliniques
  - Accès vidéo
  - Transfert d'images
  - Application sécurisée smartphone
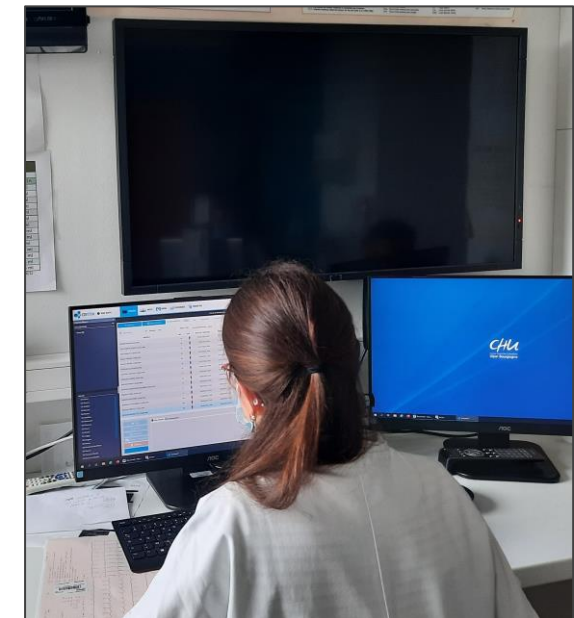
Réseau Télé-AVC Bourgogne actuel

21 Hôpitaux
2 USINV
Dont 1 centre NRI

SENS
235 km ‡
145 min - 55 min

TONNERRE
155 km ‡
90 min - 40 min

CHAUMONT
110 km ‡
65 min - 30 min

JOIGNY
190 km ‡
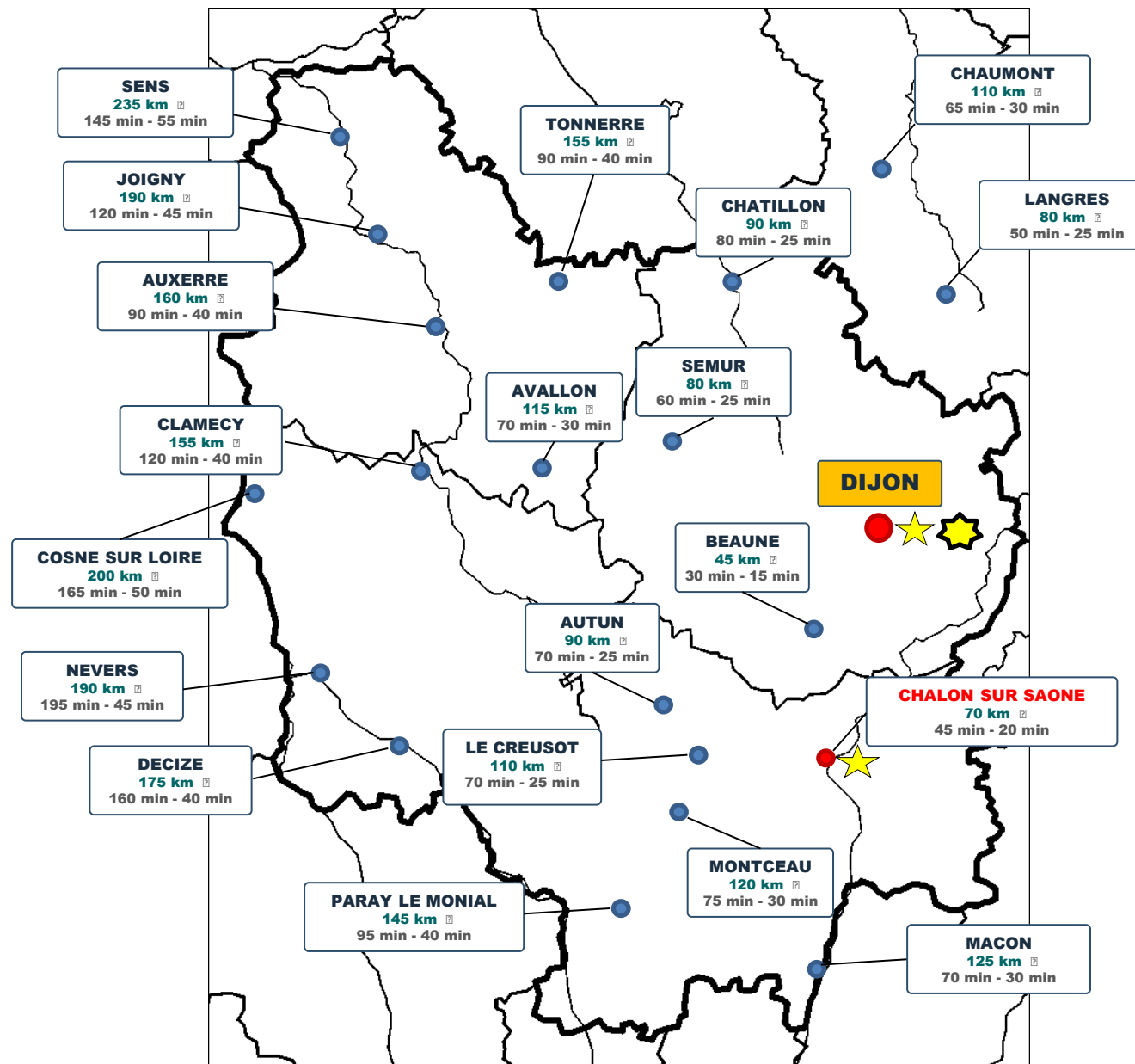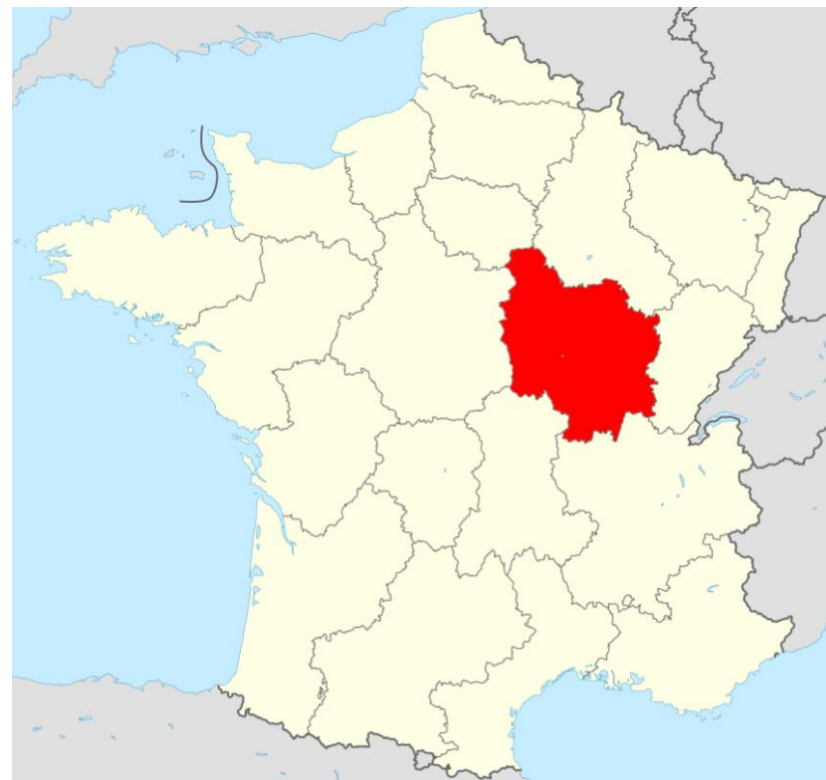120 min - 45 min

