

# Incidence of chronic disease in the aging population :do social factors matter ?

*Our experience on the relationship between level of education and dementia*

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The Paquid research program on the epidemiology of dementia.

Methods and initial results

Dartigues JF et al. Revue Neurologique 1991;147:225-230

Prevalence of probable Alzheimer's Disease according to educational level in elderly people living at home

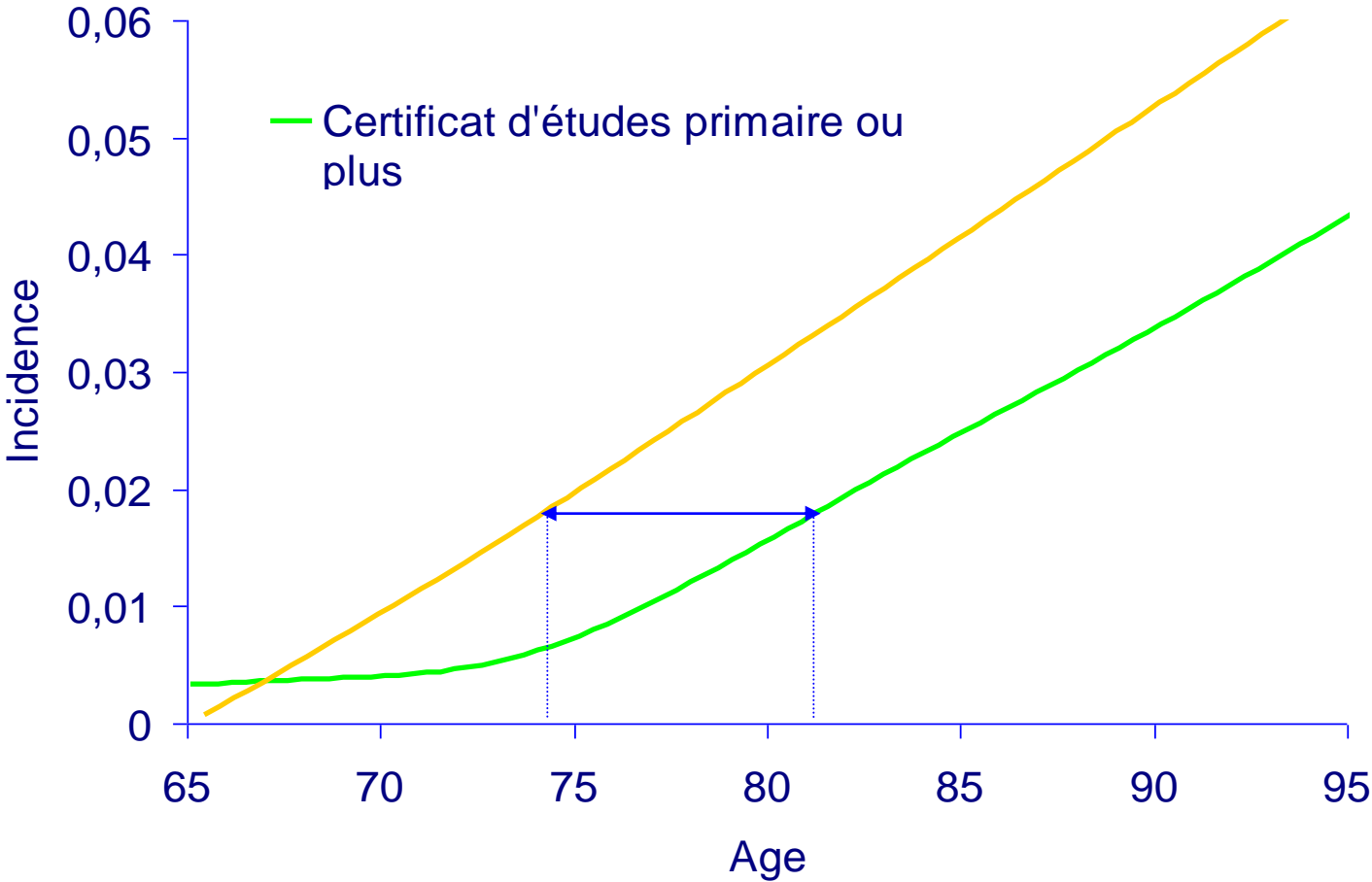
No education or primary level without diploma	5.4%
Primary level with diploma	1.7%
Secondary level	0.4%
University level	0.4%

