

JOURNEES INTERNATIONALES ET FRANCOPHONES D'ANGEOLOGIE 2015

Methodolgy CV Risque and Clinical Practice

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Disclosure

- ✓ R&D Activity in Intelligence in Medical Technologies company
- ✓ Royalties on IMT software

Current Risk estimation

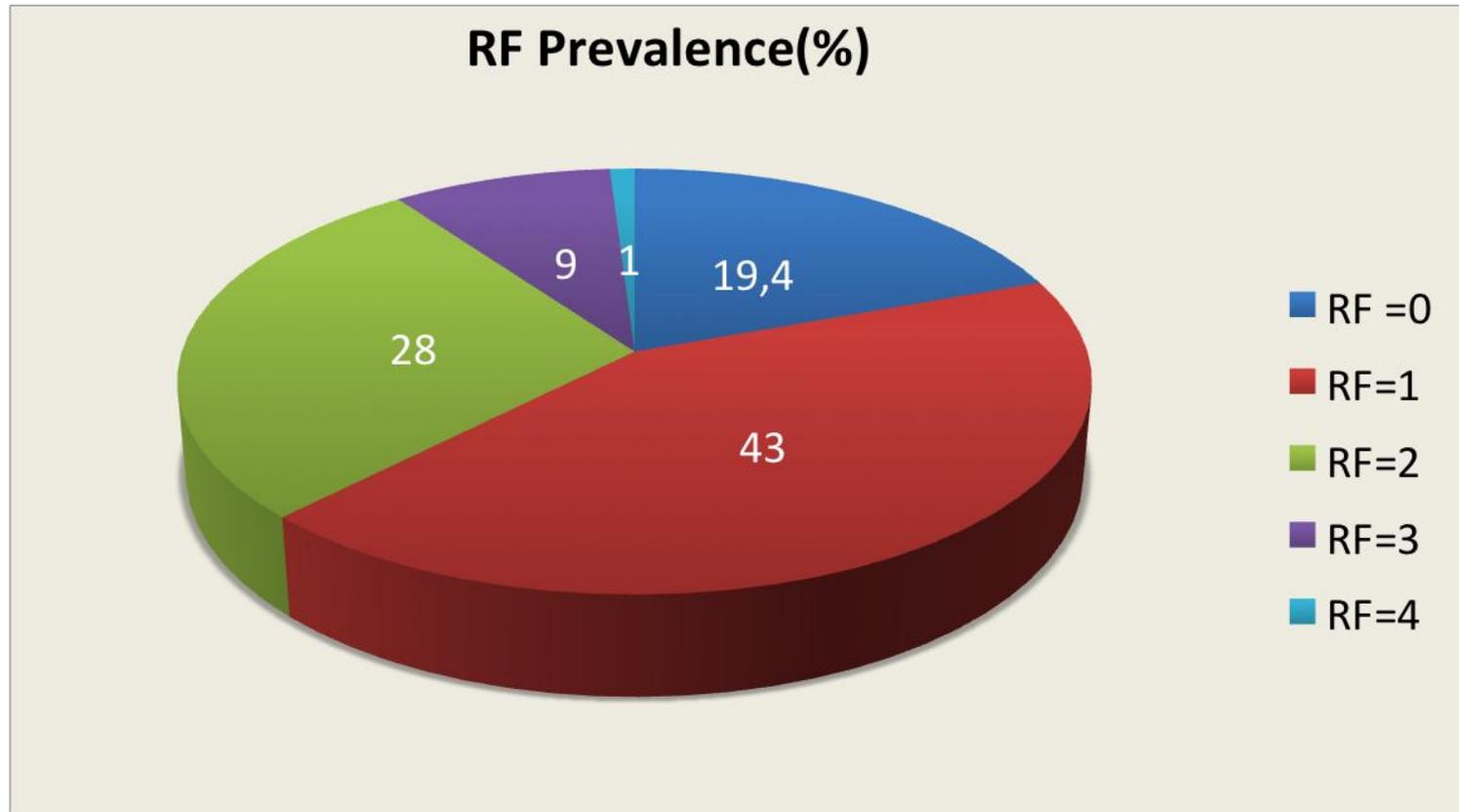
- Based on RF in NCEP-ATPIII :
 - Hypertension
 - Low LDL
 - Age (men > 45 y ; women > 55 y)
 - Family history of premature CHD (1st degree < 55 y male < 65 female).

Evaluation :

- < 2 RF : low risk
- > 2 RF : $< 10\%$ - 5-20% - $> 20\%$ (low,intermediate-high risk)