CHATILLON
90 km ‡
80 min - 25 min

LANGRES
80 km ‡
50 min - 25 min

AUXERRE
160 km ‡
90 min - 40 min

SEMUR
80 km ‡
60 min - 25 min

AVALLON
115 km ‡
70 min - 30 min

CLAMECY
155 km ‡
120 min - 40 min

DIJON

BEAUNE
45 km ‡
30 min - 15 min

COSNE SUR LOIRE
200 km ‡
165 min - 50 min

AUTUN
90 km ‡
70 min - 25 min

NEVERS
190 km ‡
195 min - 45 min

CHALON SUR SAONE
70 km ‡
45 min - 20 min

LE CREUSOT
110 km ‡
70 min - 25 min

DECIZE
175 km ‡
160 min - 40 min

MONTCEAU
120 km ‡
75 min - 30 min

PARAY LE MONIAL
145 km ‡
95 min - 40 min

MACON
125 km ‡
70 min - 30 min

⭐ Stroke unit

⭐ Thrombectomy-capable stroke center

Time from local hospital to Dijon centre: by road – by air

Réseau Télé-AVC Bourgogne actuel

Signes

Centre 15

Transport
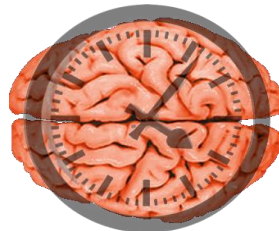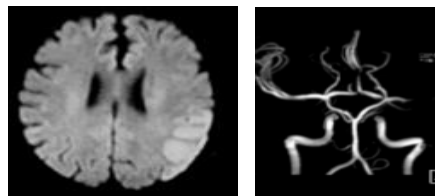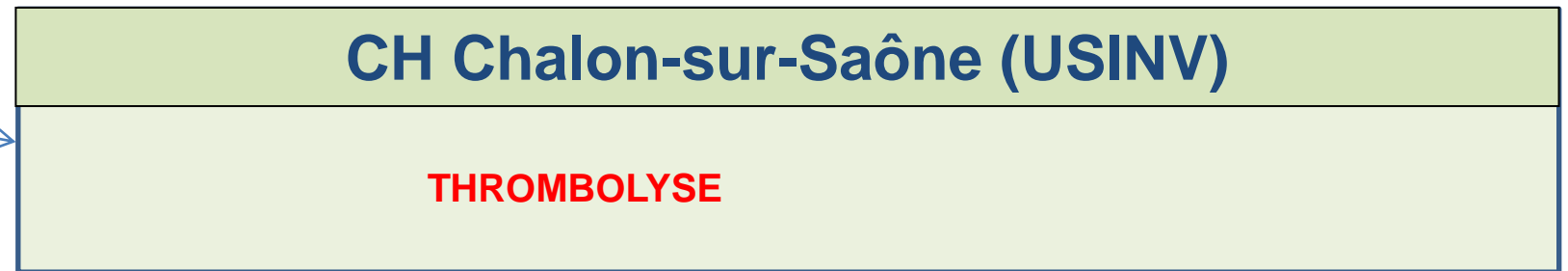
CHU DIJON (USINV + NRI)

THROMBOLYSE   **+/-**   **TM**

Téléprocédure +/-transfert

CH locaux
Services d'urgences
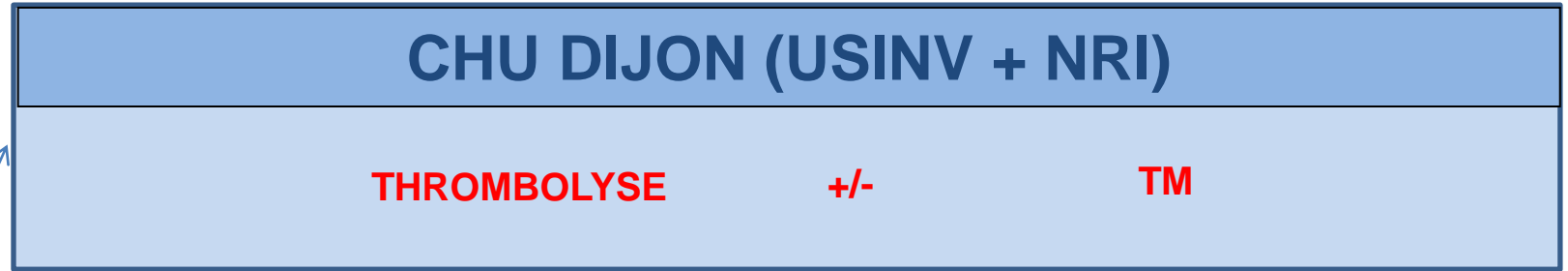
Téléprocédure +/-transfert

THROMBOLYSE

Si éligible TM

CH Chalon-sur-Saône (USINV)

THROMBOLYSE

PARADISE STUDY (2012-2014)

- First evaluation of the Burgundy Telestroke Network

- 354 consecutive patients with acute ischemic stroke
  - 132 who received IV thrombolysis during a telemedicine procedure
  - 222 who were treated at the stroke center of Dijon University Hospital

- Primary outcomes: mRS score and case fatality at 3 months

- Safety outcomes: ICH and other in-hospital complications

Prognosis After Revascularization therapy in the Dijon Ischemic Stroke Evaluation (PARADISE) study

PARADISE STUDY (2012-2014)

Patients' characteristics

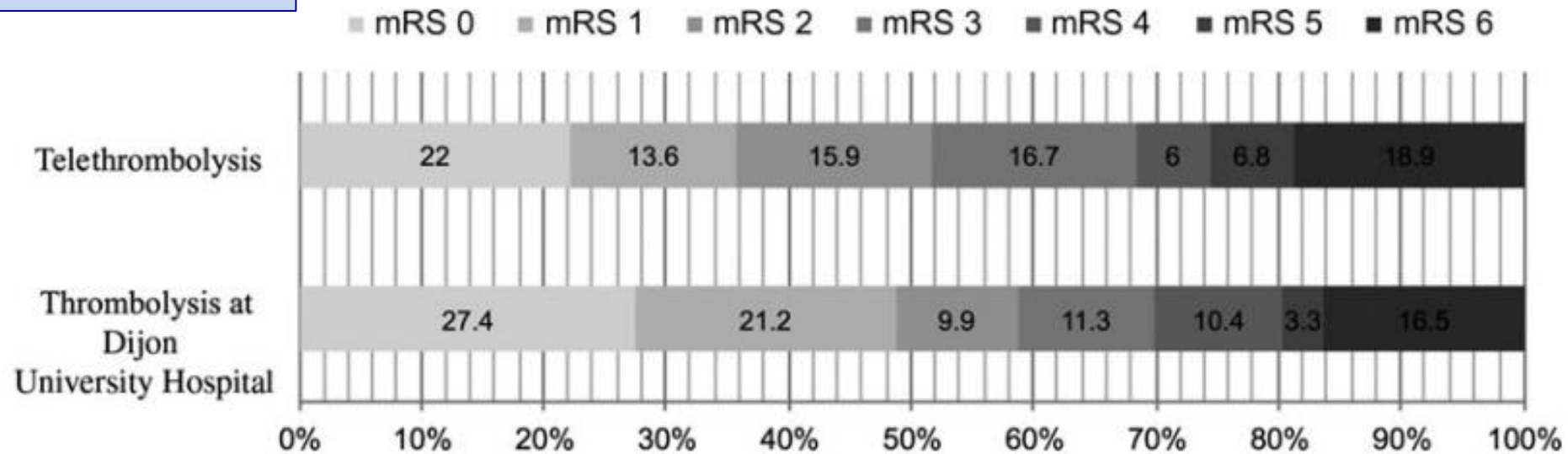|	Telethrombolysis (n = 132)			Thrombolysis at Dijon University Hospital (n = 222)			
	n	%	(95% CI)	n	%	(95% CI)	P
Demographics and vascular risk factors							
Age (years) (mean ± SD)	68.4 ± 15.1			69.3 ± 15.2			0.47
Male gender	65	49.2	(40.7–57.8)	114	51.4	(44.7–57.9)	0.70
Hypertension	90	68.2	(59.7–75.6)	137	61.7	(55.1–67.9)	0.22
Diabetes	26	19.7	(13.7–27.5)	31	14.0	(10.0–19.2)	0.16
Hypercholesterolemia	53	40.2	(32.0–48.8)	82	36.9	(30.8–43.5)	0.55
Atrial fibrillation	24	18.2	(12.4–25.8)	34	15.3	(11.1–20.7)	0.48
Smoking	36	27.3	(20.3–35.6)	52	23.4	(18.3–29.5)	0.42
Coronary artery disease	21	15.9	(10.5–23.3)	29	13.1	(9.2–18.2)	0.46
Prior stroke/TIA	19	14.4	(9.3–21.6)	18	8.1	(5.1–12.5)	0.06
Cancer	17	12.9	(8.1–19.8)	11	5.0	(2.8–8.8)	0.008
Pre-morbid treatments							
Antiplatelet agents	45	34.1	(26.4–42.7)	66	29.9	(24.2–36.3)	0.41
Anticoagulants	8	6.1	(3.0–11.7)	14	6.3	(3.8–10.4)	0.93
Antihypertensive treatments	81	61.4	(52.7–69.4)	132	59.5	(52.8–65.8)	0.72
Statins	37	28.0	(21–36.4)	60	27.0	(21.6–33.3)	0.84
Pre-morbid mRS score							0.046
mRS score 0	113	85.6	(78.4–90.7)	182	82.0	(76.3–86.5)	
mRS score 1	4	3.0	(1.1–7.9)	19	8.6	(5.5–13.1)	
mRS score 2	1	0.8	(0.1–5.3)	7	3.6	(1.5–6.5)	
mRS score 3	12	9.1	(5.2–15.4)	11	5.0	(2.8–8.8)	
mRS score 4	2	1.5	(0.4–6.0)	1	0.5	(0.01–3.2)	
mRS score 5	0	0		2	0.9	(0.2–3.6)	
Mean ± SD	0.38 ± 0.99			0.36 ± 0.91			0.51
Median (IQR)	0 (0–0)			0 (0–0)			
mRS score 0–2	118	83.4	(82.8–93.7)	208	93.7	(89.6–96.2)	0.15

