IAEA activities and overview of global activities

Madan M Rehani, PhD
International Atomic Energy Agency, Vienna, Austria

M.Rehani@iaea.org
Nationwide PACS- Estonia (1.3m)

- CT, interventional, NM, radiography and mammography (excl. dental) in PACS
- Government medical institutions: ✓
- Government hospitals (non-teaching): ✓
- Private medical institutes: ✓
- Private CT clinics: ✓
Your browser is not supported.

IMPAX ES

WEB1000 5.1
Clinical Review Station

User ID: 
Password: 
Options... Login

Eestikeelsed abimaterjalid: http://www.klinikum.ee/pacs
Kasutajatugi: abl@pacs.ee
Tehnilise toe telefon: 5331 8888
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### Dose Report

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**Total Exam DLP:** 405.11
Gender: 

Date of Birth: 

Status: 

Pregnancy Status: Unknown 

Medical Alerts: N/A 

Contrast Allergies: N/A 

Study Information 

Accession Number: EER2111110615004 

Referring Physician: Unknown 

Reason for Study: N/A 

Study Date: 10.08.2011 

Study Time: 8:39:00 

Requesting Physician: Unknown 

Study Description: SOMATOSTATINI RETSEPTORITE TSINTGRAAFIA 

Procedure code: 6184 

Procedure description: SOMATOSTATINI RETSEPTORITE TSINTGRAAFIA 

Resource Name: Unknown 

Modality: OT 

Report Information 

Report Status: Approved 

Diagnostic Code: N/A 

Impression: N/A 

Interpretation Date: N/A 

Interpretation Time: N/A 

Interpretation Transcriber: 

Kogu keha staattiline tsintograafia Ti - 99m - Taidruid, iv 520 MBq. 

K/T/SPECT uuring nnokare ja kõhu piirikonast.

Kliniliste NET on? 

Kogu kehast uuringul visualiseerub fisioloogilise märkse kogunemine maksas, põrnas, naerudus, kusedes, foonetvaid intensiivsemega kogunelisena ke kilnainnes. 

Àgapiist patoloogiliste märkse kogunemisest ei tähelda. 

SPECT/CT-uuringult visualiseerutab preparaadil fisioloogilise kogunemine, õhthuspressi 

Preparaati kogunemist ei ehis.
76 Participating countries in IAEA Survey for Smart Card/SmartRadTrack Project
### 76 countries that participated in the survey (more than one response)

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<tr>
<th>Country</th>
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</table>
How useful do you think a radiation exposure tracking program would be (assuming practicalities are attended to)?

- Extremely useful: 28.9%
- Very useful: 60.5%
- Moderately useful: 10.5%
- Not useful: 0.0%
- Mildly useful: 0.0%

Total=76 countries
Agency’s statutory objective and functions

• Objectives: promote the contribution of atomic energy to ... health:

Functions related to radiation safety:

To establish, standards of safety for the protection of health ... and to provide for the application of these standards ...
IAEA is the only organization under UN family with the mandate on Radiation Safety
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3.156. The justification of medical exposure for an individual patient shall be carried out through consultation between the radiological medical practitioner and the referring medical practitioner, as appropriate, with account taken, in particular for patients who are pregnant or breast-feeding or paediatric, of:

(a) The appropriateness of the request;
(b) The urgency of the procedure;
(c) The characteristics of the medical exposure;
(d) The characteristics of the individual patient;
(e) Relevant information from the patient’s previous radiological procedures.
PROTECTION OF PATIENTS AND OTHER INDIVIDUALS SUBMITTED TO MEDICAL EXPOSURE

Article 80
Justification

The referrer and the practitioner as specified by Member States, shall seek, where practicable, to obtain previous diagnostic information or medical records relevant to the planned exposure and consider these data to avoid unnecessary exposure.
**Clinical responsibility:** responsibility regarding individual medical exposures attributed to a practitioner, notably: justification; optimisation; clinical evaluation of the outcome; cooperation with other specialists and the staff, as appropriate, regarding practical aspects; obtaining information, if appropriate, of previous examinations; providing existing medical radiological information and/or records to other practitioners and/or referrer, as required; giving information on the risk of ionising radiation to patients and other individuals involved, as appropriate.
No explicit mention of tracking for radiation dose purpose
IAEA Smart Card/SmartRadTrack Project

Chair

Madan Rehani
Secretary
Critics

• 2003: Started talking about it, but NO from almost all

• Not feasible

• Why? What are you going to use it for?