Prevalence of Conventional RF in CHD

Patients N=87869



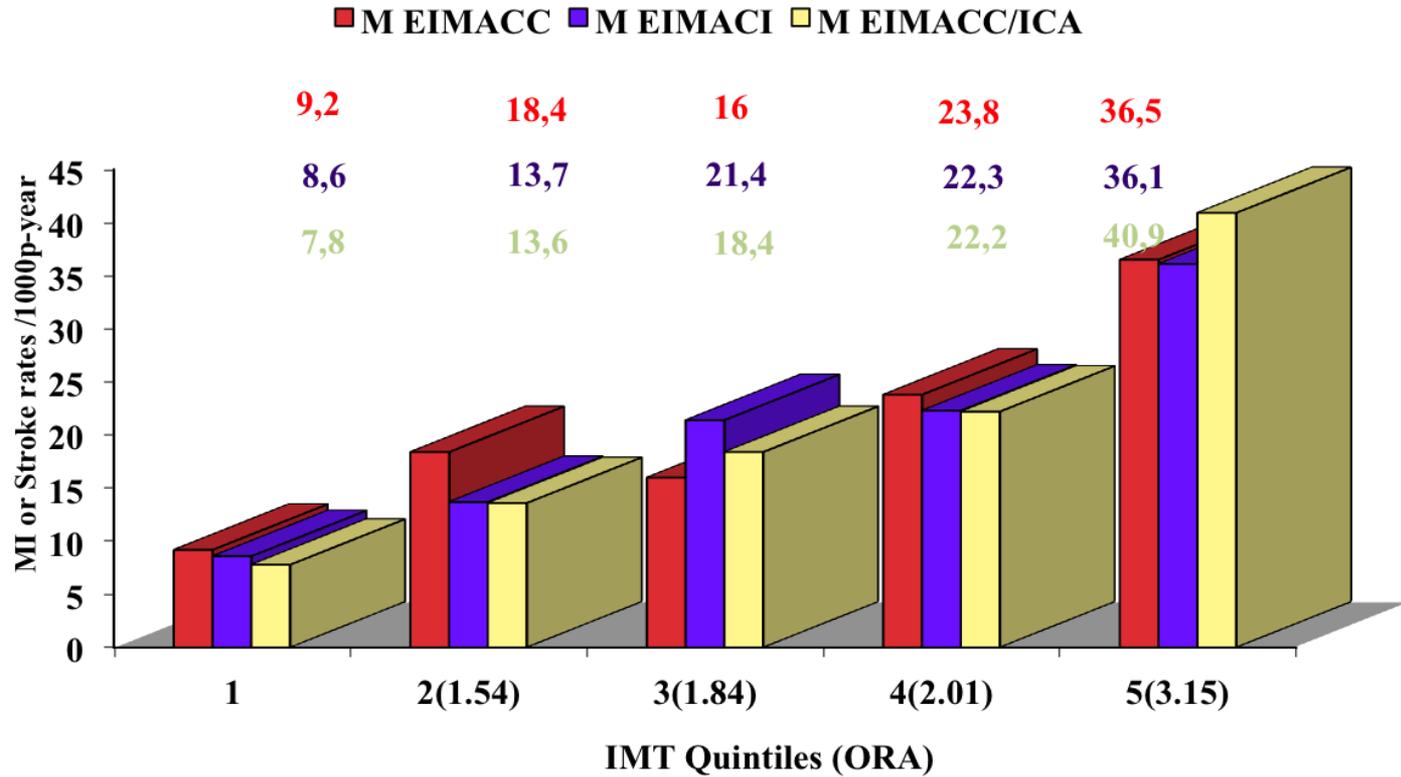
62,4 % have 0 or 1 RF



IMT and Clinical Events

IMT MI and Stroke

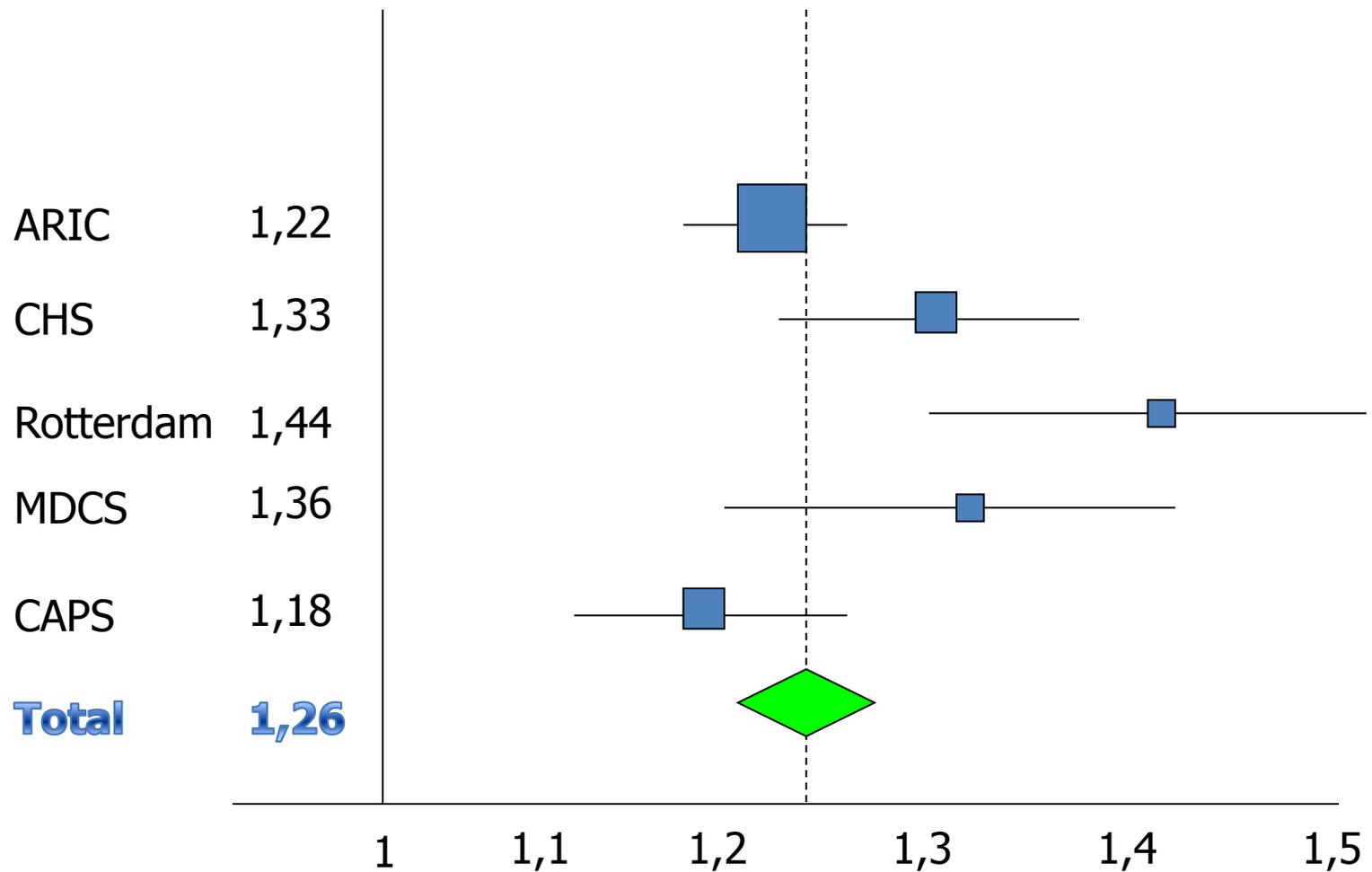
MI and Stroke rate occurrence according to carotid IMT quintile



