

# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE



European Heart Journal  
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ESC REPORT

### The appropriate and justified use of medical radiation in cardiovascular imaging: a position document of the ESC Associations of Cardiovascular Imaging, Percutaneous Cardiovascular Interventions and Electrophysiology

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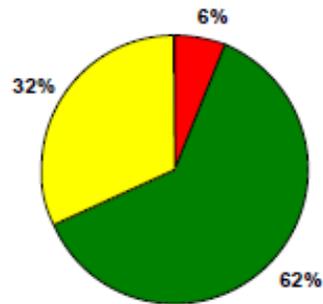
E. Picano, EU scientific seminar Nov 2013

[http://ec.europa.eu/energy/nuclear/radiatio\\_protection/seminars/scientific\\_seminar\\_en/htm](http://ec.europa.eu/energy/nuclear/radiatio_protection/seminars/scientific_seminar_en/htm)

# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

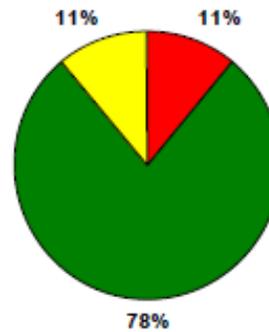
## THE 5 A'S FOR EUROPE: APPROPRIATENESS

**Stress echocardiography**



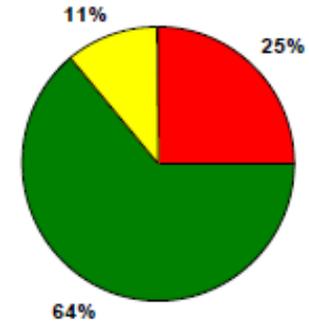
*Picano E, Marwick TH. Am Heart J 2007*

**Cardiac CT**



*Ayyad AE et al. J Cardiovasc Comput Tomogr. 2009*

**Stress Scintigraphy**



*Gibbons, Pellikka et al. JACC 2008*

**Appropriate**      **Partially inappropriate**      **Inappropriate**

**Stop paying quantity (with public money),  
start paying appropriateness**

# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: APPROPRIATENESS

Development of common **guidelines** with all imaging modalities

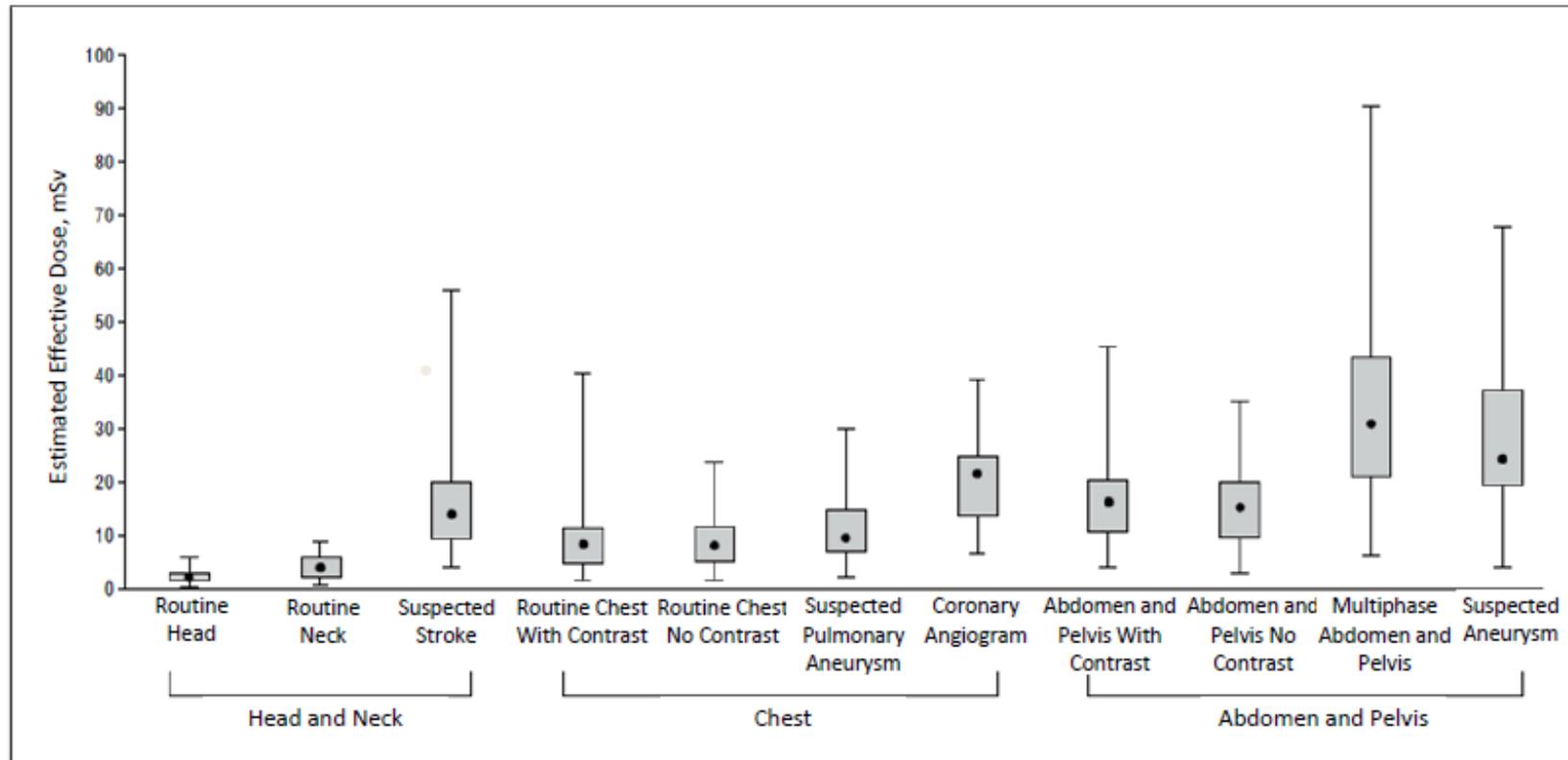
Clinically-based diagnostic algorithms

Re-evaluate them on a regular basis



# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: AUDIT



Rebecca Smith-Bindman et al. Arch Intern Med 2009;169(22):2081.

ARCHIVES OF  
INTERNAL MEDICINE

**The truly given dose in mSv should be spelled-out in the written report (you know what you did)**

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# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: AUDIT

Diagnostic reference levels are to be defined (DRLs)

The change in practice will be monitored

(The change in practice can be monitored locally)

This will first occur for so-called diagnostic CTs

DICOM compliant RDSR (radiation dose structured report)



# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: AWARENESS

**Table 6** Terminology that should be used

Investigation (example)	Effective dose range	Additional lifetime risk of fatal and non-fatal cancer	RCR symbolic representation	Proposed risk term
CXR	<0.1 mSv	1:1 million		Negligible
Abdominal X-ray	0.1–1 mSv	1 in 100 000 to 1 in 1 million		Minimal
Chest CT	1–10 mSv	1 in 10 000 to 1 in 1000		Very low
PCI	10–100 mSv	1 in 1000 to 1 in 100		Low

These examples relate to a healthy 50-year-old man. Multiply by 1.38 for women, by 4 for children, and by 0.5 (reduced by 50%) in an 80-year-old man. Adapted from references 18,48, and 49.

CXRs, chest X-rays; RCR, Royal College of Radiology; PCI, percutaneous coronary intervention.

 <0.1 mSv;  0.1–1 mSv;  1–10 mSv;  >10 mSv.

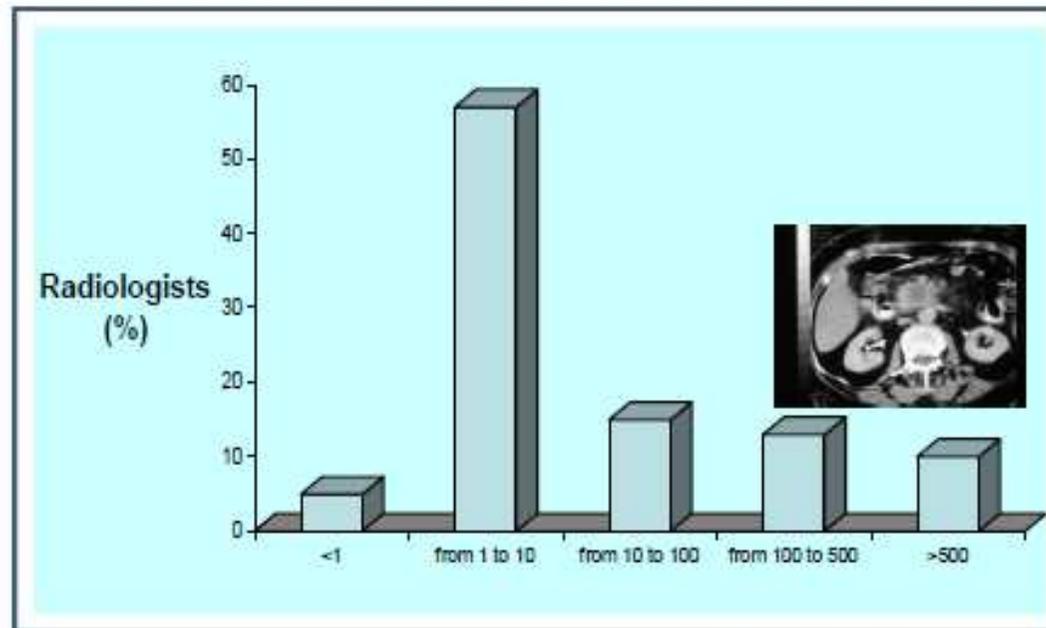
*Picano E, et al. Eur Heart J doi: 10.1093/eurheartj/eh394*