PARADISE STUDY (2012-2014)

Patients' characteristics

	Telethrombolysis (n = 132)			Thrombolysis at Dijon University Hospital (n = 222)			P
	n	%	(95% CI)	n	%	(95% CI)	
NIHSS score							0.06
Mean ± SD	13.6 ± 6.6			11.7 ± 5.8			
Median (IQR)	12.5 (7.5–18)			11 (7–16)			
Associated endovascular treatment[a]	7	5.3	(2.5–10.8)	21	9.5	(6.2–14.1)	0.16
Time to treatment initiation (min)	192.1 ± 48.4			195.4 ± 58.1			0.94
TOAST classification							0.12
Large artery	25	18.9	(13.1–26.6)	32	14.4	(10.4–19.7)	
Cardioembolic	48	36.4	(28.5–45.0)	91	41.0	(34.7–47.6)	
Lacunar	2	1.5	(0.4–6.0)	5	2.3	(0.9–5.3)	
Other causes	7	5.3	(2.5–10.8)	17	7.7	(4.8–12.0)	
Undetermined causes	46	34.9	(27.1–43.5)	77	34.7	(28.7–41.2)	
Multiple causes	4	3.0	(1.1–7.9)	0	0		

PARADISE STUDY (2012-2014)

3-month mRS score

Legend: mRS 0, mRS 1, mRS 2, mRS 3, mRS 4, mRS 5, mRS 6

Telethrombolysis: 22 | 13.6 | 15.9 | 16.7 | 6 | 6.8 | 18.9

Thrombolysis at Dijon University Hospital: 27.4 | 21.2 | 9.9 | 11.3 | 10.4 | 3.3 | 16.5

Outcome	Adjusted OR	(95% CI)	P
mRS score[a]	1.11	(0.74–1.66)	0.62
mRS score of 0–1[b]	0.59	(0.33–1.08)	0.09
mRS score of 0–2[c]	0.83	(0.46–1.50)	0.54
Death[d]	0.86	(0.44–1.69)	0.66

Multivariable ordinal logistic regression analysis. Common OR for a shift towards a worse outcome according to the mRS score. Model adjusted for age, gender, hypertension, diabetes, atrial fibrillation, smoking, coronary artery disease, prior treatment with anticoagulants, pre-morbid mRS score 0–2 and admission NIHSS score.
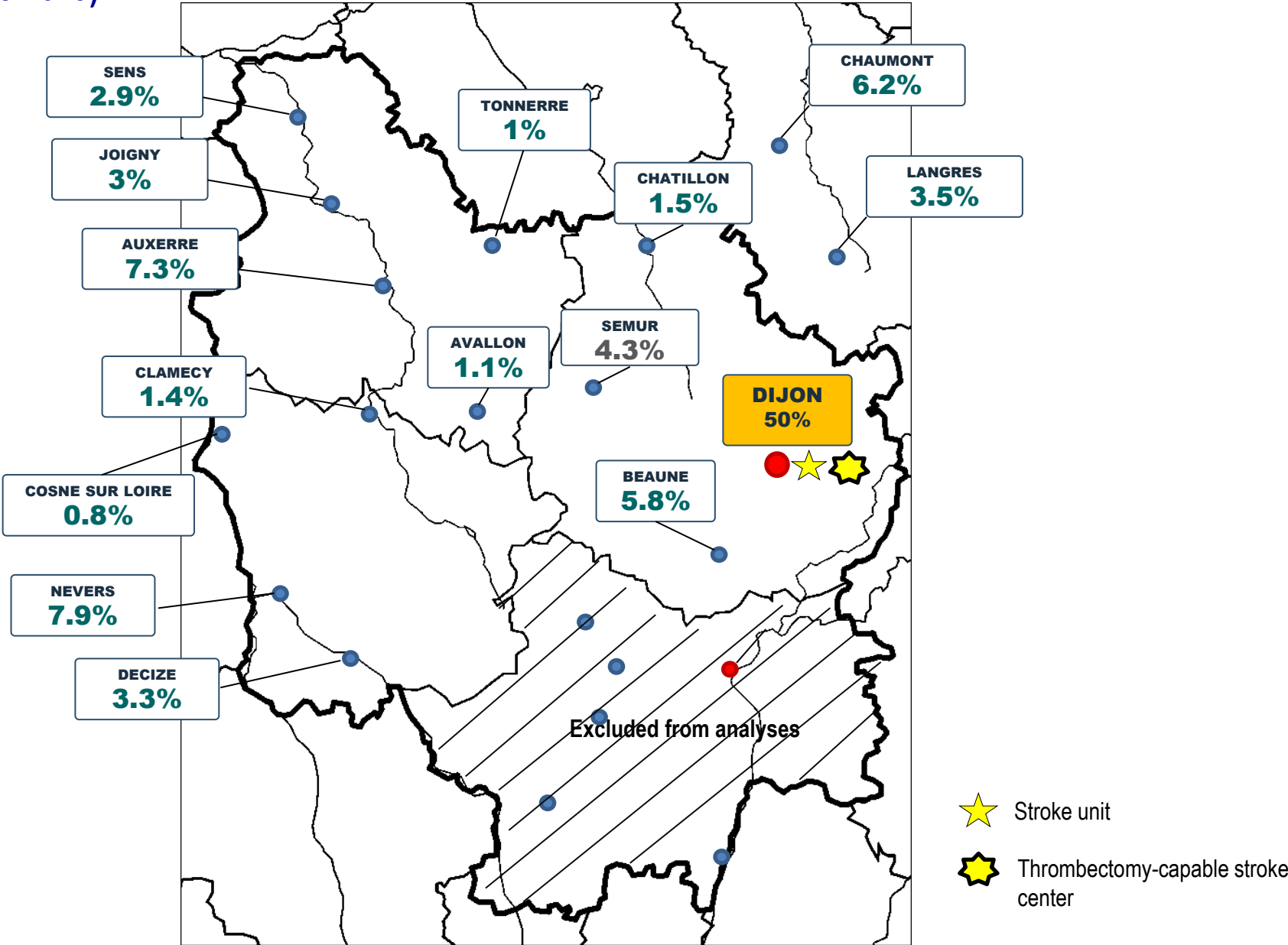
PARADISE STUDY (January 2016-June 2019)

- Prospective cohort study in a context of development of MT

- 900 patients with acute ischemic stroke treated with IVT (at Dijon University Hospital or Chalon-sur-Saône Hospital or by telestroke) and/or MT and admitted to Dijon Stroke Unit

- Follow-up visits at 3 months (Telephone) – 6 months (Face-to-face evaluation) and 12 months (Telephone)

- Primary outcome: mRS score
- Secondary outcomes: functional evaluation: cognition, fatigue, depression, quality of life

- For this evaluation:
  - Exclusion of patients treated at Chalon-sur-Saône Hospital (locally or by telestroke) or transferred for MT from outside the region due to a shortage of resources

  → **Final analyses performed on 795 patients**

Evaluation du Réseau Télé-AVC Bourgogne

PARADISE STUDY (January 2016-June 2019)

Distribution of patients according to first hospital admission

SENS 2.9%
JOIGNY 3%
AUXERRE 7.3%
CLAMECY 1.4%
COSNE SUR LOIRE 0.8%
NEVERS 7.9%
DECIZE 3.3%
TONNERRE 1%
CHATILLON 1.5%
AVALLON 1.1%
SEMUR 4.3%
DIJON 50%
BEAUNE 5.8%
CHAUMONT 6.2%
LANGRES 3.5%