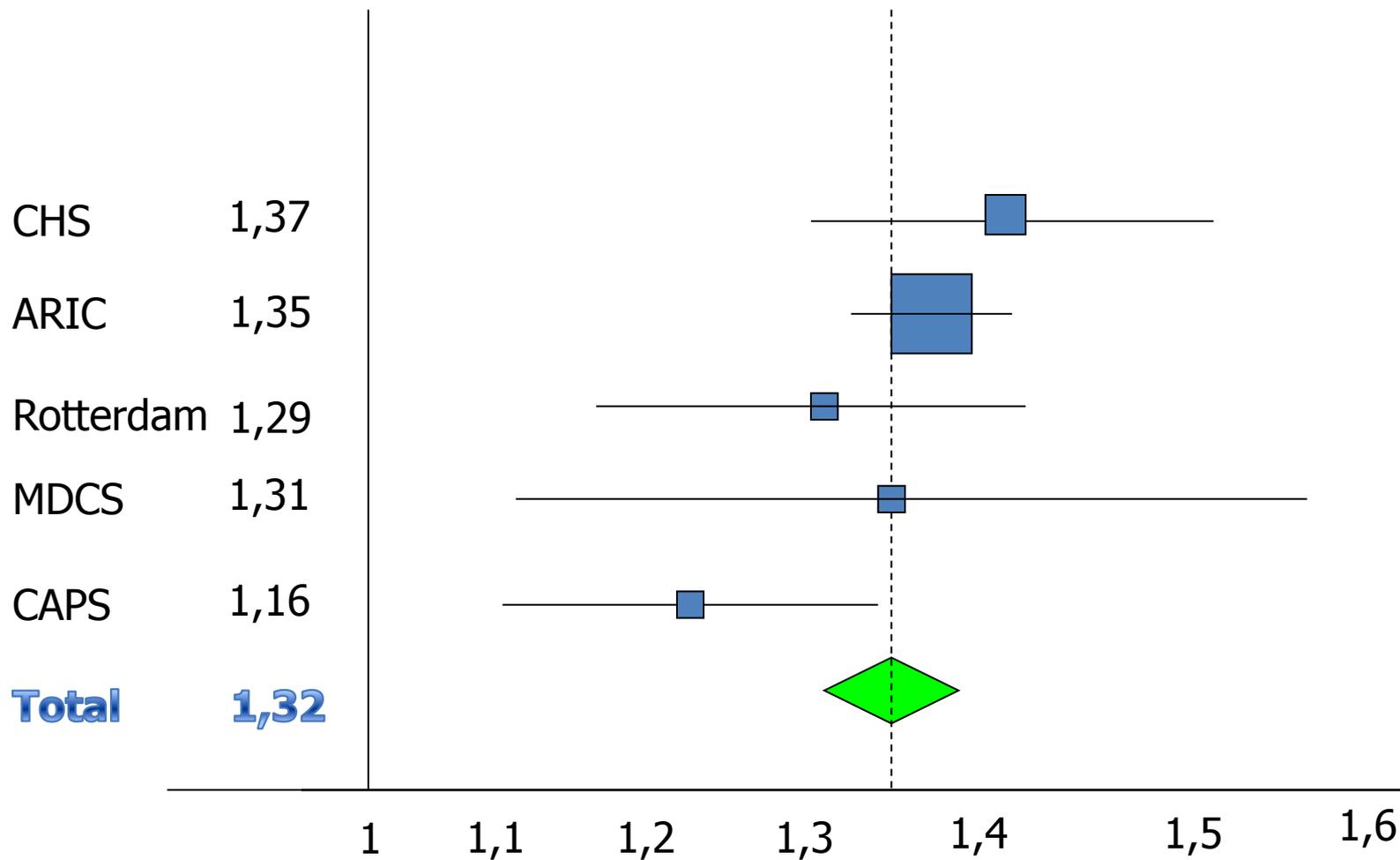
MI Stroke & IMT Studies

Study	Author	Year	Design	End.P	Age	F U(m)	Segments
KIHD	Salonen	93	Longitudinal	MI	42-60	1-36	CCA
ARIC	Chambless	97	Longitudinal	MI	45-64	64 127 Ψ	CCA Bif ICA & Combined
""	Chambless	2000	Longitudinal	Stroke		86 128 Ψ	CCA Bif ICA & Combined
Rotterdam	Bots	97	Nested K/C	MI,Stroke	>55	32	CCA
""	Iglesias	2002	Nest K/Coht	MI		55	CCA Bif ICA & Combined
""	Holander	2003	Longitudinal	Stroke		73	CCA
CH	O Leary	1999	Longitudinal	MI,Stroke	>65 No CVD	74	CCA ICA & Combined
NA	Kitamura	2004	Longitudinal	Stroke	60-74 No CVD	54	CCA ICA & Combined
MDCS	Rosvall	2005	Longitudinal	V Death	46-68 No CVD	84	CCA
""	Rosvall	2005	Longitudinal	Stroke		84	CCA
LILAC	Murakami	2005	Longitudinal	V Death	>75	38	CCA
CAPS	Lorenz	2006	Longitudinal	MI Stroke	19-90	50	CCA Bif ICA

HR for MI per 1SD difference in CCA-IMT (A & S adjusted)



HR for **Stroke** per 1SD difference in CCA-IMT (A& S adjusted)