Are sex and educational level independent predictors of dementia and Alzheimer's disease? Incidence data from the PAQUID project Letenneur L. et al JNNP 1999

The risks of dementia and Alzheimer's disease were associated with a lower educational attainment (primary school without diploma vs higher level)

hazard ratio=1.8,  $p < 0.001$

Incidence of dementia according to the educational level



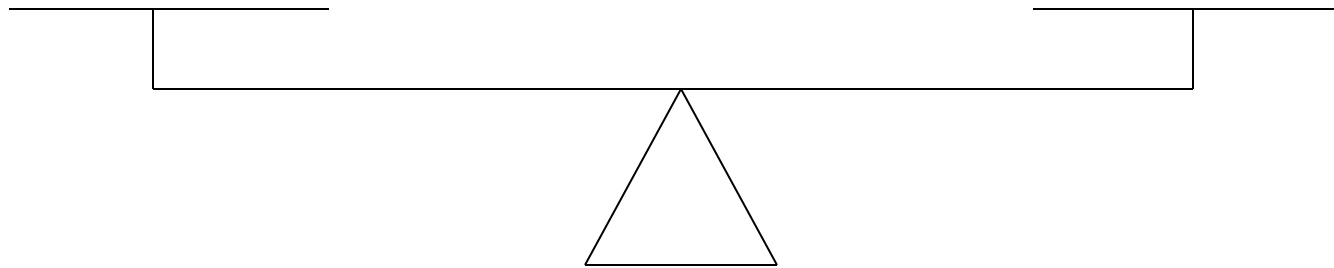
# How could we explain a protective effect of education ?

- Enhancement of reserve capacity of the brain
- Better management of risk factors for dementia by highly educated subjects

# Brain Aging and AD

Morbide  
Process

Reserve  
Capacity



# Anatomo-pathological studies on subjects without clinical AD but with histological AD

Authors	Number	Mean Age (in years)	MMSE	CERAD <sup>a</sup> (%)	NIA-Reagan <sup>b</sup> (%)
Davis, 1999	59	84	28	25	12
Neuropathol Group, 2001	109	85	-	33	-
Knopman, 2003	36	85	28	18	10
Galvin, 2005	41	85	-	34	29
Bennett, 2006	134	85	28	45	37
Roe, 2007	265/320	85	25	14	19
Price, 2009	97	84	28	20	17

<sup>a</sup> Consortium to Establish a Registry for Alzheimer's disease neuropathologic criteria for probable AD (CERAD)