*E. Picano, EU scientific seminar Nov 2013*



# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: ACCOUNTABILITY



Lee TH et al. *Radiology*. 2004;231:393-8

### Dose abdomen CT =500 CXR's

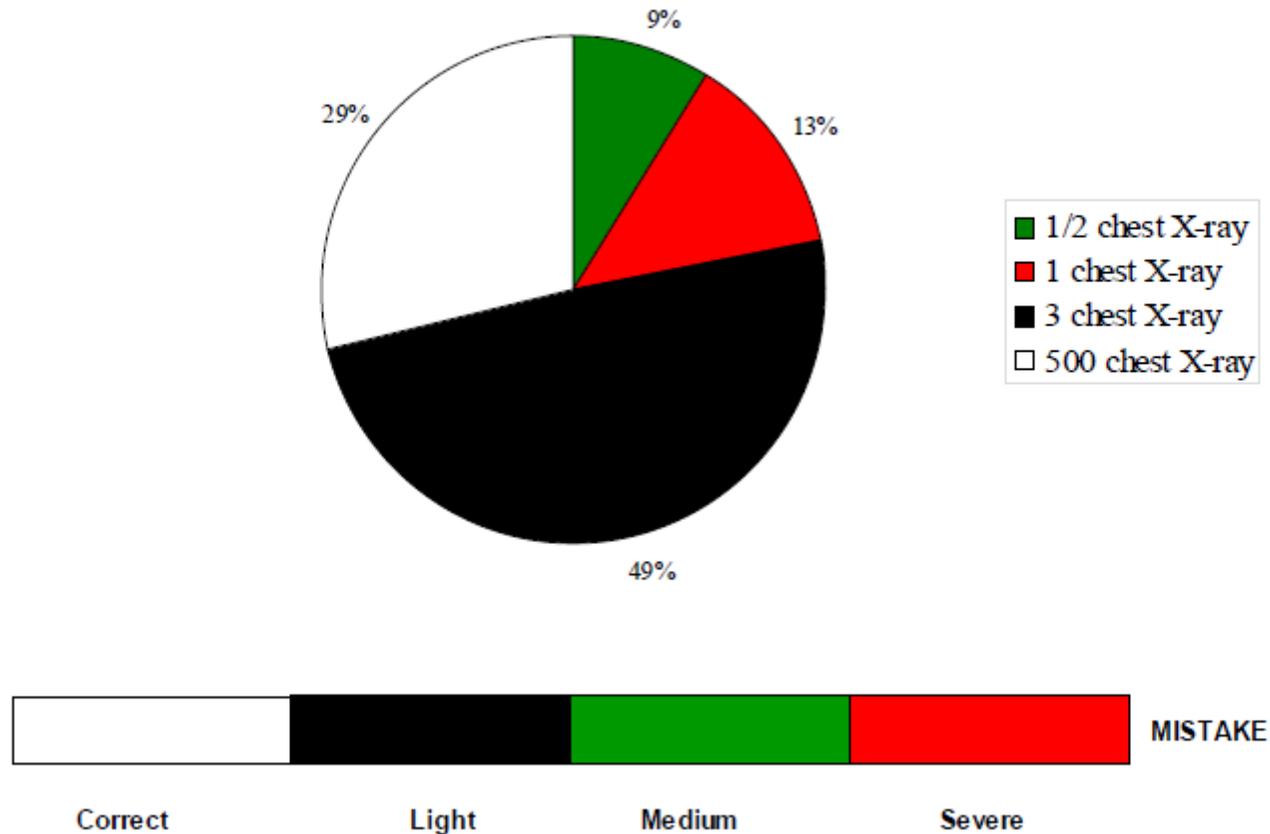
- 20% of internists believe MRI is ionizing (Shiralkar. *BMJ* 2004)
- 12% of pediatricians think scintigraphy is non-ionizing (Thomas et al. *Pediatr Radiol*, 2006)
- 60% of cardiologists underestimate of 500 times the dose of a scintigraphy (Correia et al. *Int J Cardiol*, 2005)
- 22% of interventional radiologists do not wear dosimeter (Kottou et al. *Radiat Prot Dosimetry*, 2001)
- 81% of the interventional cardiology fellows did not know their radiation exposure (Kim C, *Am J Cardiol* 2010)