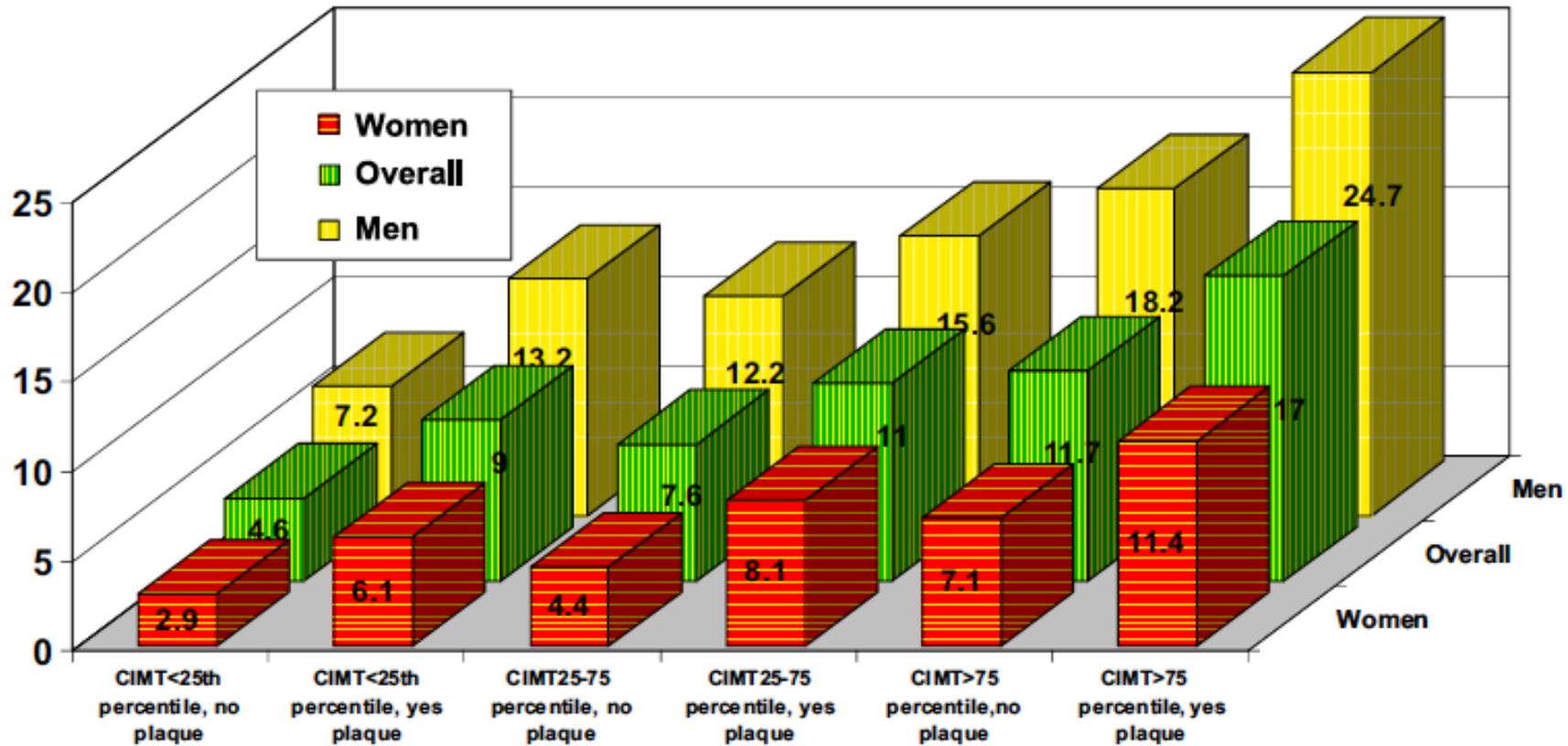


IMT & Plaque

- ARIC study, included 13,145 individuals followed for approximately 15 years for incident hard coronary events and revascularization.
- Carotid IMT measurements, which included both IMT and carotid plaque, were incremental to traditional risk factors for prediction of incident cardiovascular events.
- In particular, among intermediate-risk patients (10% to 20%, 10-year estimated risk group),
- Addition of carotid IMT and plaque information led to clinical net reclassification improvement of approximately 9.9%

Nambi V, Chambless L, Folsom A, et al. Carotid intima-media thickness and the presence or absence of plaque improves prediction of coronary heart disease risk in the Atherosclerosis Risk in Communities (ARIC) study. *J Am Coll Cardiol* 2010;55:1600–7.

CHD incidence rate by CIMT categories according to plaque presence



Nambi V, Chambless L, Folsom A, et al. Carotid intima-media thickness and the presence or absence of plaque improves prediction of coronary heart disease risk in the Atherosclerosis Risk in Communities (ARIC) study. *J Am Coll Cardiol* 2010;55:1600-7.