<sup>b</sup> NIA-Reagan histological criteria for probable AD

# How education could contribute to the reserve capacity ?

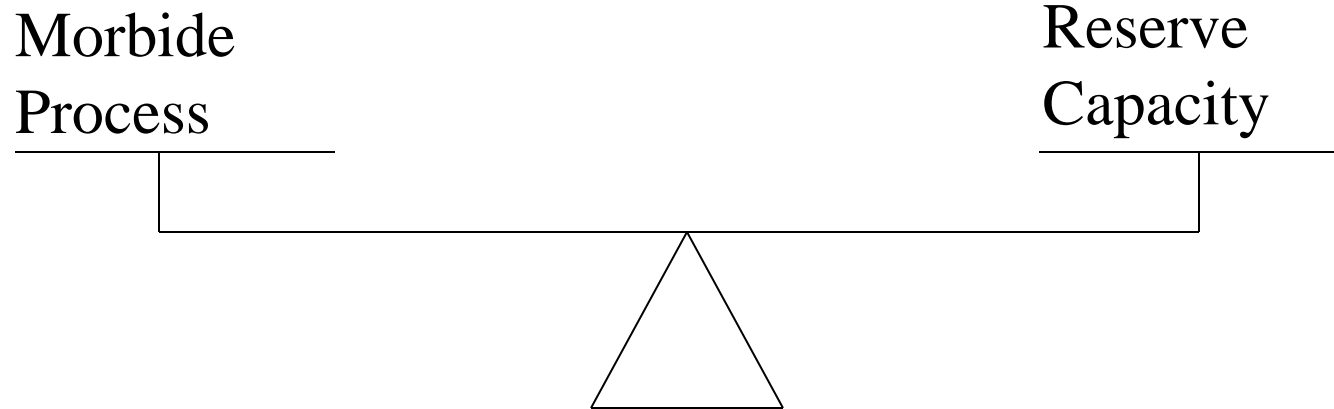
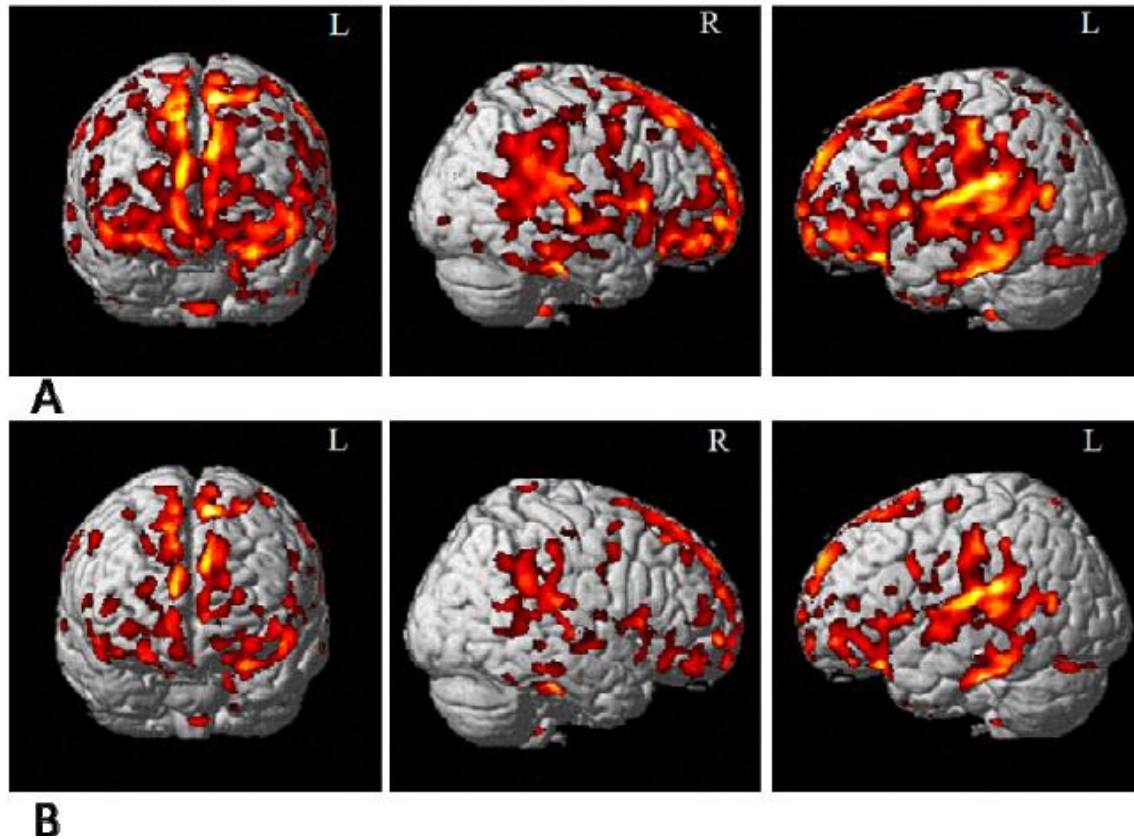




Figure 1: Brain areas of grey matter showing a positive association with subjects with a high education level compared to a low level in A and C adjusting for age and gender; in B and D adjusting for age, gender and TIV (n=331) (contrast with a t-test, a p-value corrected < 0.05 by FDR and an extend cluster threshold of 100).

