A SMARTool project workshop

CAD RISK PREDICTION AND STRATIFICATION: THE ICT APPROACH

Scientific and Clinical Framework of the SMARTool Project

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IFC CNR Pisa, Italy

Tuesday 6th November 2018

CNR Research Area Campus
Building A, Room 27
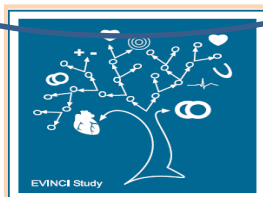via Moruzzi, 1 Pisa - Italy

FROM FP7 TO
HORIZON 2020 EU PROJECTS

CTA,
CA, IVUS, MRI,
BIOMARKERS

RTreat

FP7-ICT, 2007-2013

CTA,
CA, SPECT, PET,
MRI,
BIOMARKERS

EVINCI Study

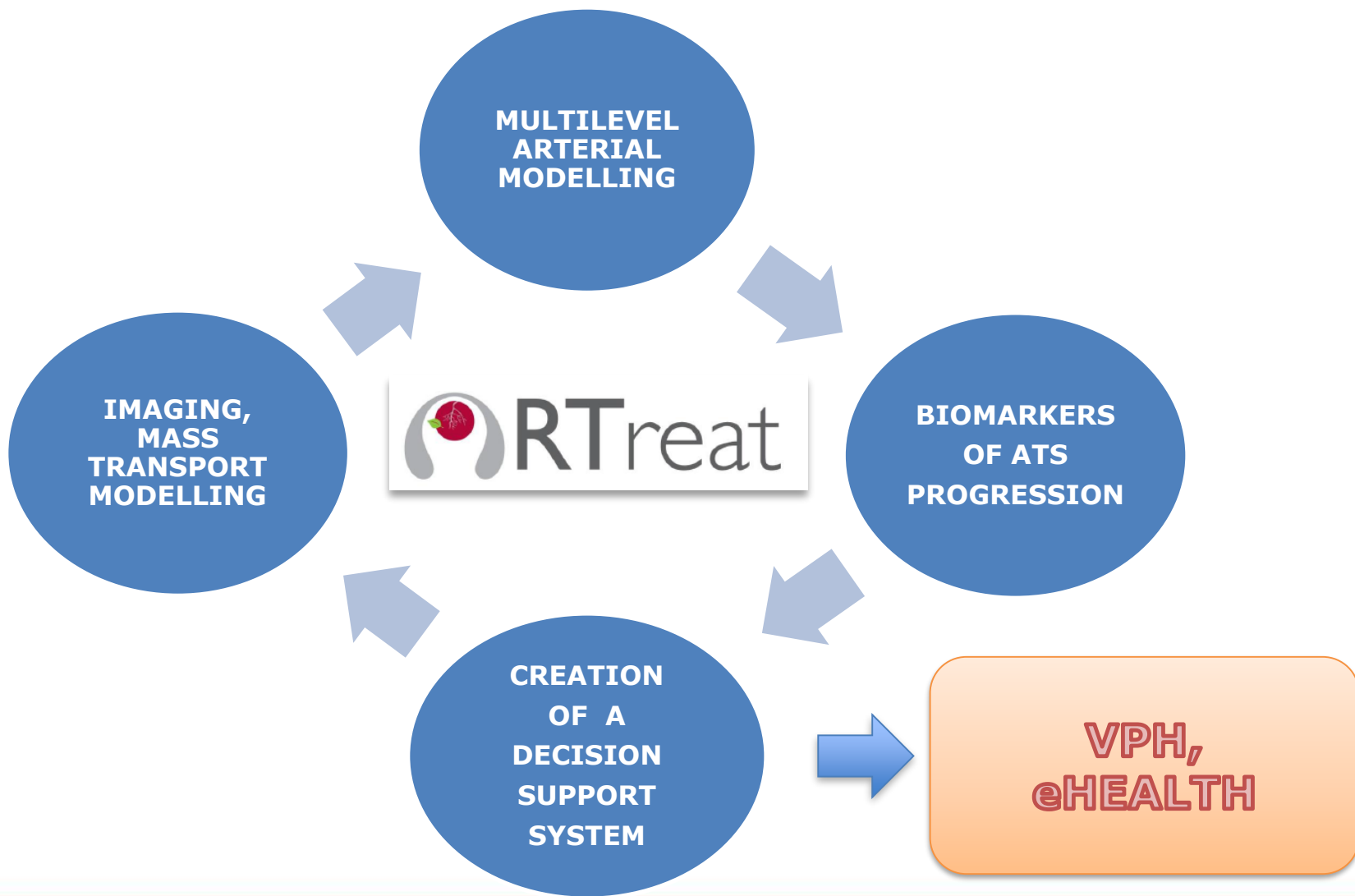**EVINCI FP7-Health, 2009-2012**

CTA,
BIOMARKERS

SMARTool