IMT CV RF and Plaque

IMT and CV RF

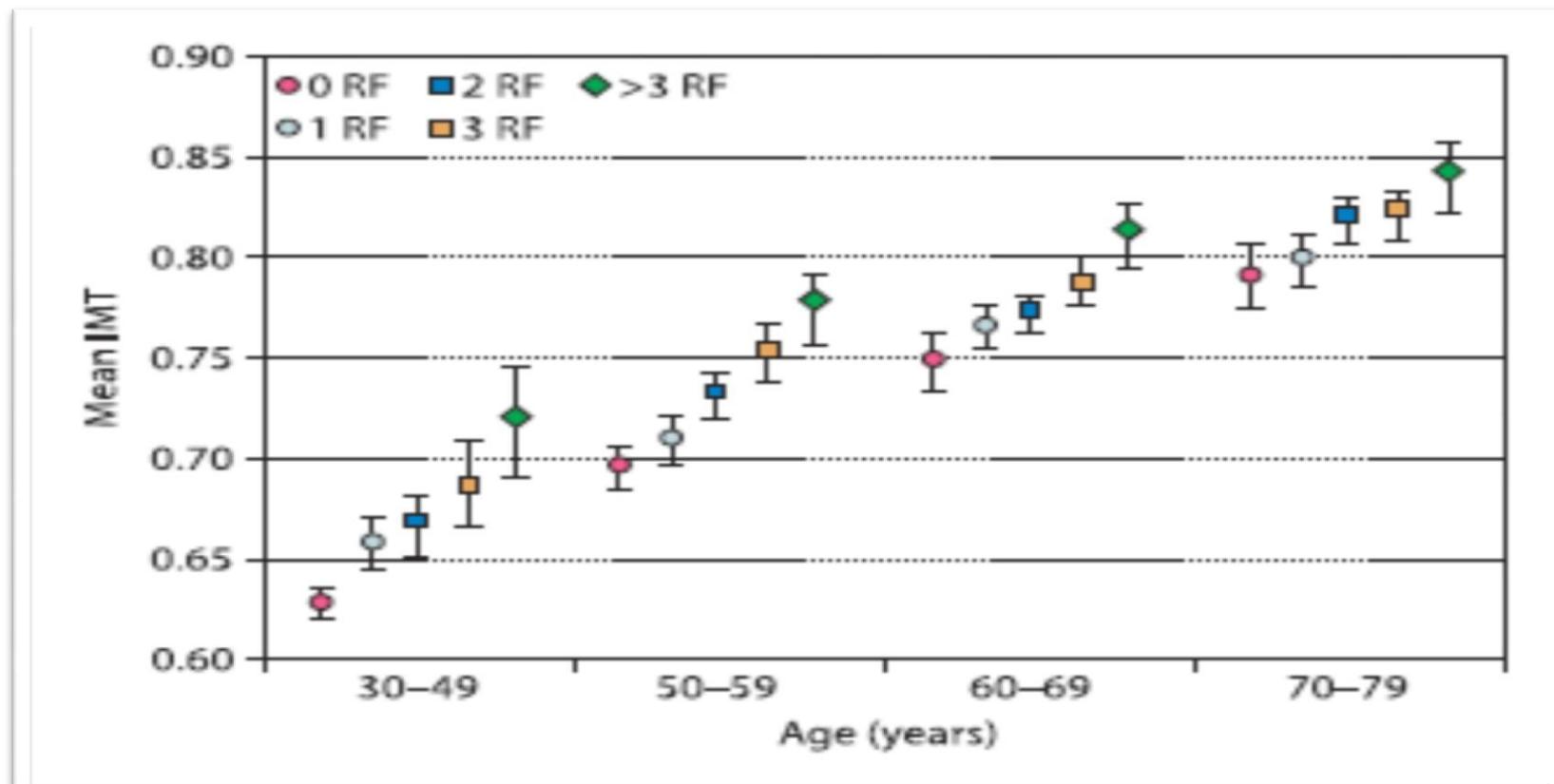
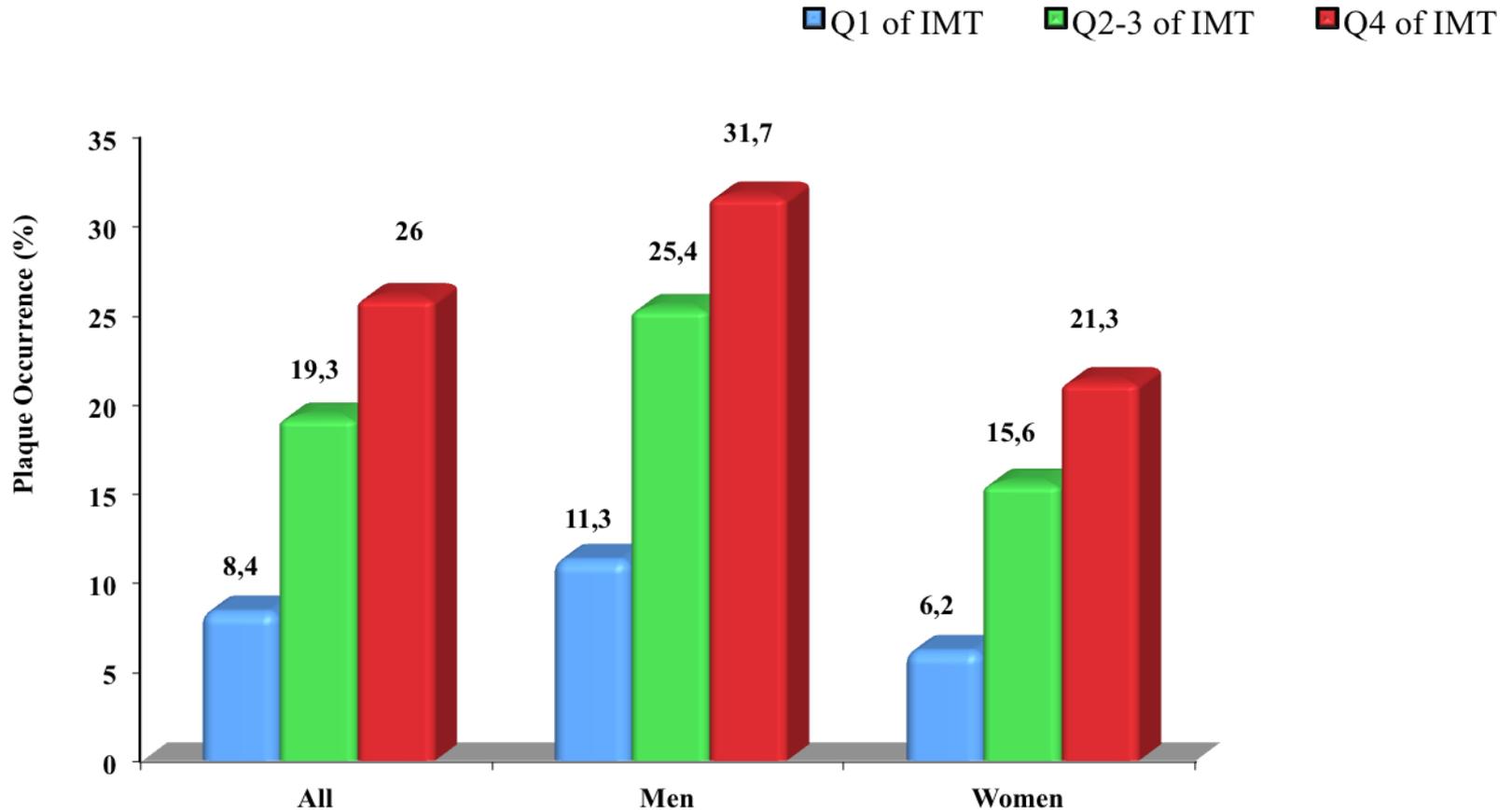


Fig. 2. Age-related quartiles of risk factors (RF). No patients between 30 and 39 years have >3 risk factors.