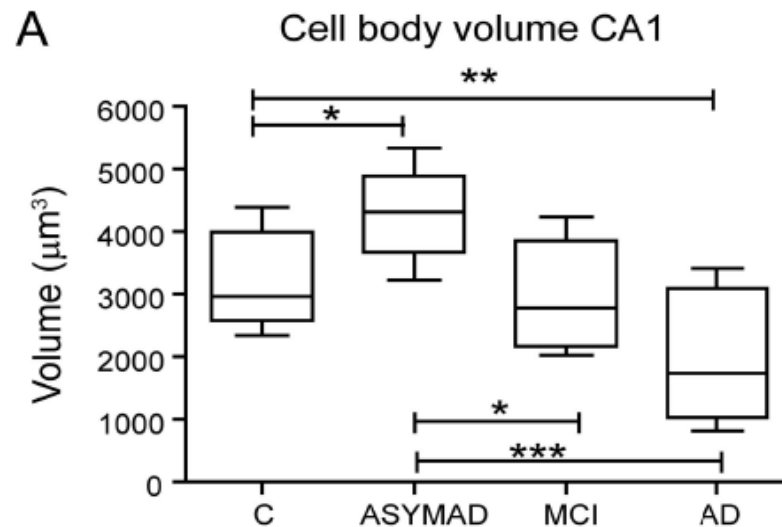


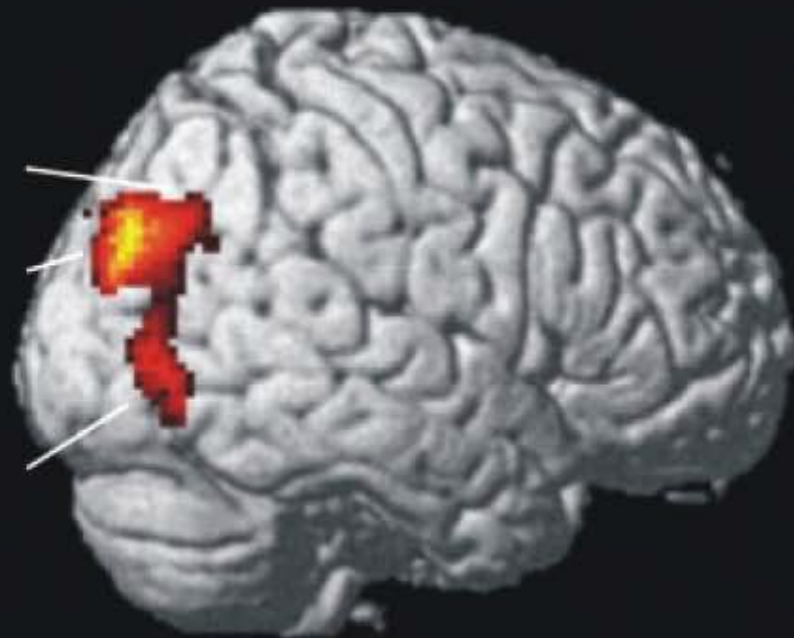
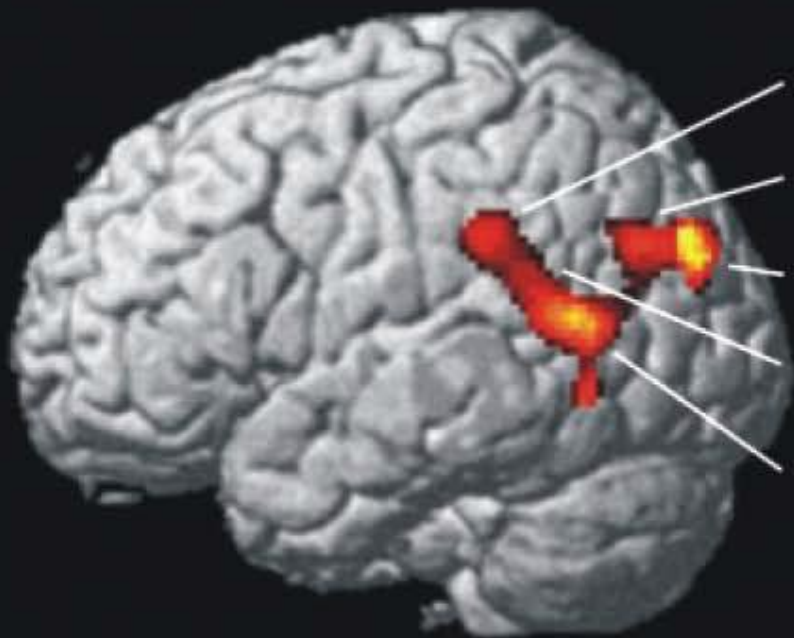
# Education and Dementia : the Nun study