A clinical decision support tool
for prediction of CAD progression
through a personalized
e-Health approach.
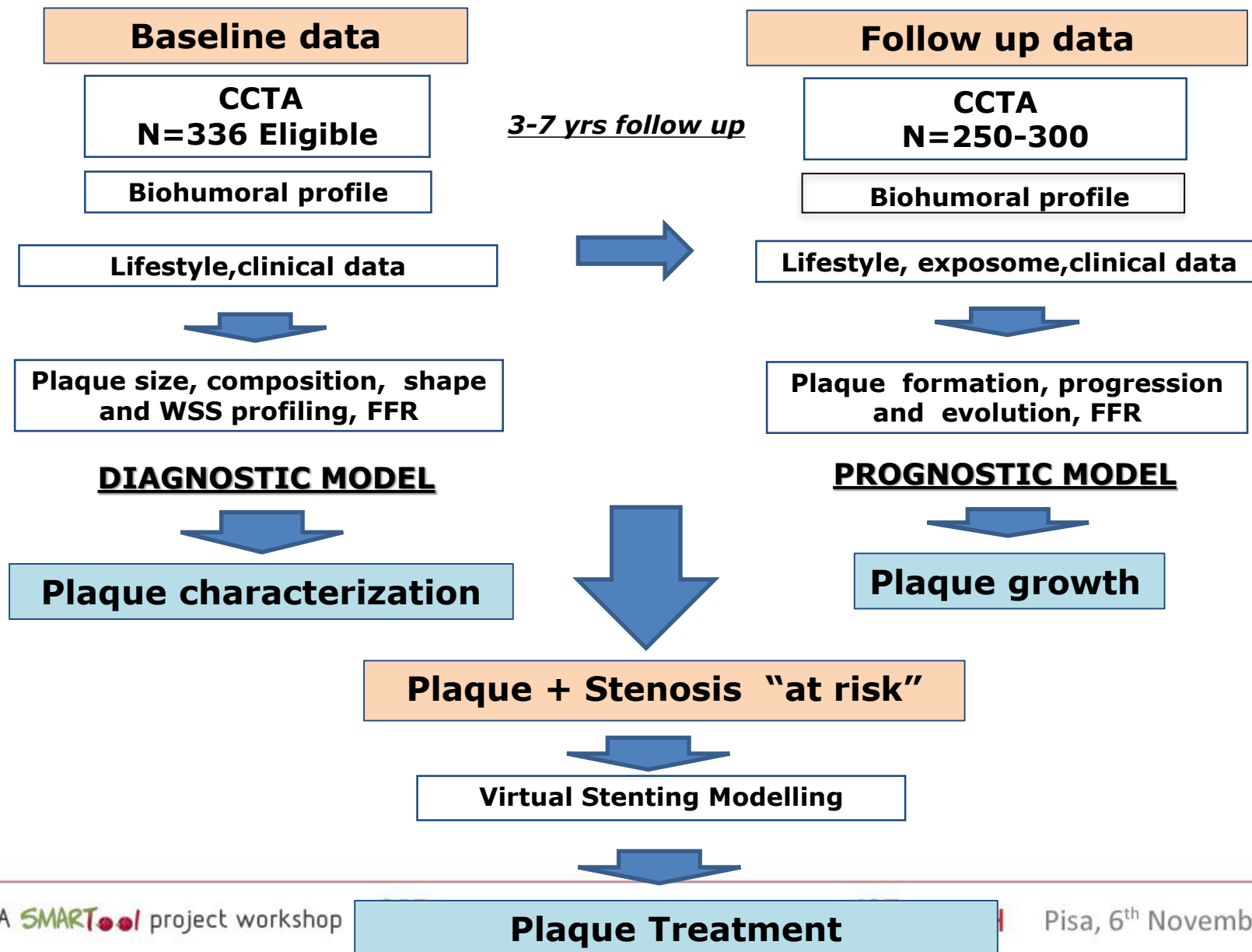
PHC30 - ICT, 2016-2019

ARTreat END-POINT AND IMPACT

MULTILEVEL ARTERIAL MODELLING

IMAGING, MASS TRANSPORT MODELLING

BIOMARKERS OF ATS PROGRESSION

CREATION OF A DECISION SUPPORT SYSTEM

VPH, eHEALTH

EVINCI END-POINT AND IMPACT

IMAGING PERFORMANCE IN SIGNIFICANT CAD

MULTI IMAGING FOR CAD DETECTION

BIOMARKERS FOR RISK STRATIFICATION

CLINICAL DECISION SUPPORT

HEALTHCARE ESC, ESCVI
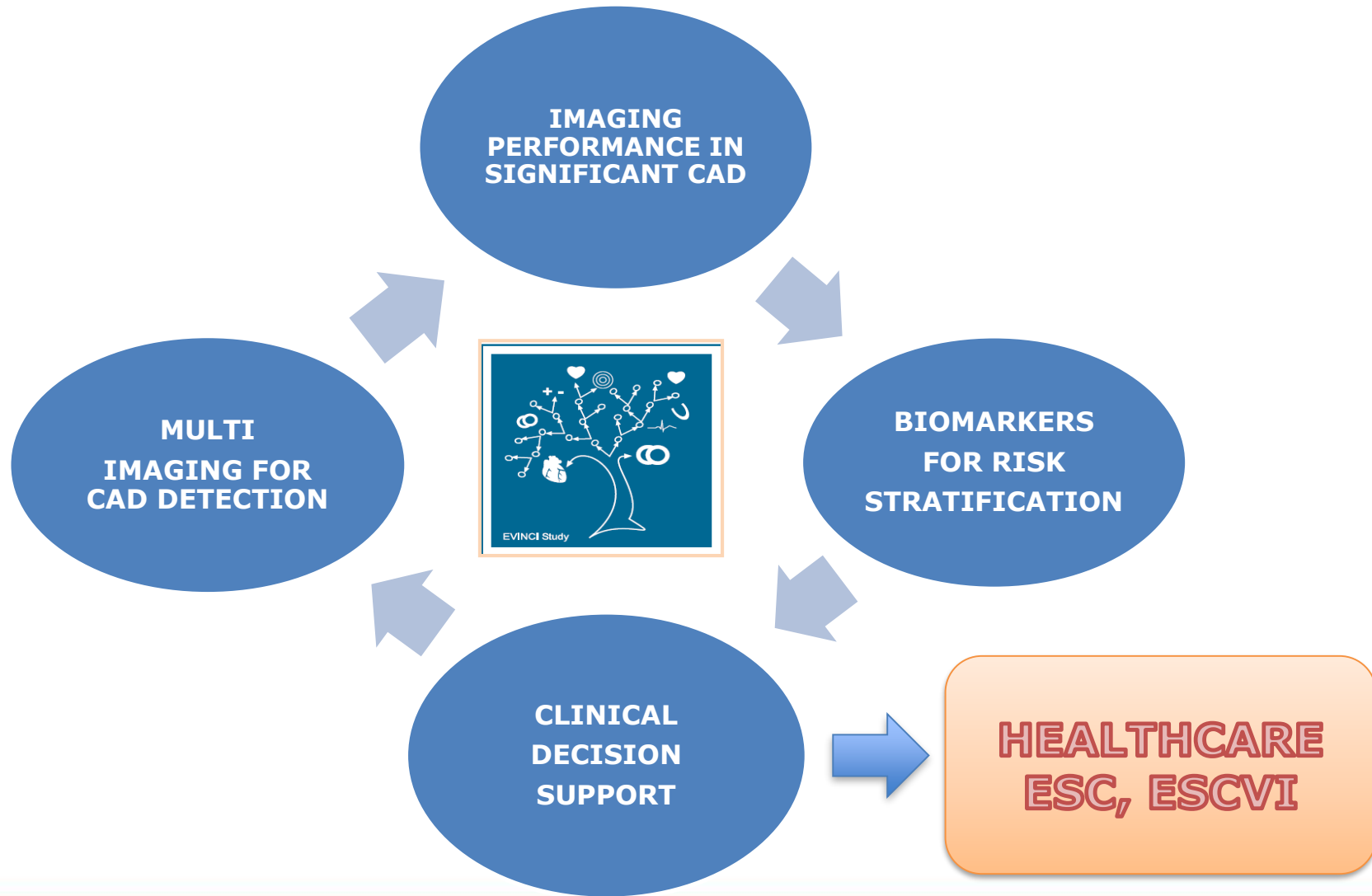
CLINICAL DATA FOR SMARTool MODEL IMPLEMENTATION/VALIDATION