IMT and Plaque : EVA Study



CCA-IMT predicts Carotid Plaque Occurrence

CCA-IMT Predict Occurrence of New Carotid Plaques

TABLE 4. ORs and 95% CIs for Carotid Plaque Occurrence During Follow-Up Associated With Quartiles of Baseline CCA-IMT According to Presence of Carotid Plaques at Baseline

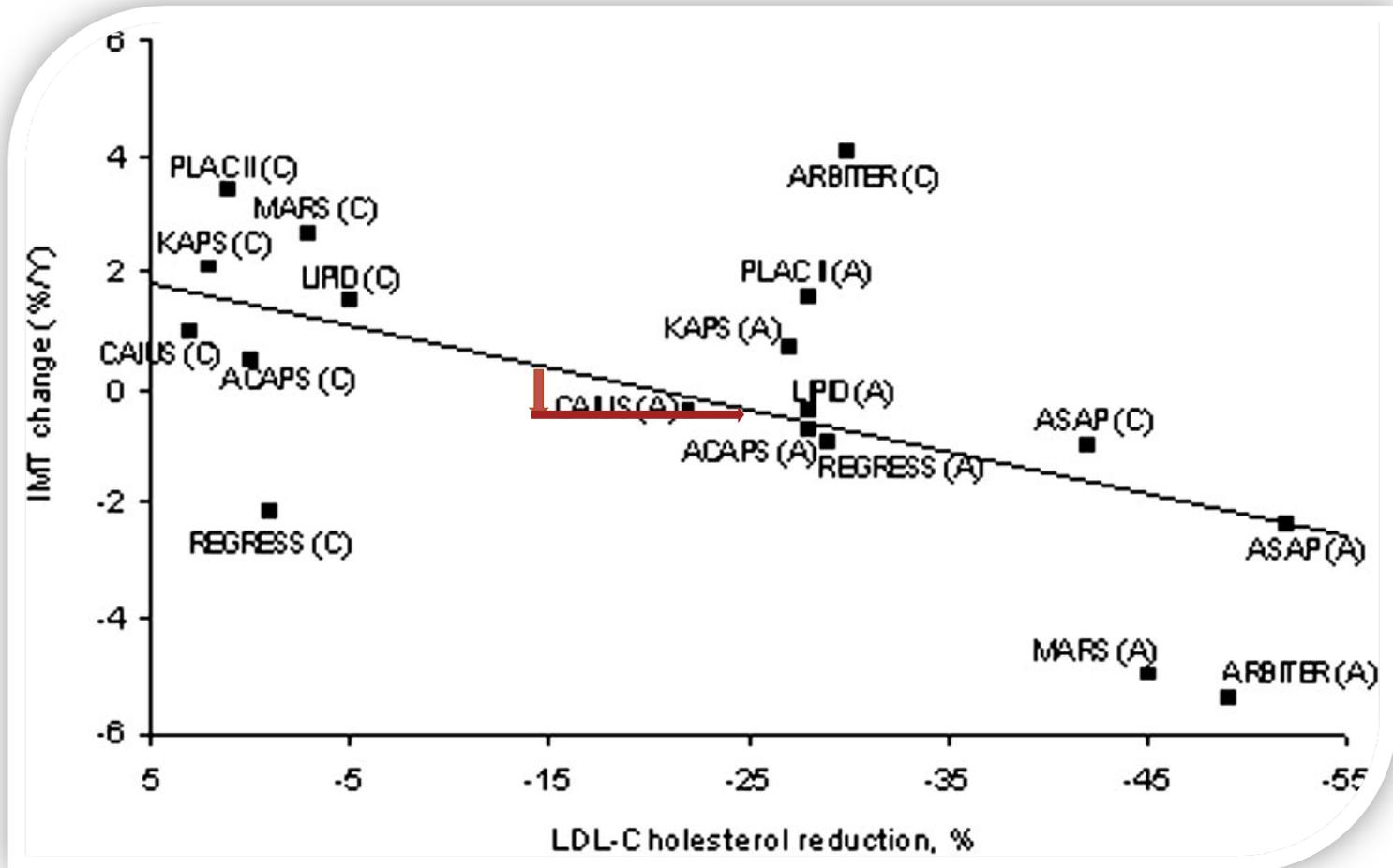
Presence of Carotid Plaques at Baseline	Quartile 1	Quartiles 2–3	Quartile 4
No			
n	197	461	156
Plaque occurrence, %	7.6	16.5	18.6
Age- and sex-adjusted OR	1	2.43 (1.35–4.36)†	2.66 (1.36–5.19)†
Multivariate-adjusted OR*	1	2.29 (1.27–4.12)†	2.43 (1.23–4.78)†
Yes			
n	29	100	67
Plaque occurrence, %	13.8	32.0	43.3
Age- and sex-adjusted OR	1	3.24 (1.03–10.20)‡	5.06 (1.56–16.41)†
Multivariate-adjusted OR*	1	3.28 (1.00–10.27)‡	5.24 (1.51–18.26)†

*Adjusted for sex and baseline age, history of smoking, hypertension (3 categories as in Table 2, 2 dummy variables), diabetes (3 categories as in Table 2, 2 dummy variables), hypercholesterolemia, and personal history of CHD.

† $P \leq 0.01$ and ‡ $P \leq 0.05$.

LDL-C Reduction and IMT change

Statins in Stroke prevention – Meta Analysis



For each 10% reduction in LDL-C ,0,73%/year IMT reduction (95% CI, 0.27 to 1.19).



IMT in Clinical Practice

Methodology

- Arterial sites
 - 1 to 6 sites on each side
 - Near and or far wall
- Image quality
 - Controlled only by education program
 - Controlled by electronic procedures
- Statistical bias
 - Induced by differences of variance across sites , structures , vessels.