# The Nun Study

Clinically silent AD, neuronal hypertrophy, and linguistic skills in early life *Neurology*® 2009;73:665-673





# Study of the pre-dementia phase of AD according to the education level of participants



- Follow-up visits: 1, 3, 5, 8, 10, 13, 15, 17 and 20-year visit of the PAQUID cohort

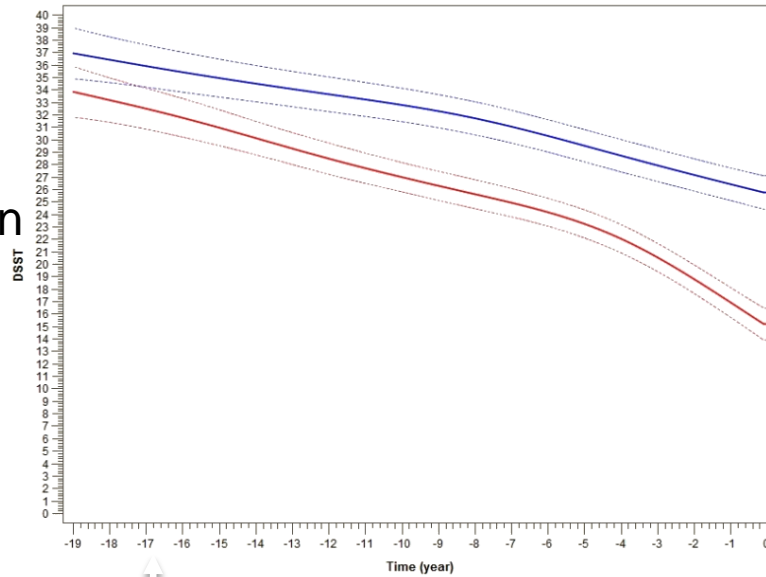
## ↳ Retrospective analysis of the trajectory of :

- ✓ **392** persons diagnosed with Alzheimer dementia
- ✓ divided in 2 groups according to educational level : those who achieved the primary level certificate and those who did not achieve any diploma
  - 234 with primary level certificate (called highly educated) ;  
mean age : 76.0 (SD= 6.1)
  - 158 with no diploma (called low educated) ;  
mean age : 76.8 (SD= 6.0)