Baseline data		Follow up data
CCTA **N=336 Eligible**	*3-7 yrs follow up*	**CCTA** **N=250-300**
Biohumoral profile		Biohumoral profile
Lifestyle,clinical data		Lifestyle, exposome,clinical data
Plaque size, composition, shape and WSS profiling, FFR		Plaque formation, progression and evolution, FFR
DIAGNOSTIC MODEL		**PROGNOSTIC MODEL**
Plaque characterization		**Plaque growth**

Plaque + Stenosis "at risk"

Virtual Stenting Modelling

Plaque Treatment

Underlying idea: a multilevel approach to a multifactorial disease

Local level → **CAD /MACE** ← **Systemic level**

KET Lab.On.Chip

CTA
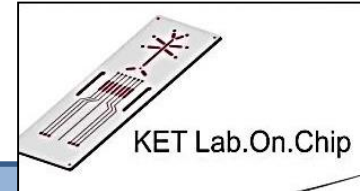
Coronary Anatomy

3D geometry, plaque composition, features, progression over time

+ **Coronary Function**

flow profile, WSS and vFFR

↓

Plaque risk

Models

Patient Blood Genotype
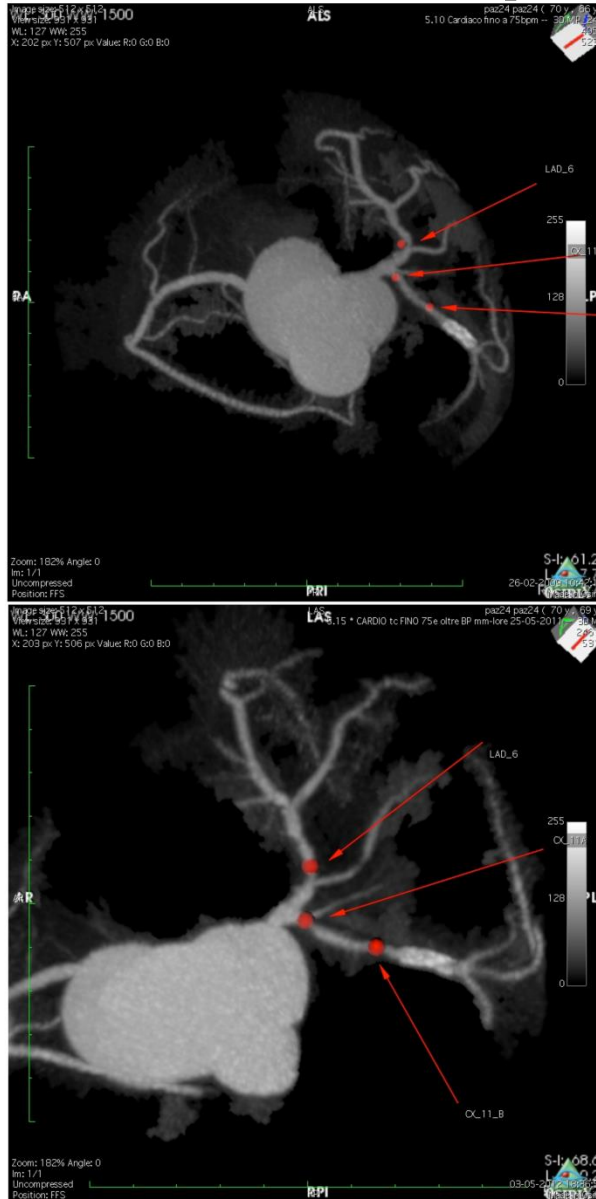
DNA, RNA

+

Patient Blood Phenotype

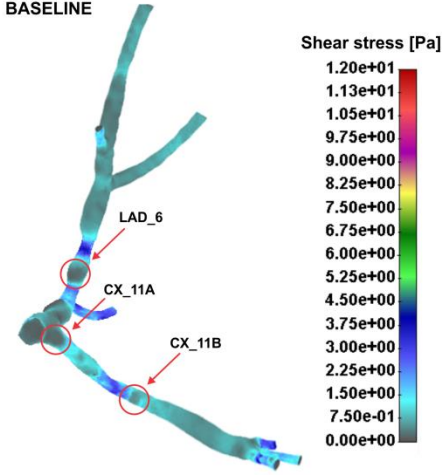Lipidomics, inflammation Molecules/MN markers