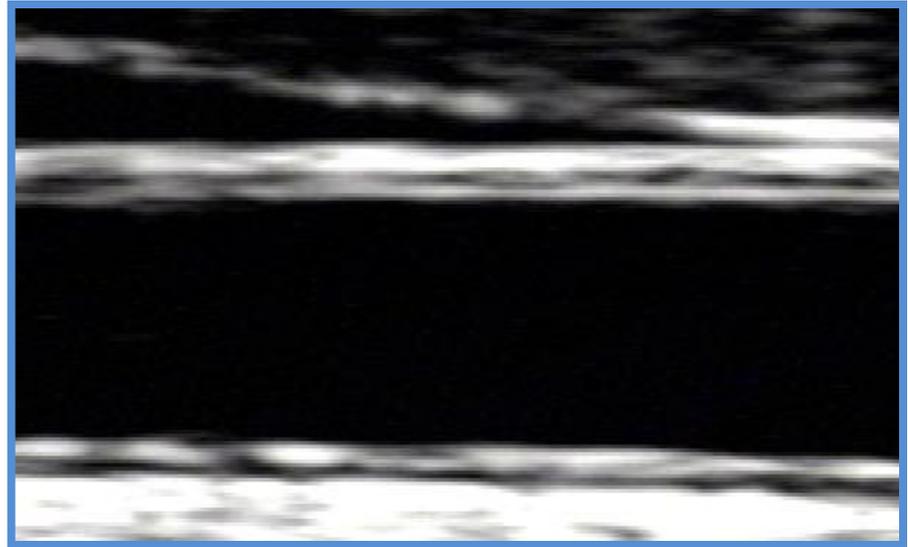
Control of IMT-Technical Issues

PATIENT	DEVICE	SONOGRAPHER	MEASUREMENT
1.Age	1.Frequency	1.Education	1.Manual
2.Tissue Echogenicity	2.Grey scale	2.Far Wall	2.Semi automatic
3.Neck Anatomy	3.Depth settings	3.CCA/C.Bif/OICA	3.Real time
4.Risk Factors	4.Gain settings	4.Left / Right	4.Software
5.Race	5.Frame rate	5.Plaque /No Plaque	5.Mean/Max
6.Gender	6.RF/Video	6.Number of Angles	6.Points or Segment(10mm)
7. Country			7.Cardiac cycle

Definition

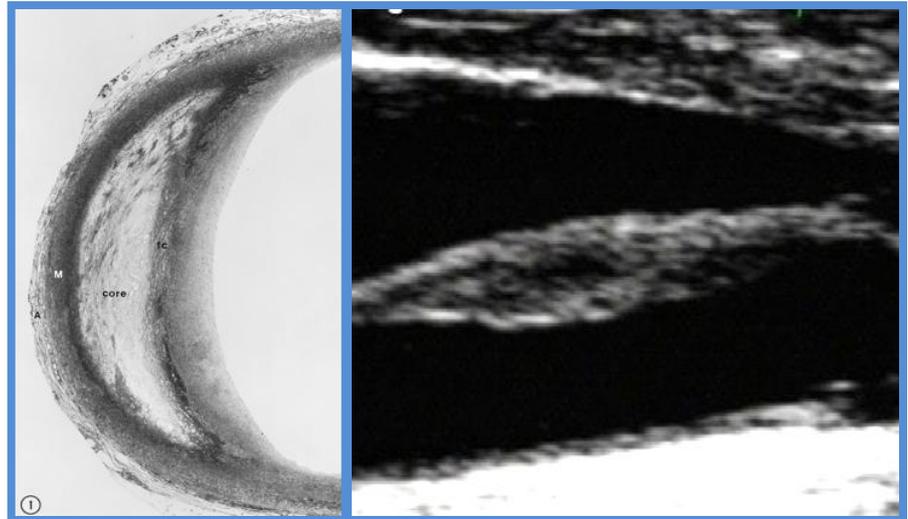
Intima Media Thickening

(1) IMT is a double-line pattern visualized by echotomography on both walls of the common carotid arteries in a longitudinal view.



Plaque

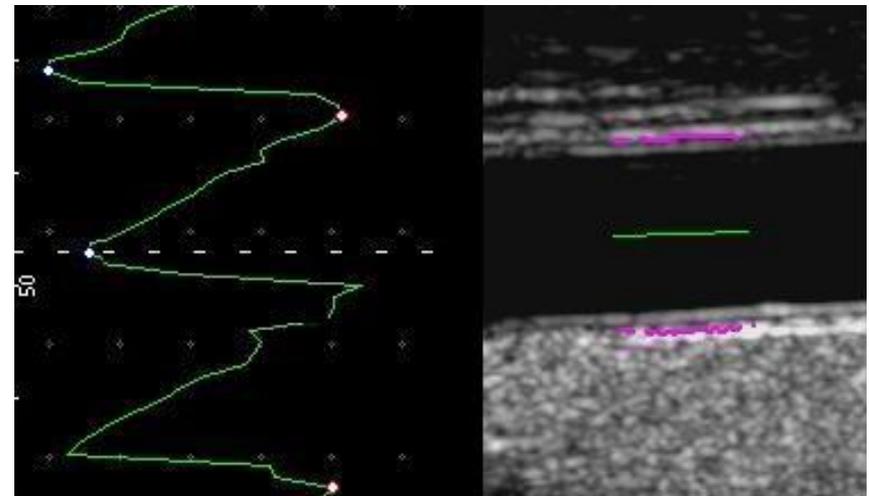
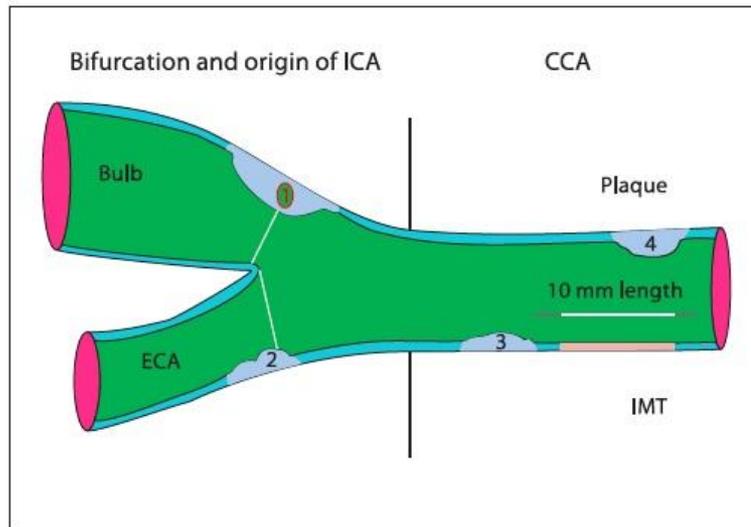
(2) Plaque is a focal structure encroaching into the arterial lumen of at least 0.5 mm or 50% of the surrounding IMT value or demonstrates a thickness of at least 1.5 mm as measured from the media-adventitia interface to the intima-lumen interface.



Atherosclerosis Monitoring : How to ?