Excluded from analyses

★ Stroke unit

✦ Thrombectomy-capable stroke center

UNPUBLISHED DATA-DO NOT COPY OR DISTRIBUTE

Evaluation du Réseau Télé-AVC Bourgogne

PARADISE STUDY (January 2016-June 2019)

Characteristics of patients	Dijon (N=398)	Rural areas (N=397)	p
Age *mean ±SD*	74.2 ± 14.3	71.4 ± 14.1	**0.003**
median (IQR)	77 (66-85)	73 (63-82)	
Male sex	49%	51%	0.54
NIHSS score at admission *mean ±SD*	12.3 ± 7.9	11.9 ± 6.9	0.80
median (IQR)	10 (6-19)	11 (6-17)	
Proximal arterial occlusion*	50.5%	54.4%	0.27
Acute revascularization therapy			
IVT alone	45.2%	59.5%	**<0.001**
MT alone	35.9%	22.9%	
Bridging therapy	18.8%	17.6%	
Time to IVT initiation$ minutes *mean ±SD*	183 ± 78	224 ± 153	**<0.001**
median (IQR)	165 (140-210)	199 (165-240)	
Time to MT initiation,$ minutes *mean ±SD*	319 ± 700	438 ± 294	**<0.001**
median (IQR)	165 (128-253)	365 (305-456)	

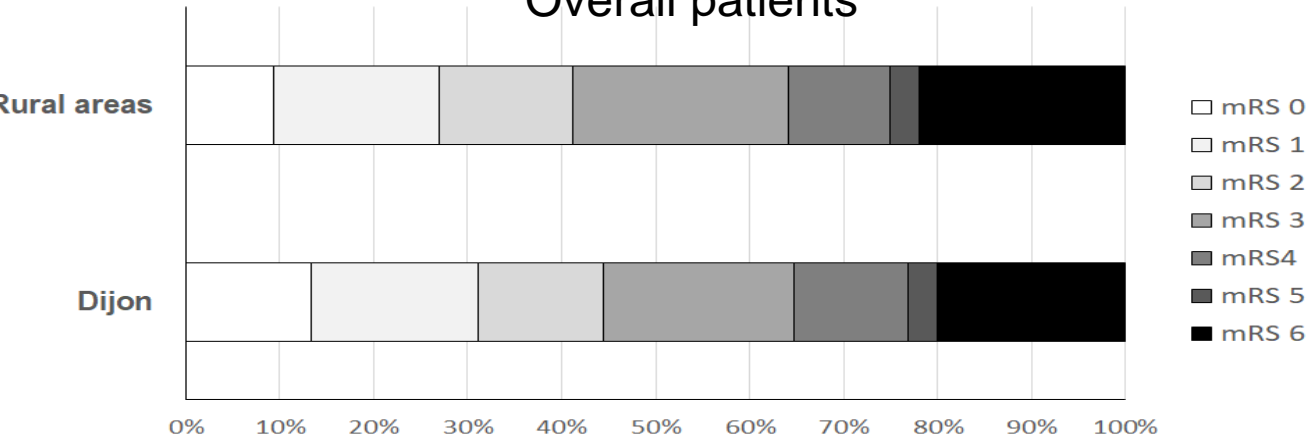*defined as occlusion of terminal ICA, M1-MCA, M1-M2 junction MCA, or BA
$ in patients with known time of stroke onset

Evaluation du Réseau Télé-AVC Bourgogne

mRS score at 3 months

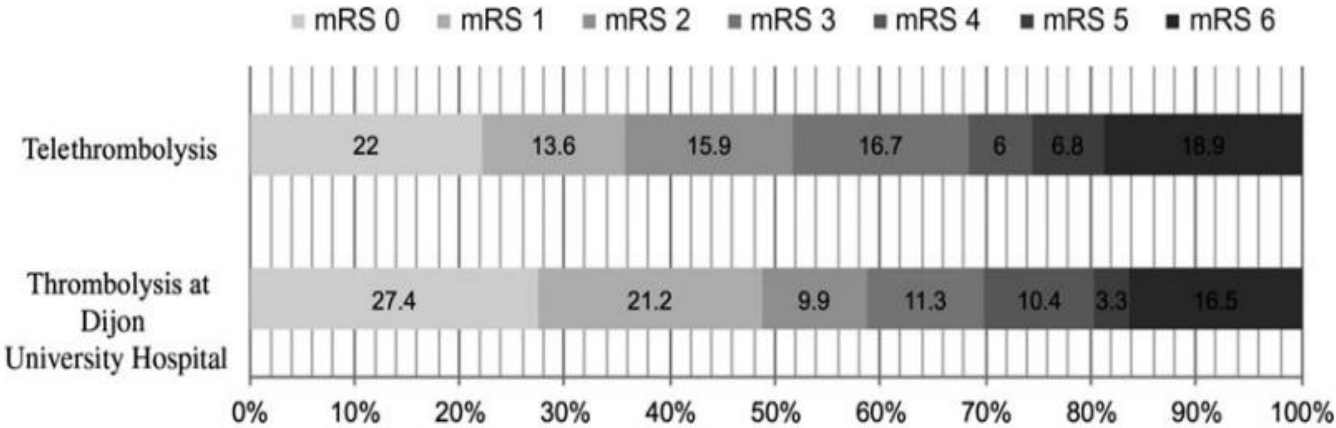### PARADISE STUDY (2016-2019)

Overall patients

% patients with mRS 0-2

Rural areas: 41%   Dijon Hospital: 44%

PARADISE STUDY (2012-2014)

% patients with mRS 0-2

Rural areas: 51%   Dijon Hospital: 58%

OLDER PATIENTS

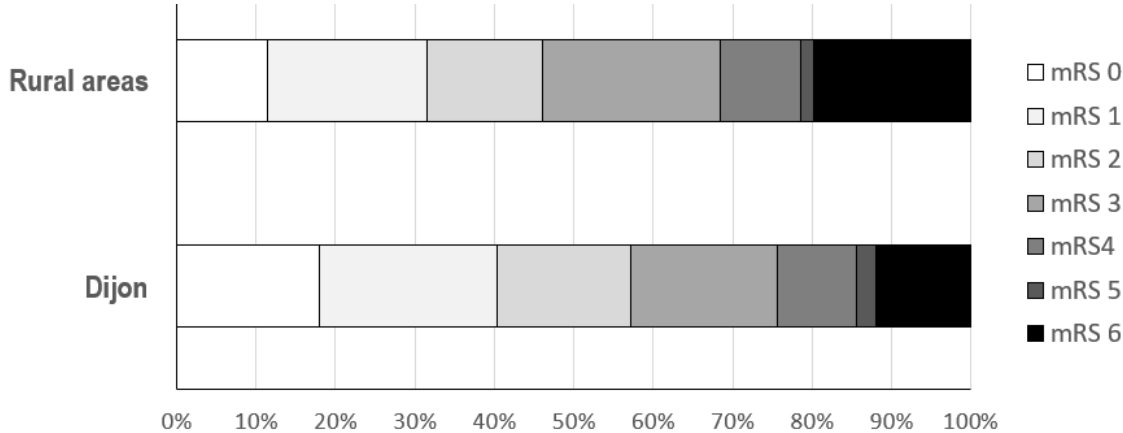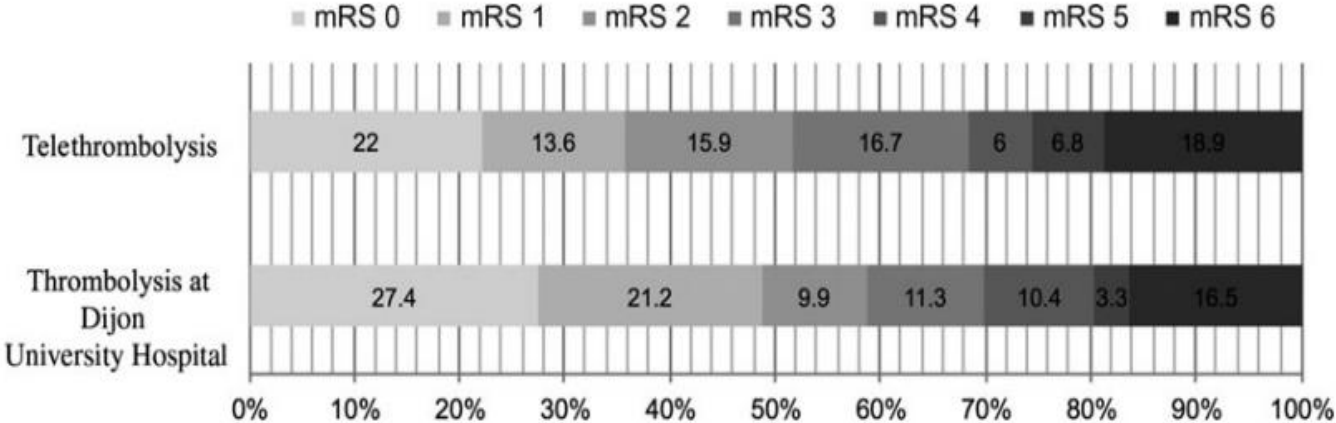Mean age   Rural: 71.4 yo   Dijon: 74.2 yo   versus   Rural: 68.4 yo   Dijon: 69.3 yo