↓

Patient risk

LOC

On cloud PLATFORM

3dnet

SMARTool platform

- ❖ **Patient-specific repository of imaging and non imaging data**
- ❖ **Integrated models of plaque/patient risk**
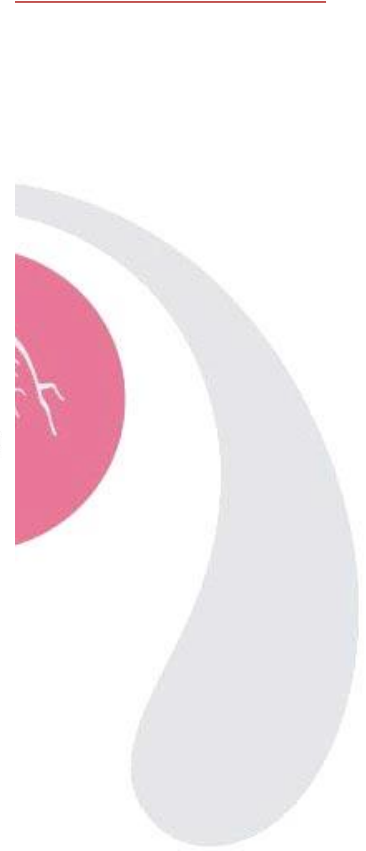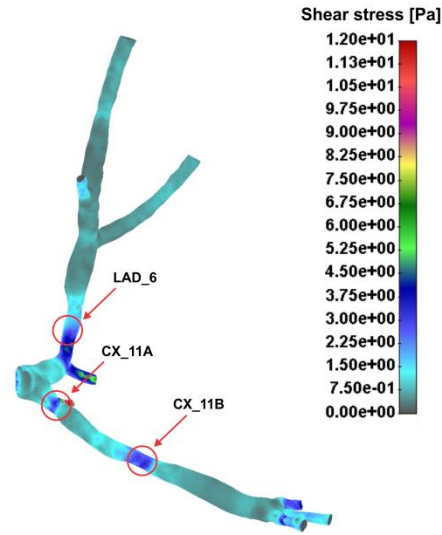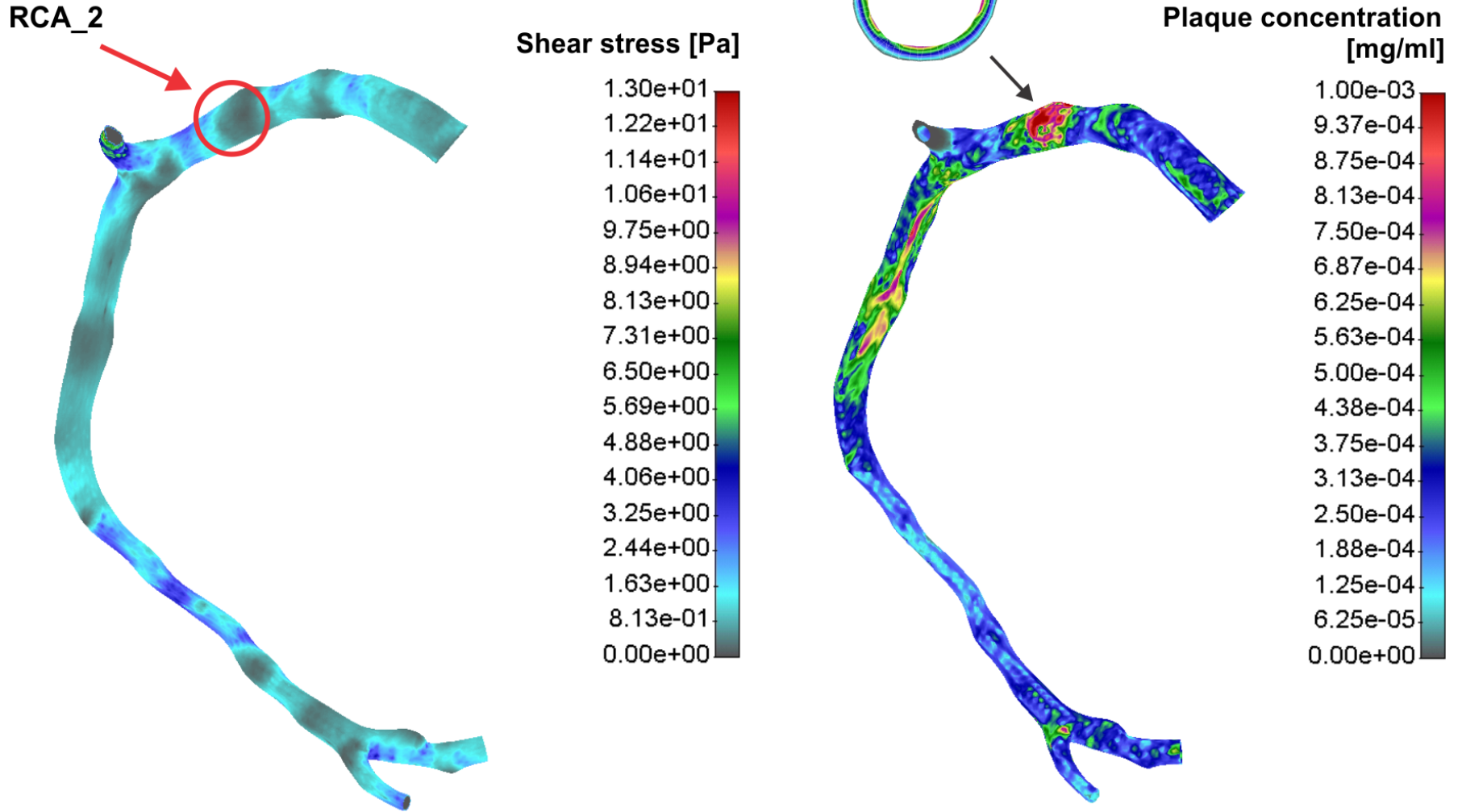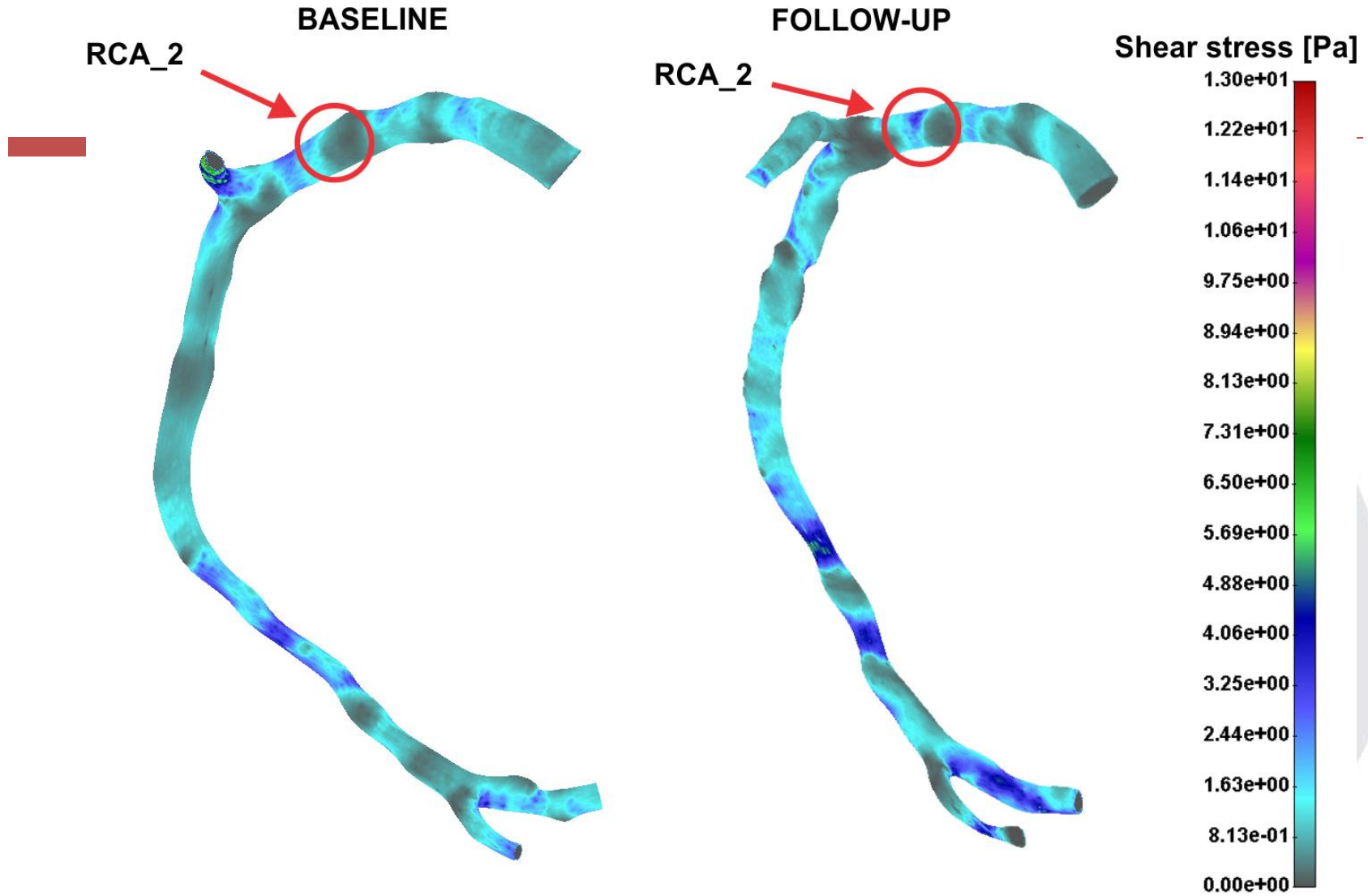- ❖ **On cloud patient-specific CDSS**