# Digit Symbol Substitution task

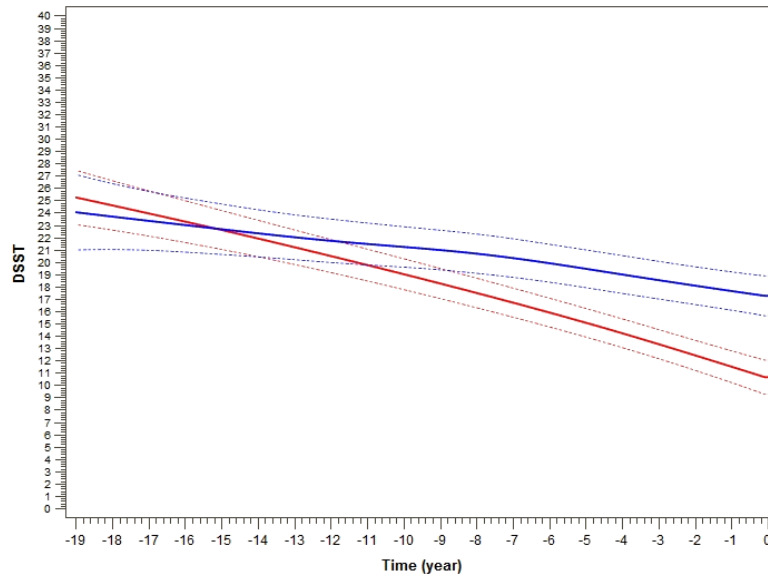


High education



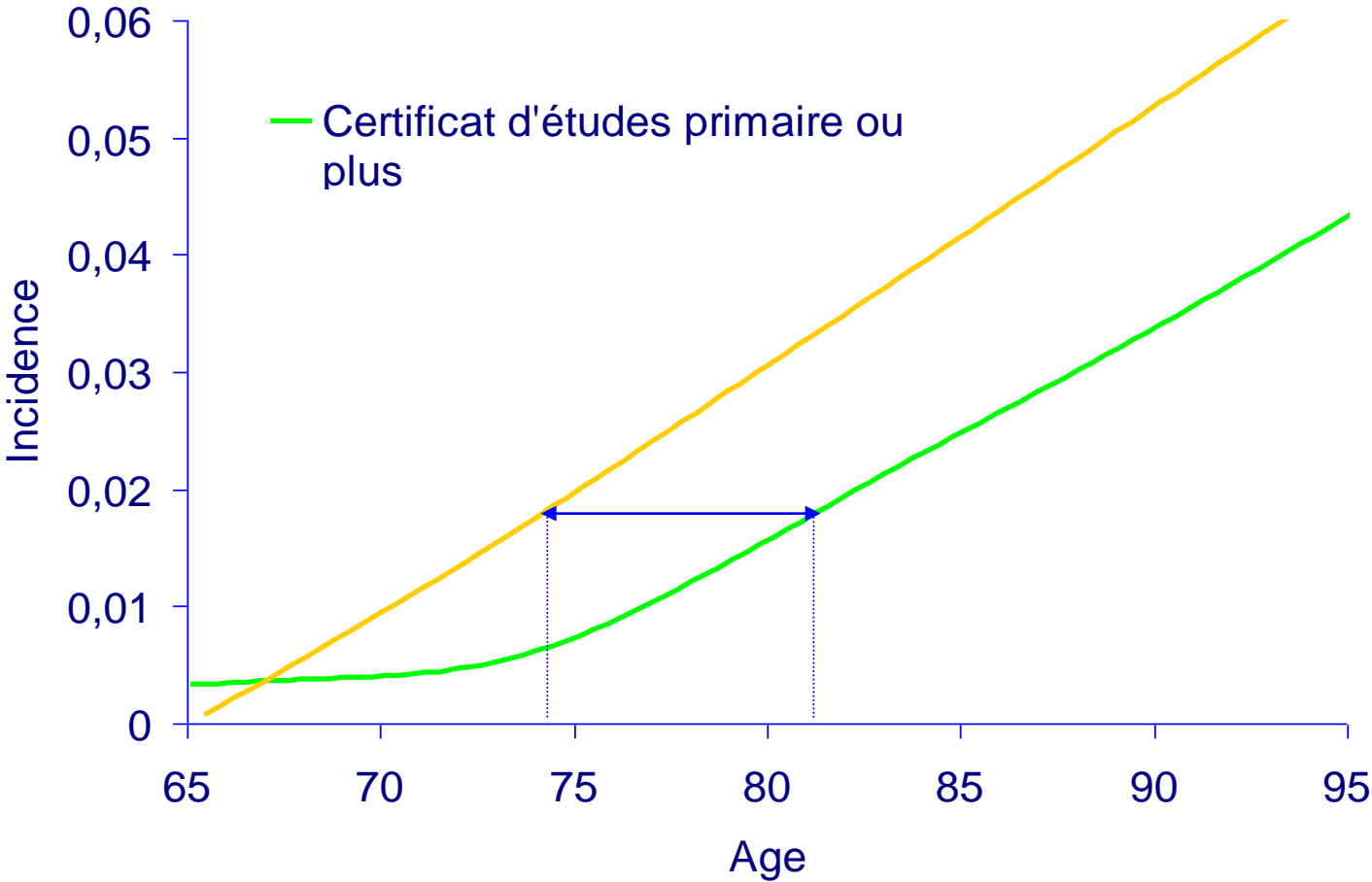
— Controls  
— Pre-demented

Low education



— Controls  
— Pre-demented

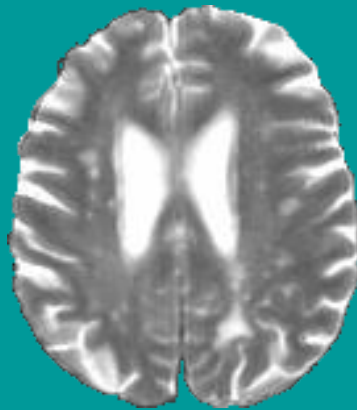
Incidence of dementia according to the educational level



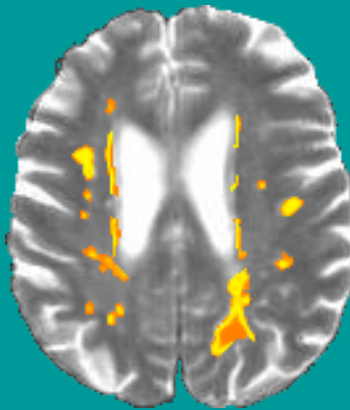
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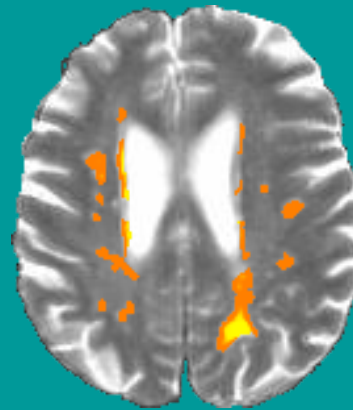




T2



CF-HSB



CE-HSB

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## For each WMH

- Volume
- Coordinates (in Talairach space and in the native space)
- Type: deep WM, periventricular, etc.
- Intensity
- Distance to ventricle

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## For each subject

- Density cards of WMH (native space and MNI)
  - Volume of WMH by type
  - Volume of the mask of WM
  - Burden of WMH
-

# Comparison between change in White Matter Hyperintensities (WMH) in high versus low educated subjects. Repeated MRI in 3C Bordeaux cohorte (n=382)

	Without adjustment on vascular factors $\beta$ value, IC à 95%	With adjustment on vascular factors $\beta$ value, IC à 95%
Total WMH change	-0,07 [-0.13 ; -0,02]	-0,09 [-0.15 ; -0,03]
Periventricular WMH	-0,06 [-0,11 ; -0,01]	-0,08 [-0.14 ; -0,02]
Deep WMH	-0,01 [-0,02 ; -0,001]	-0,01 [-0.02 ; 0,001]

# Conclusion

- Education is one of the strongest protective factor for dementia and AD
- Education enhance the reserve capacities of the brain (both brain and cognitive reserves)
- The better management of vascular risk factors in highly educated subjects could also participate to the protective effect