INCLUSION OF PATIENTS WITH STROKE BEYOND 4h30

Evaluation du Réseau Télé-AVC Bourgogne

mRS score at 3 months

PARADISE STUDY (2016-2019)

Patients who received IVT (with or without MT)

% patients with mRS 0-2

Rural areas: 46%   Dijon Hospital: 57%

Mean age   Rural: 70.9 yo   Dijon: 74.0 yo

PARADISE STUDY (2012-2014)

% patients with mRS 0-2

Rural areas: 51%   Dijon Hospital: 58%

versus   Rural: 68.4 yo   Dijon: 69.3 yo

PARADISE STUDY (2016-2019)

Comparison between rural areas and Dijon

mRS score at 3 months

Overall patients

Rural areas

Dijon

☐ mRS 0
☐ mRS 1
☐ mRS 2
☐ mRS 3
☐ mRS4
☐ mRS 5
■ mRS 6
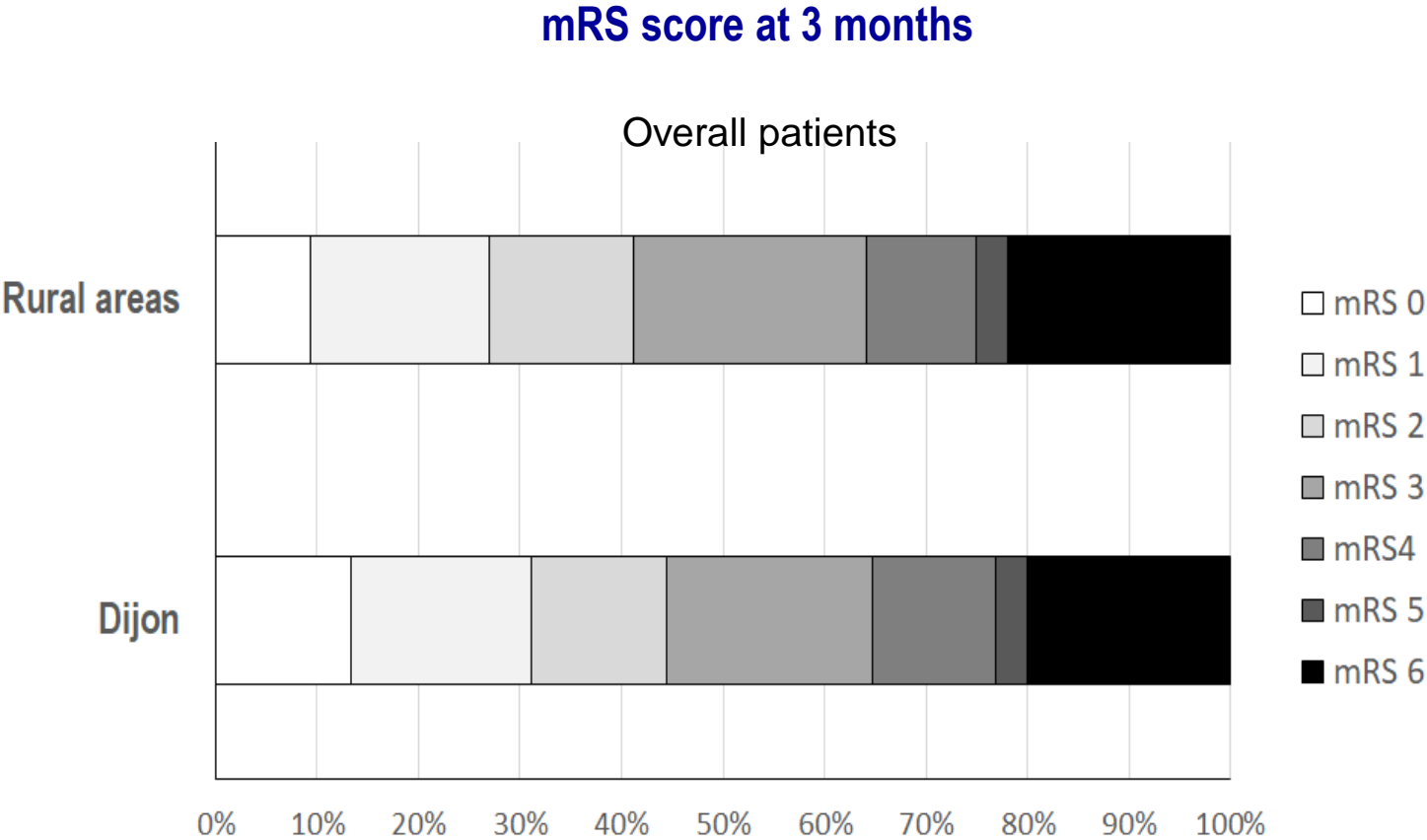
Shift analysis (ordinal logistic regression)

Unadjusted OR: 1.15 [0.90-1.48], p=0.27

Adjusted OR: 1.76 [1.34-2.30], p<0.001

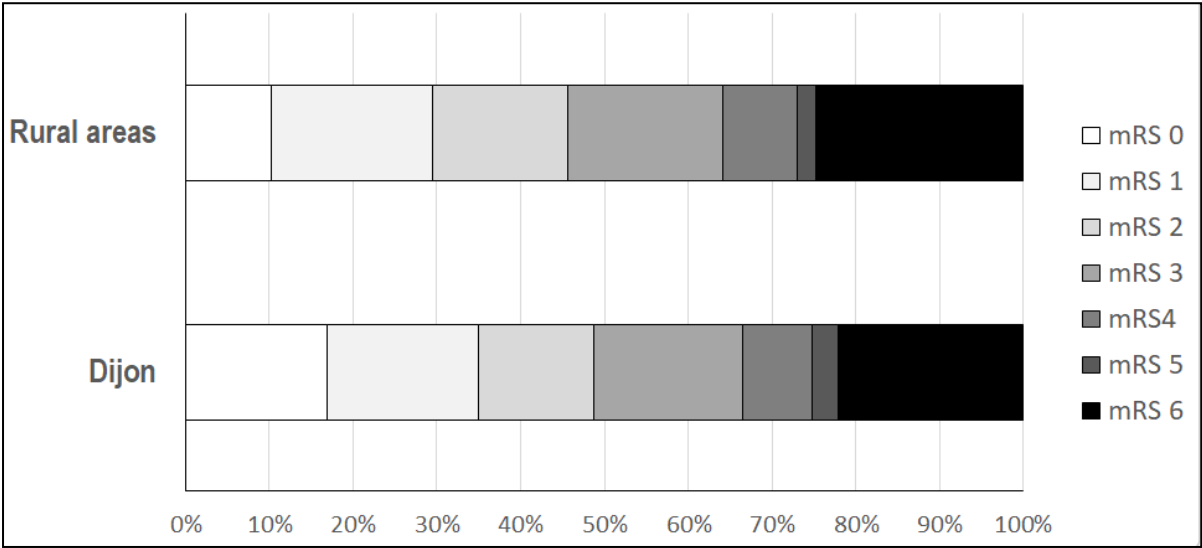*Adjusted for age, sex, NIHSS score, premorbid mRS > 2, acute revascularization therapy, proximal occlusion*