CNR patient #24

CNR patient #17

RCA_2

Shear stress [Pa]

1.30e+01
1.22e+01
1.14e+01
1.06e+01
9.75e+00
8.94e+00
8.13e+00
7.31e+00
6.50e+00
5.69e+00
4.88e+00
4.06e+00
3.25e+00
2.44e+00
1.63e+00
8.13e-01
0.00e+00

Plaque concentration
[mg/ml]

1.00e-03
9.37e-04
8.75e-04
8.13e-04
7.50e-04
6.87e-04
6.25e-04
5.63e-04
5.00e-04
4.38e-04
3.75e-04
3.13e-04
2.50e-04
1.88e-04
1.25e-04
6.25e-05
0.00e+00

CNR patient #17

BASELINE

FOLLOW-UP

RCA_2

RCA_2

Shear stress [Pa]

1.30e+01
1.22e+01
1.14e+01
1.06e+01
9.75e+00
8.94e+00
8.13e+00
7.31e+00
6.50e+00
5.69e+00
4.88e+00
4.06e+00
3.25e+00
2.44e+00
1.63e+00
8.13e-01
0.00e+00
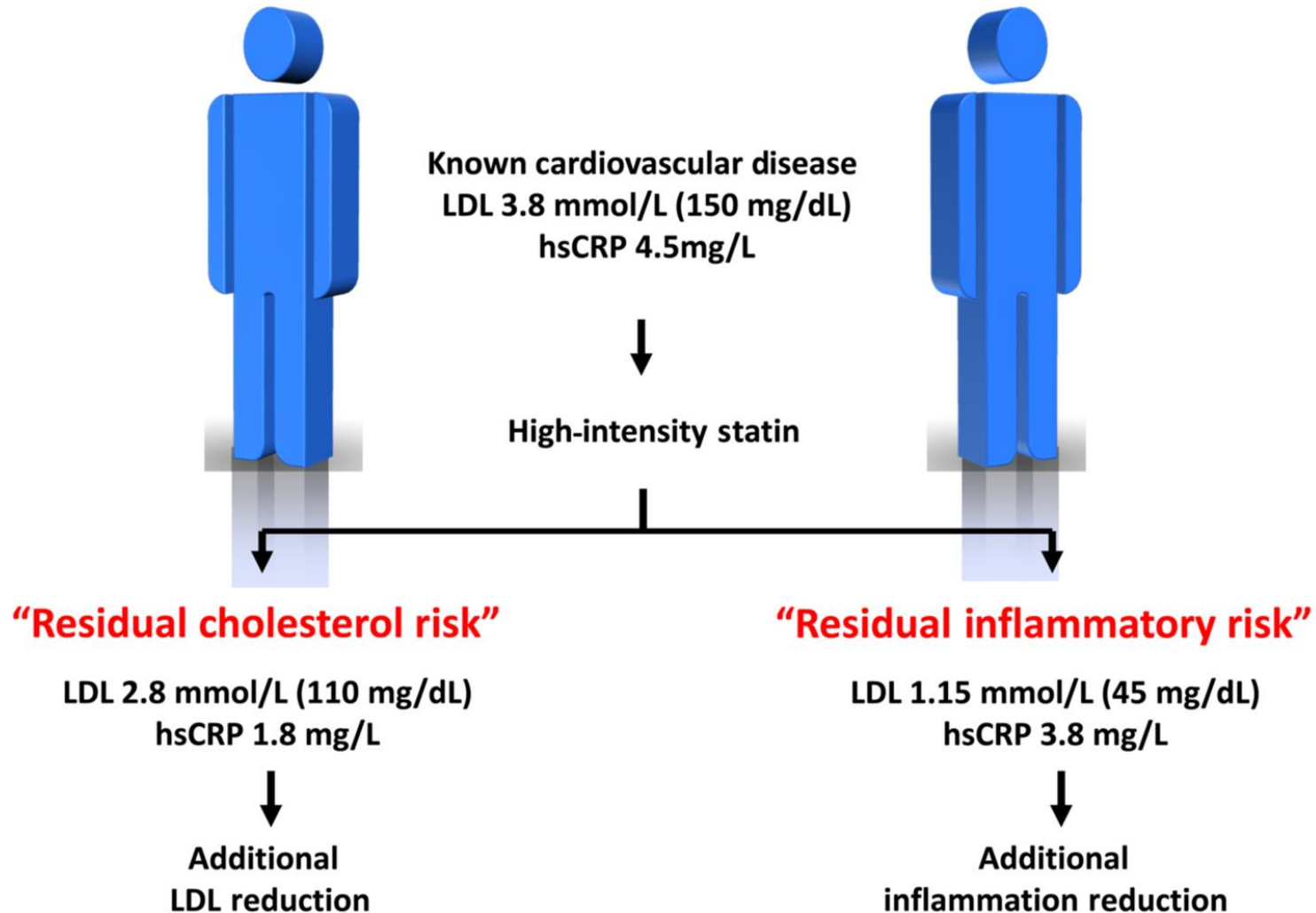
SMARTool END-POINT AND IMPACT
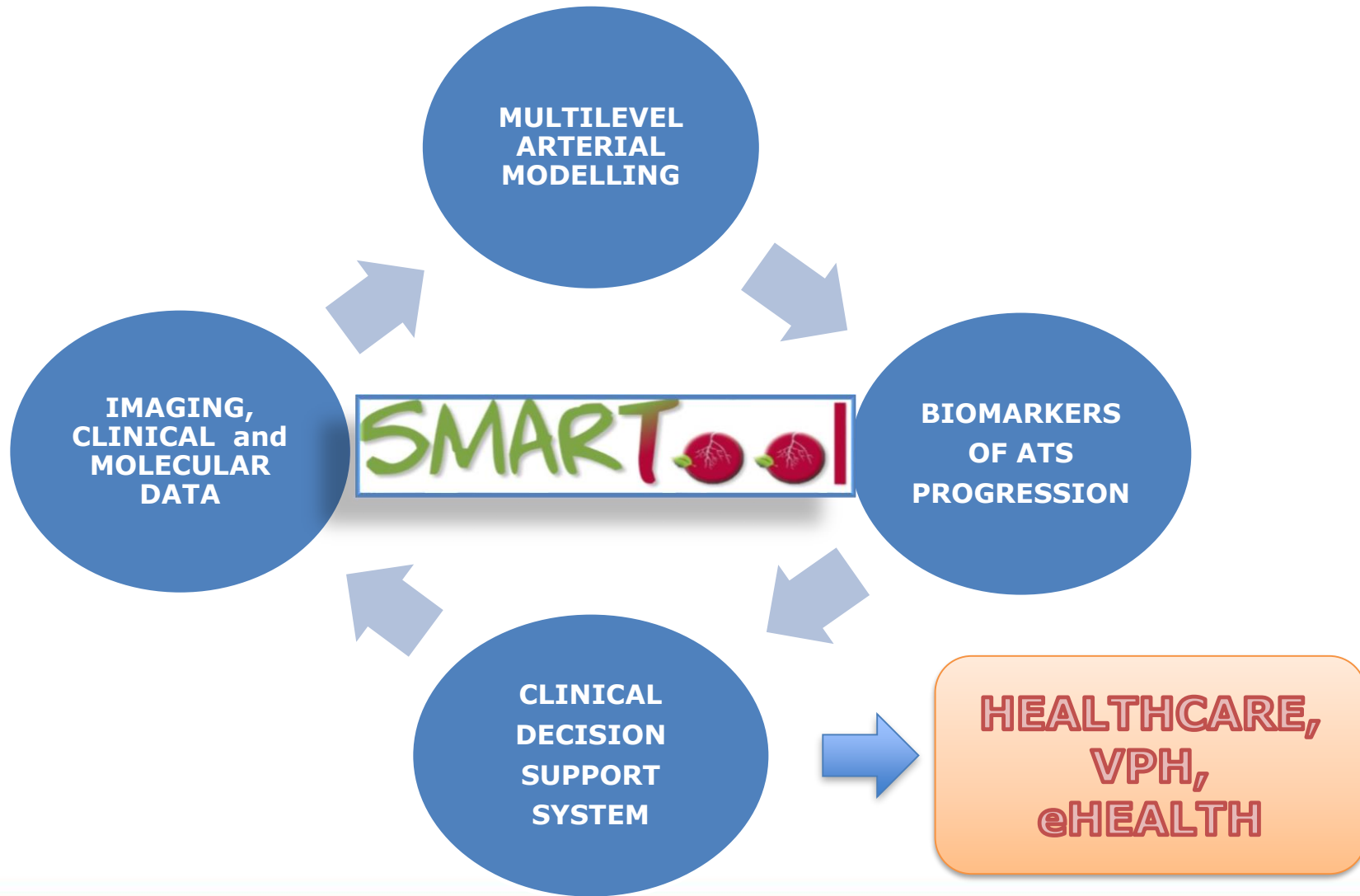
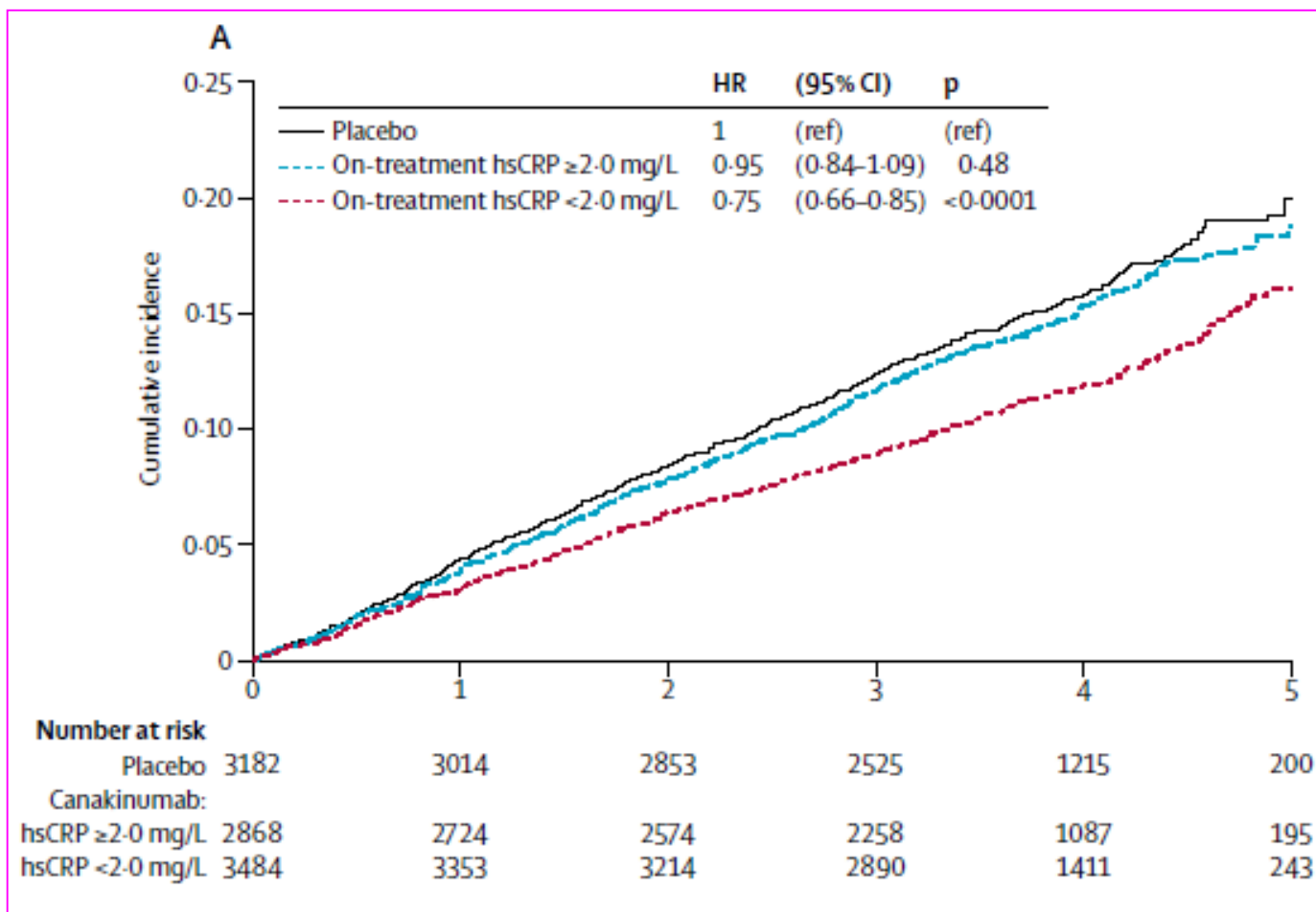# RESPONSE TO ANTI-INFLAMMATORY TREATMENT PROVIDES CV BENEFIT
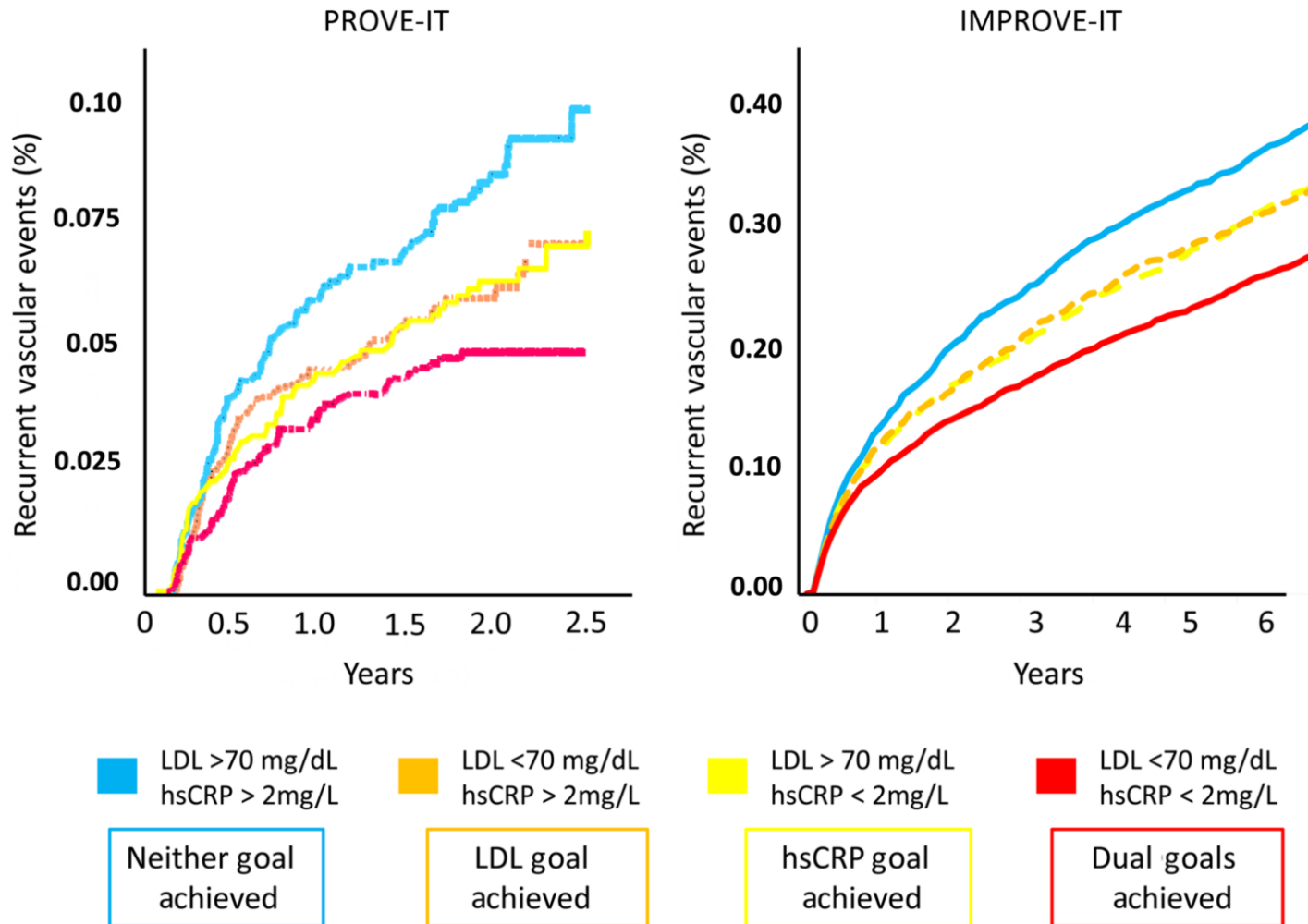
Differential secondary prevention: treatment options for statin-treated patients