Examination Procedure

- (1) Arterial wall segments should be assessed in a longitudinal view, strictly perpendicular to the ultrasound beam.
- (2) Both walls should be clearly visualized in order to achieve diameter measurements. The optimal diameter should be obtained during diastole by automatic cineloop detection or by looking for the minimal diameter during the cardiac cycle



VITA Project: References IMT values in Italy

Table 2 Percentile analysis of carotid intima-media thickness (CIMT) for different age classes

Age	n	Percentile (95% confidence interval around the percentile)				
		20th	40th	60th	80th	97.5th
< 50 years						
Female	269	0.58 (0.57–0.59)	0.60 (0.60–0.61)	0.63 (0.62–0.64)	0.65 (0.65–0.66)	0.71 (0.70–0.79)
Male	220	0.58 (0.58–0.59)	0.61 (0.60–0.62)	0.64 (0.63–0.66)	0.68 (0.67–0.69)	0.77 (0.75–0.95)
All	489	0.58 (0.58–0.59)	0.61 (0.61–0.63)	0.63 (0.63–0.64)	0.67 (0.66–0.67)	0.75 (0.74–0.76)
50–55 years						
Female	481	0.60 (0.59–0.61)	0.63 (0.62–0.64)	0.65 (0.65–0.67)	0.69 (0.69–0.79)	0.80 (0.77–0.83)
Male	367	0.60 (0.59–0.61)	0.64 (0.63–0.65)	0.67 (0.67–0.68)	0.73 (0.71–0.75)	0.85 (0.82–0.86)
All	848	0.60 (0.60–0.61)	0.63 (0.63–0.64)	0.67 (0.66–0.67)	0.70 (0.70–0.71)	0.82 (0.81–0.82)
55–60 years						
Female	429	0.62 (0.62–0.63)	0.66 (0.65–0.67)	0.69 (0.68–0.70)	0.73 (0.72–0.74)	0.83 (0.82–0.88)
Male	387	0.61 (0.61–0.62)	0.66 (0.65–0.67)	0.70 (0.69–0.71)	0.77 (0.75–0.79)	0.94 (0.88–1.00)
All	816	0.62 (0.61–0.63)	0.66 (0.65–0.67)	0.70 (0.69–0.70)	0.75 (0.73–0.75)	0.87 (0.86–0.88)
> 60 years						
Female	195	0.63 (0.62–0.64)	0.66 (0.65–0.69)	0.70 (0.69–0.73)	0.76 (0.74–0.77)	0.88 (0.86–1.00)
Male	136	0.63 (0.62–0.65)	0.67 (0.66–0.70)	0.73 (0.71–0.73)	0.78 (0.77–0.81)	0.89 (0.86–0.94)
All	331	0.63 (0.62–0.64)	0.67 (0.66–0.68)	0.72 (0.70–0.73)	0.77 (0.76–0.78)	0.88 (0.88–0.90)
Overall	2484	0.60 (0.60–0.61)	0.64 (0.64–0.64)	0.67 (0.67–0.68)	0.73 (0.72–0.73)	0.85 (0.84–0.87)

Cut-off values for percentiles corresponding to quintiles and 97.5th percentile are reported for four different age classes by gender and for the overall studied population.

Use of Carotid ultrasound to Identify Subclinical Vascular Disease and Evaluate Cardiovascular Disease Risk

Population to be addressed

FRS 6% to 20%

- **Excludes :**

PAD,CHD,Abdom.

Aneurysm,Diabetes

- Family history of premature CVD
- Individuals under 60 with 1 severe risk factor.
- Women <60 y with 2 or more CVD RF
- Not in patients with established CVD.
- No need to monitor in clinical practice.

IMT Methodology = Mannheim Consensus

Mannheim Consensus & ASE Statement

Use of Carotid ultrasound to Identify Subclinical Vascular Disease and Evaluate Cardiovascular Disease Risk

- CIMT values > 75th percentile : high risk of CVD
- Appropriate training for sonographers and readers.
 - Ultrasound background
 - Medical education on CVD risk
 - Technical issues : signal acquisition and processing
 - Hands on supervised training
 - Sonographer Certification
 - Certification maintenance.

IMT in Clinical Practice

Rapport échographique EIMC

Identifiant : DggBJvL19G Nom patient : Charles DUPONT
 Date de naissance : 14/03/1960 Numéro de visite : 1
 Etablissement ou cabinet : Cabinet Medical Praticien : Pierre-Jean Touboul



Droite

Épaisseur Intima Media. Moy = 0,526 mm. Max = 0,615 mm

Gauche



Épaisseur Intima Media. Moy = 0,794 mm. Max = 0,914 mm

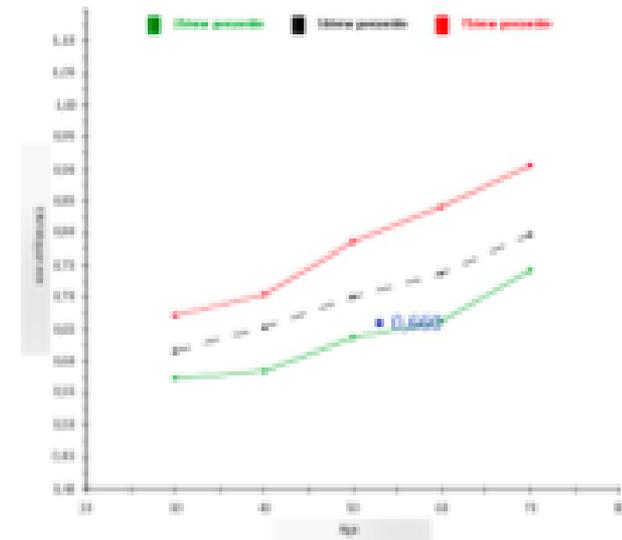
Charles DUPONT

22/06/2014

Moyenne

Âge	25ème percentile	50ème percentile	75ème percentile
30	0,574	0,618	0,672
40	0,588	0,663	0,708
50	0,637	0,701	0,767
60	0,663	0,738	0,842
70	0,743	0,798	0,907

Abaque : Europe, France, 30-79 years, PARC 2009 (Mean)



Conclusion

- IMT is not plaque . Both predicts occurrence of CV events
- IMT and plaque integrate Conventional RF/ Genetic / environment F
- IMT/Plaque => vascular phenotype for individuals
- Easy to get on conventional ultrasound carotid examination
- > 75th percentile : high risk.
- May benefit to individuals at intermediate risk in order to :
 - Evaluate early vascular damage
 - Focus on RF therapy control
 - Help the patient to be aware of potential disease
 - To increase awareness of physicians
 - Delay the first cardio vascular events and improve the quality of life.