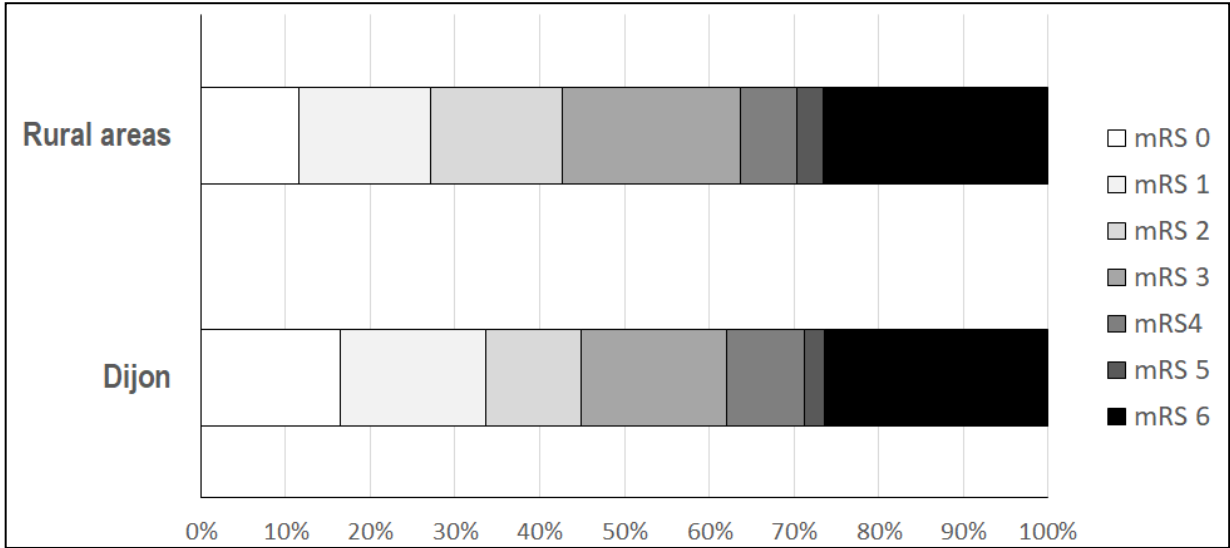# Evaluation du Réseau Télé-AVC Bourgogne

PARADISE STUDY (2016-2019)
Comparison between rural areas and Dijon

mRS score at 6 months

Rural areas
Dijon

☐ mRS 0
☐ mRS 1
☐ mRS 2
☐ mRS 3
☐ mRS4
☐ mRS 5
☐ mRS 6

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

mRS score at 12 months

Rural areas
Dijon

☐ mRS 0
☐ mRS 1
☐ mRS 2
☐ mRS 3
☐ mRS4
☐ mRS 5
☐ mRS 6

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Shift analysis (ordinal logistic regression)

Unadjusted OR: 1.22 [0.95-1.58], p=0.27

Adjusted OR: 1.90 [1.44-2.52], p<0.001

Shift analysis (ordinal logistic regression)

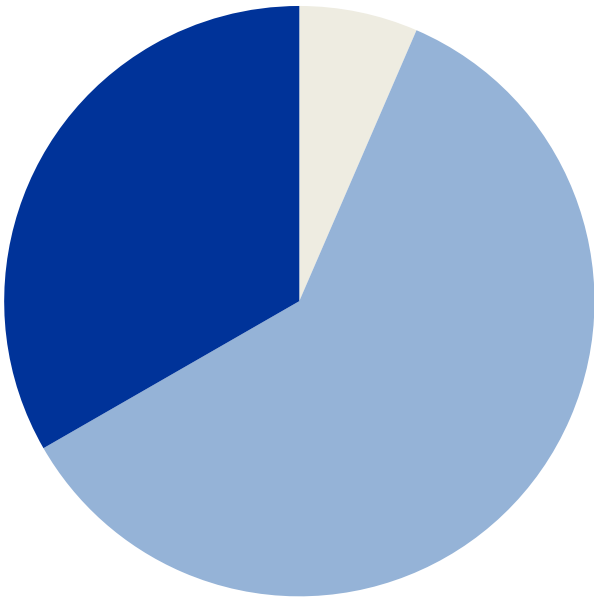Unadjusted OR: 1.12 [0.87-1.46], p=0.36

Adjusted OR: 1.63 [1.23-2.15], p=0.001

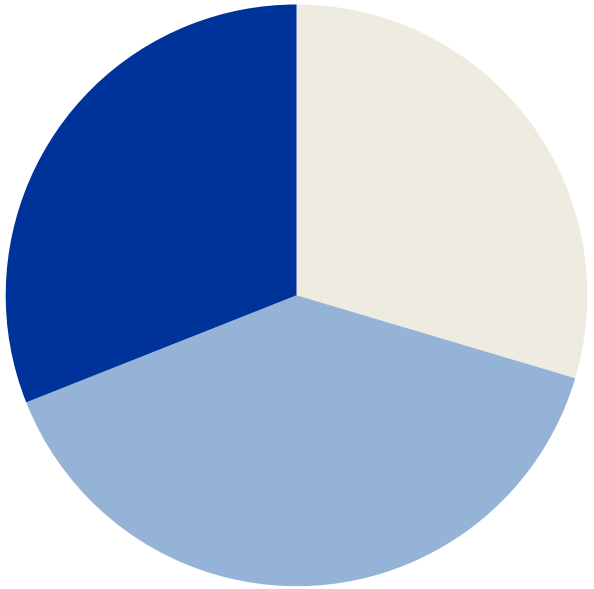*Adjusted for age, sex, NIHSS score, premorbid mRS > 2, acute revascularization therapy, proximal occlusion*

Evaluation du Réseau Télé-AVC Bourgogne

Patients with a proximal arterial occlusion

Dijon (N=201)

Rural areas (N=216)

Acute revascularization therapy

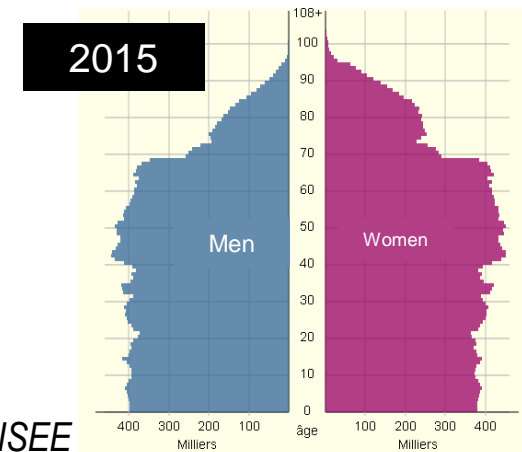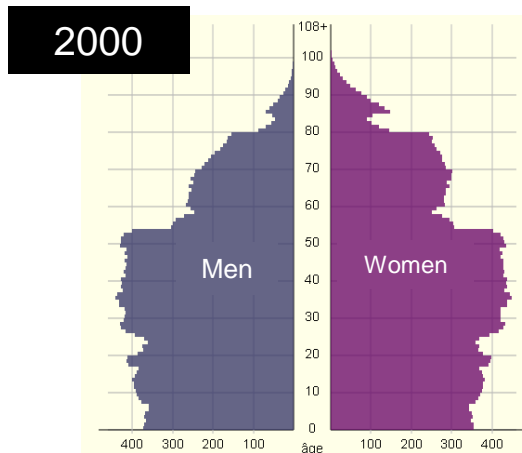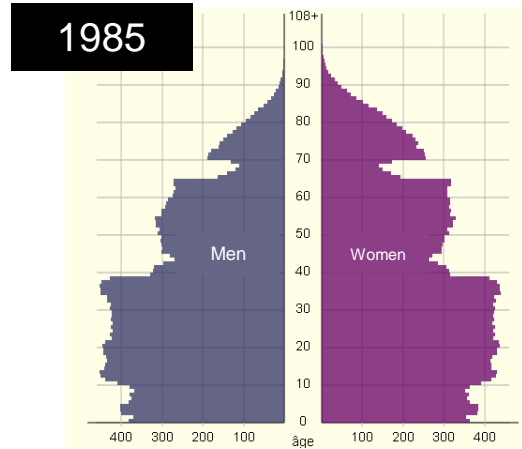☐ IV thrombolysis alone

☐ MT alone

■ Bridging therapy

	Dijon	Rural areas	p
Time to MT initiation, minutes mean ±SD	319 ± 700	438 ± 294	**<0.001**
median (IQR)	165 (128-253)	365 (305-456)	