Known cardiovascular disease
LDL 3.8 mmol/L (150 mg/dL)
hsCRP 4.5mg/L

High-intensity statin

"Residual cholesterol risk"

LDL 2.8 mmol/L (110 mg/dL)
hsCRP 1.8 mg/L

Additional
LDL reduction

"Residual inflammatory risk"

LDL 1.15 mmol/L (45 mg/dL)
hsCRP 3.8 mg/L

Additional
inflammation reduction

Cumulative incidence of CV events according to Kanakinumab effects on hsCRP

P.M. Ridker C ANTOS Study, Lancet 2018; 391:319

Exploitation of SMARTool Project in clinical practice

➤ SMARTool project has potential to provide comprehensive information on CAD progression

➤ Local model of plaque growth, PIM for risk stratification, or on-cloud integrated platform for CDSS represent different options offered to the specialist for better management of CAD patients

➤ Patient-specific CDSS, including residual lipid and inflammatory risk, may correctly approach the choice of innovative drugs proposed for prevention of ATS burden and progression

SMARTool Questionnaire

- 6 sections
  - Generic questions
  - System usage scenarios
  - Risk Stratification DSS
  - CCTA Imaging DSS
  - DSS for Treatment of CAD patients (Virtual Stenting)
  - Functional aspects (device choice, interface)

- Please give your feedback by the questionnaire provided to You today or online on SMARTool homepage (www.smartool.eu)