**There is no cut-off value between high or low dose:  
but the certainly wrong dose is the one we ignore**

# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: ACCOUNTABILITY

### Dose of Myocardial perfusion scintigraphy



Correia, Picano. *Int J Cardiol* 2005

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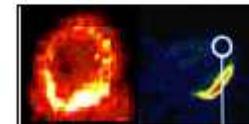
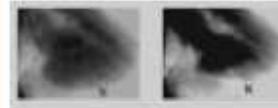
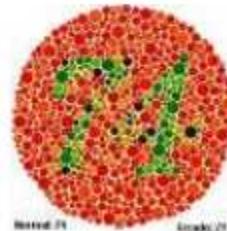
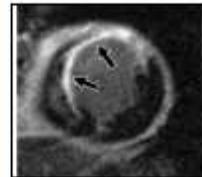
## THE 5 A'S FOR EUROPE: ACCOUNTABILITY AND AWARENESS

### Radiologic daltonism

20% believes MRI is ionizing

•10% believes ultrasound is ionizing

*Shiralkar S et al, BMJ 2003*



4 % thinks US are ionizing

12% thinks scintigraphy is non-ionizing

*Thomas KE et al. Pediatr Radiol. 2006*

### Internist

### Pediatrician

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# CLINICAL IMPLEMENTATION OF HYBRID IMAGING

## THE 5 A'S FOR EUROPE: ADVANCING KNOWLEDGE



Main funding	NIH and NCI	Italian CNR National Research Council – IFC, Institute of Clinical Physiology
Scientific Societies endorsement	Multispecialty Occupational Health Group	Italian Society of Invasive Cardiology (GISE)
Enrolled population	<ul style="list-style-type: none"> <li>• 44,000 fluoroscopists (interventional cardiologists, radiologists, neuroradiologists)</li> <li>• 49,000 non-interventional radiologists</li> <li>• 100,000 non-exposed physicians</li> </ul>	<ul style="list-style-type: none"> <li>• 500 exposed interventional cardiologists (nurses, technicians)</li> <li>• 500 non exposed clinical cardiologists (nurses, technicians)</li> </ul>
Endpoint	Epidemiological clinical endpoints (cancer, cataract, vascular events)	Surrogate biomarkers of genetic, vascular, reproductive, neurocognitive effect



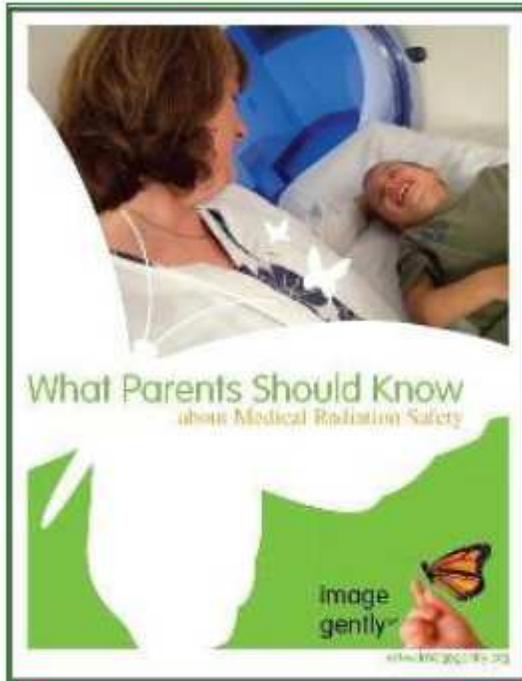
- ❖ Genetic factors in radiation risk
- ❖ Heritable genetic effects of radiation
- ❖ Future medical radiation studies: *"including studies of infants who experience diagnostic exposures related to cardiac cath..."*
- ❖ Future occupational radiation studies *"...Studies of occupational radiation exposures are well suited for direct effects of long-term, low-level radiation exposure in humans"*.

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(BEIR VII Executive Summary, 2005)



# The Image Gently Campaign



**IMAGE WISELY™**  
Radiation Safety in  
Adult Medical Imaging

<http://www.choosingwisely.org/doctor-patient-lists/american-college-of-cardiology/>

The paternalistic (“trust me, I’m the expert”) and efficientistic (“I have no time to loose”) era is over. Social marketing campaign directly on public is more effective than moral suasion on specialists and corporations