Proximal occlusion defined as occlusion of ICA, M1-MCA, M1-M2 junction MCA, or BA
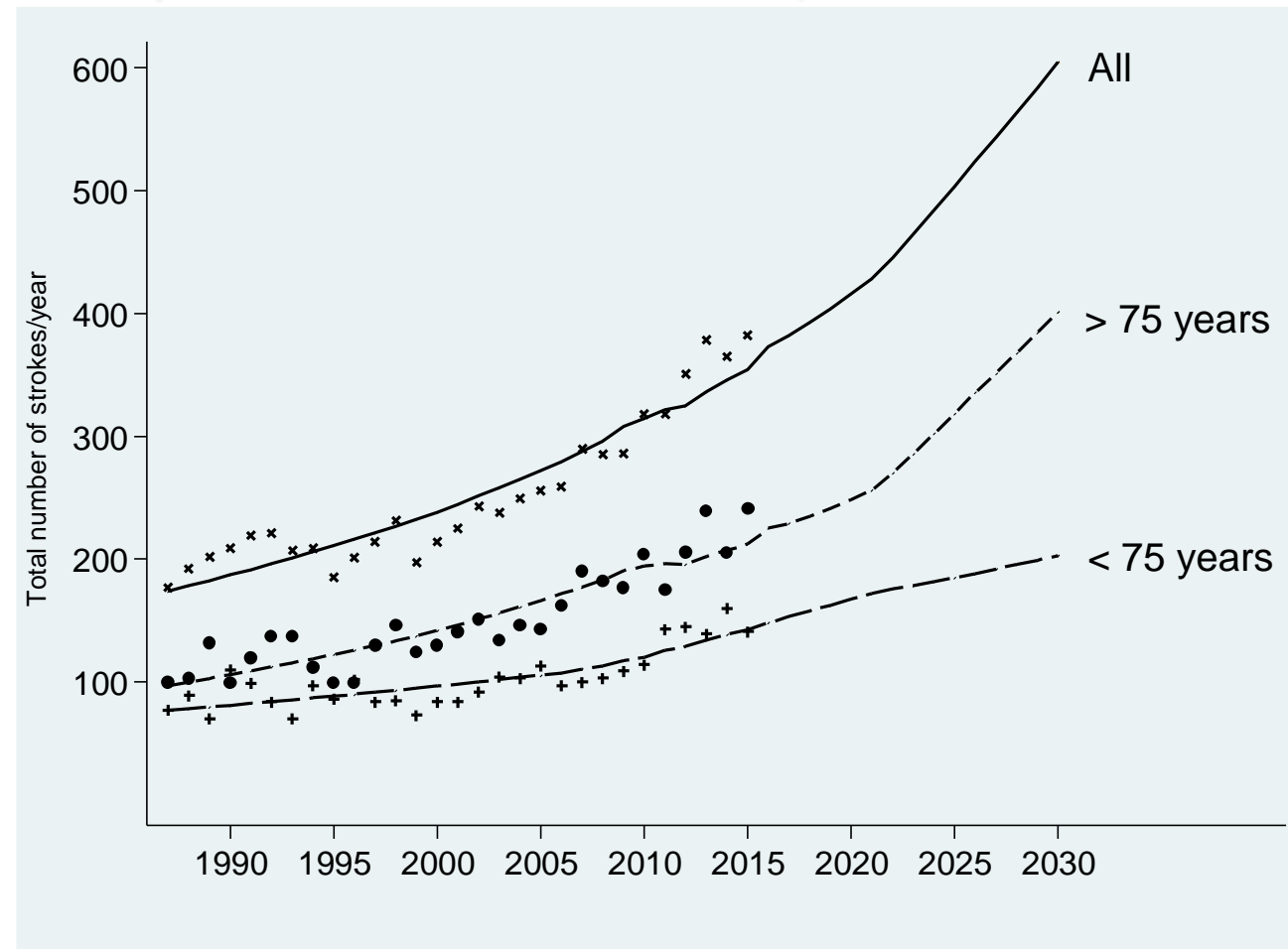
Perspectives épidémiologiques

French population structure

1985

2000

2015

City of Dijon, France

145,000 inhabitants
9.6% > 75 years

156,000 inhabitants
12.4% > 75 years

All
> 75 years
< 75 years

Total number of strokes/year

DIJON STROKE REGISTRY

Large vessel occlusion in stroke patients

*Duloquin G, Stroke. 2020;5:2122-2130*

- Dijon stroke registry (2013-2017)
- 1060 patients with acute IS (92% with available data on arterial imaging)
- Visible occlusion: 29%
- LVO of anterior circulation: 17% - Incidence 22/100,000/year
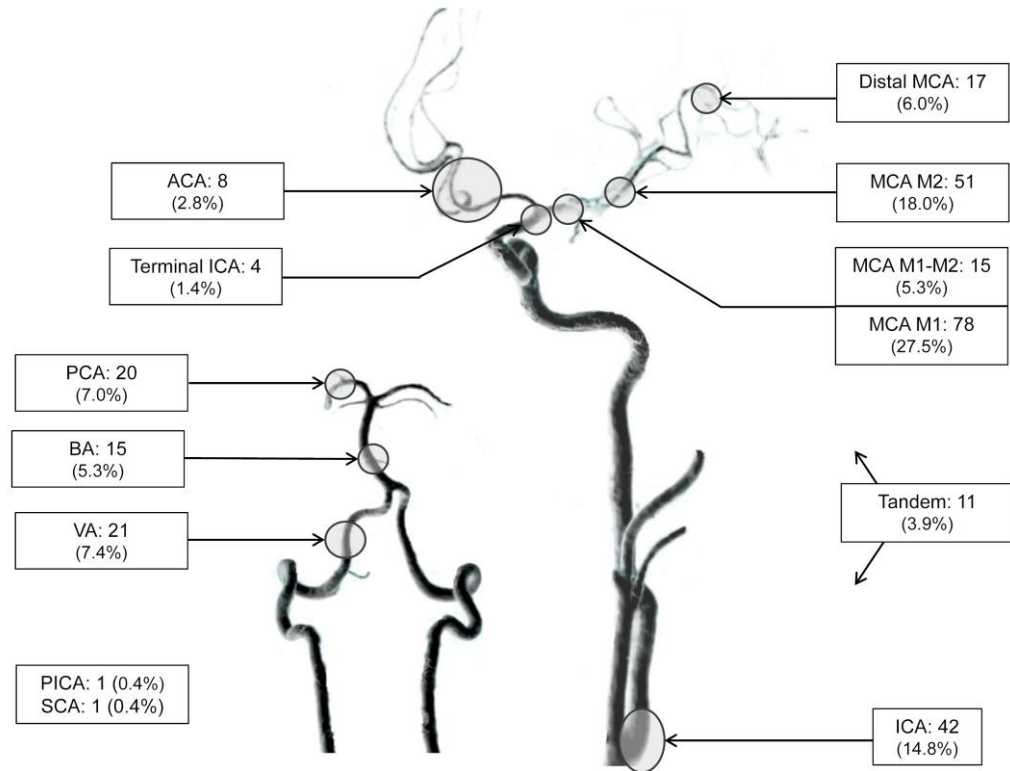
		Total IS			Total IS With Visible Arterial Occlusion			Total IS With Proximal Occlusion of the Anterior Circulation		
	N at Risk	N	Rates	(95% CI)	N	Rates	(95% CI)	N	Rates	(95% CI)
Men and women										
<35	387 023	16	4.1	(2.1–6.2)	3	0.8	(0.0–1.7)	2	0.5	(0.0–1.2)
35–40	42 813	17	39.7	(20.8–58.6)	7	16.4	(4.2–28.5)	3	7.0	(0.0–14.9)
40–45	43 258	18	41.6	(22.4–60.8)	3	6.9	(0.0–14.8)	3	6.9	(0.0–14.8)
45–50	40 701	26	63.9	(39.3–88.4)	12	29.5	(12.8–46.2)	6	14.7	(2.9–26.5)
50–55	41 426	40	96.6	(66.7–126.5)	12	29.0	(12.6–45.4)	5	12.1	(1.5–22.6)
55–60	41 997	46	109.5	(77.9–141.2)	15	35.7	(17.6–53.8)	8	19.0	(5.9–32.2)
60–65	42 587	71	166.7	(128.0–205.5)	11	25.8	(10.6–41.1)	5	11.7	(1.5–22.0)
65–70	36 257	98	270.3	(217.0–323.7)	23	63.4	(37.5–89.4)	11	30.3	(12.4–48.3)
70–75	24 666	70	283.8	(217.6–350.2)	20	81.1	(45.6–116.6)	15	60.8	(30.0–91.6)
75–80	21 203	119	561.3	(461.2–661.8)	36	169.8	(114.4–225.2)	24	113.2	(64.2–152.8)
80–85	21 218	175	824.8	(702.7–946.5)	34	160.2	(106.4–214.1)	23	108.4	(67.9–158.5)
85–90	17 055	169	990.9	(841.5–1139.6)	47	275.6	(196.9–354.3)	24	140.7	(84.5–197.0)
>90	10 537	195	1850.7	(1590.9–2108.0)	61	578.9	(434.1–723.8)	38	360.6	(246.2–475.1)
Total	770 738	1060	137.5	(129.3–145.8)	284	36.8	(32.6–41.1)	167	21.7	(18.4–25.0)
ASR, WHO population			65.9	(50.0–81.8)		17.9	(9.6–26.1)		10.3	(8.0–12.5)
ASR, 2013 European population			141.2	(117.9–164.5)		38.2	(26.1–50.3)		22.7	(19.3–26.0)

Large vessel occlusion in stroke patients in France

Duloquin G, submitted
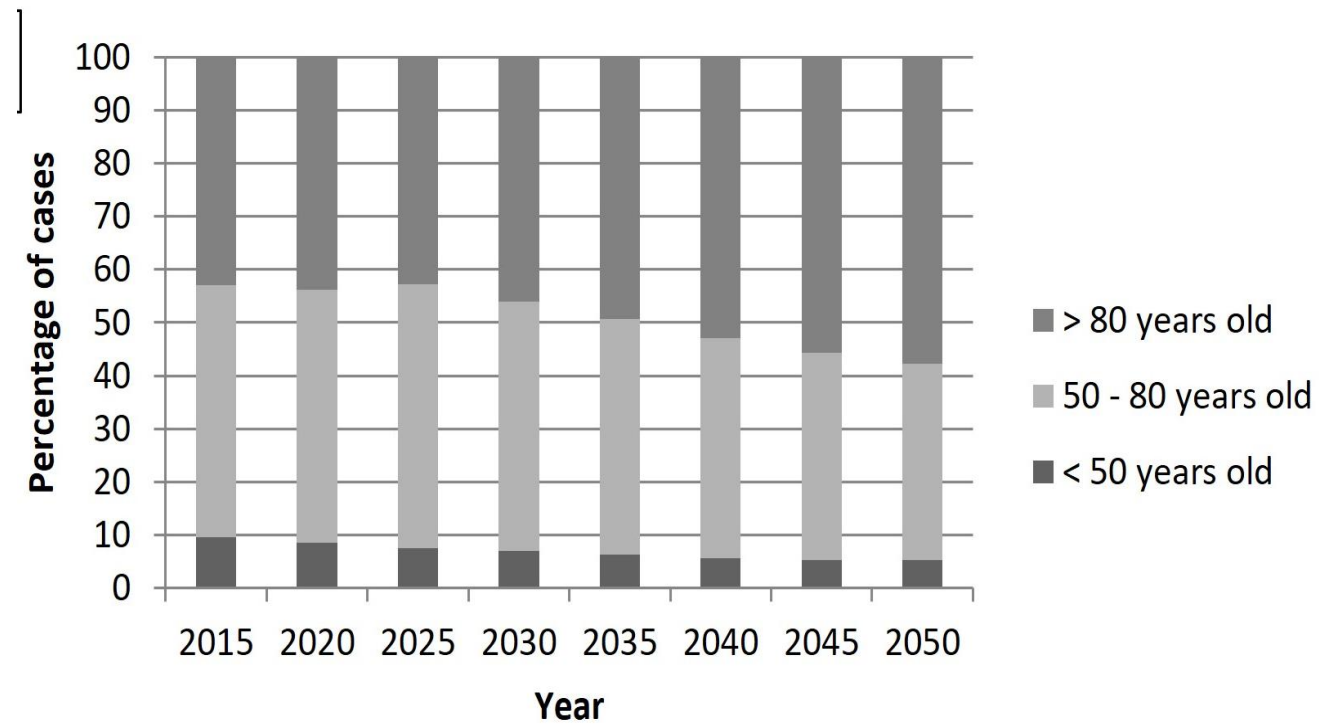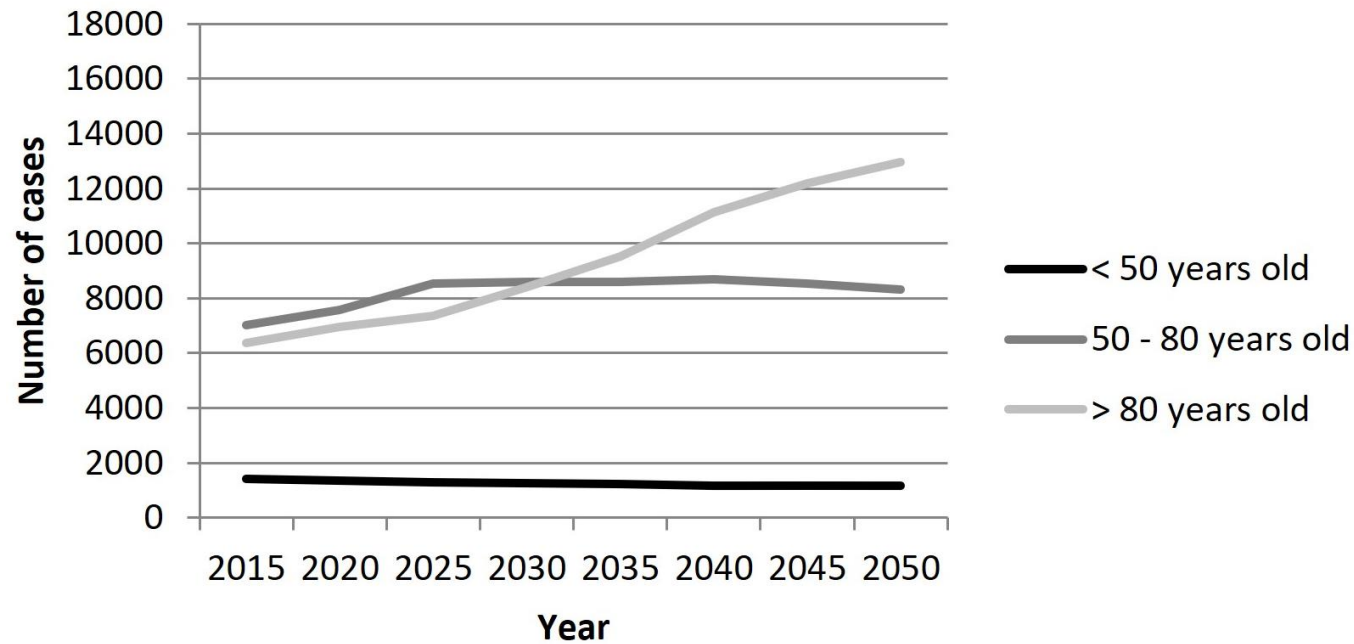
Points clés

- **Apports structurels du Réseau Télé-AVC Bourgogne en zone rurale**
  - Vaste région rurale avec nombreux hôpitaux de petite taille et peu d'expérience dans la prise en charge des AVC, sans d'accès à l'imagerie cérébrale et sans connexion technique inter-hospitalière
  - Peu de relai neurologique, lien direct avec les services d'urgence
  - Formation initiale et continue des médecins d'urgence

- **Impact sur le pronostic des patients**
  - Réduction des inégalités territoriales dans la prise en charge des AVC aigus pour l'accès à la TIV

- **Mais pronostic des patients victimes devenu globalement moins bon en zone rurale vs. urbaine depuis l'avènement de la TM.**
  - Délais d'accès à la TM
  - Prise en charge post-aigue dans les zones rurales
  - Autres facteurs non mesurés : comorbidités; facteurs socio-économiques

▪ **Développements en cours**

- Mise en œuvre de l'imagerie de perfusion dans tous les hôpitaux locaux (principalement CT-perfusion)
  - Meilleure selection des patients

- Augmenter la proportion de patients ruraux bénéficiant d'une thrombectomie mécanique
  - Réduction du door-in door-out time
  - Accélérer le transfert des patients

- Développer un parcours de soins post-AVC innovant (article 51 Loi de Financement de la SS)

DiVa

Dijon Vascular Project