• It may implicate staff for having given more radiation dose to patient.
Situation before 2008

FUTILITY

No matter how hard you try, you will fail.
Looking back

- It was good that I did not pursue it aggressively about 5 years ago
- Radiation units were not as matured
- PACS not talking to each other
- e-Health was in infancy
- Reports of few tens of or 100 mSv doses to an individual were not there
NOW

Who Does Not Want It?
Misconceptions

• Radiation doses on a card with patient
• Card like ATM card or Credit Card
• Acts as digital signature to access information online
The IAEA launches a project to develop methodologies to track radiation exposure of patients for Radiation SmartCare.

Although the scope of the Smart Card project that was initiated by the IAEA in 2006 was comprehensive, it tended to give a narrow impression and, thus, the new name Smart Card/SmartRadTrack has been adopted. It includes following possibilities:

a. An electronic card that contains a patient’s information, including radiation exposure history.

b. A card only as a digital signature to access the radiation exposure data that is actually available online. A patient-accessible website can serve as a ‘virtual’ card.

c. The information about radiation exposure history is made available in e-health records in a manner that can help track individual patients’ exposure over time. With interoperability, it should provide the possibility of access from anywhere.

d. In countries where neither an electronic card nor e-health record is feasible, a methodology to achieve information on tracking all radiological procedures, such as a radiation passport, somewhat like a vaccination card, could be initiated.

The project is aimed at:
Smart Protection

A ‘smart card’ that contains patients’ information including radiation dose data would help protect them from radiation effects.

Up until a decade ago, radiation protection programmes in the world were largely dominated by actions that concerned protection of the staff at the medical facility. Patient protection was felt to be not as important, as it was assumed that a patient undergoes examination with ionizing radiation once or only a few times in his or her lifetime.
Madan M. Rehani

Une protection intelligente

Une carte à puce pourrait servir de carnet électronique d’irradiation médicale pour les patients qui le souhaitent.

Jusqu’à il y a une décennie, les programmes de radioprotection en médecine avaient principalement pour objet la protection du personnel médical. La protection des patients était jugée moins importante car on partait de l’hypothèse qu’au cours de leur vie, ceux-ci ne subiraient qu’un
Smart Protection

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【出版日期】2009
【卷号】Vol.50
【期号】No.2
【关键词】Radiation Protection; Medical Facilities; Radiation Doses; Healthcare Profession

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August 2009

IAEA MOUNTS EFFORT TO RECORD PATIENT DOSE

In April of this year, the International Atomic Energy Agency announced a new project to record medical radiation exposures to patients over a lifetime. Besides calling attention to the increased exposure from the growing volume of x-ray examinations, the IAEA also notes a jump in patient exposure from CT scans as distinct from traditional x-ray examinations, said Madan Rehani, an IAEA radiation safety specialist.

The IAEA has invited the ISR and other international organizations to participate in the design of a “smart card” which people might carry to record their radiation exposures over a lifetime. How such a system might function has not been determined, he said.
IAEA calls for enhanced radiation protection of patients

The International Atomic Energy Agency (IAEA), in collaboration with other international organizations, is developing a series of measures aimed at strengthening patient radiation dose protection. The focus of recent efforts is a Smart Card project, to log how much radiation a person receives in the course of a lifetime.

Tracking Patient Radiation Dose: IT Implications

by Cat Vasko

In February, the FDA announced a new initiative to reduce unnecessary radiation exposure from CT, nuclear-medicine, and fluoroscopy exams. The agency’s three-pronged approach will include issuing safeguard requirements for device manufacturers, incorporating quality-assurance measures in mandatory CMS accreditation for imagers, and creating national dose registries to aid in the development of diagnostic-radiation reference levels.
International agency wants smart cards to track patient radiation histories

By Paula Gould | May 4, 2009

The International Atomic Energy Agency has launched an effort to create a running total of how much medical radiation patients are exposed to over time by issuing smart cards and modifying electronic medical records.

IAEA safety experts note that tracking dose for patients would provide a level of protection already available to medical practitioners. Standard protocols already exist to monitor levels of ionizing radiation that radiologists, technologists, and nursing staff are exposed to over prolonged periods.

The wearing of film badge or thermoluminescent dosimeters for several weeks or months is common practice. No such efforts, however, are made to record the cumulative x-ray dose received by patients.

For more information from the Diagnostic Imaging and SearchMedica archives:

Radiation dose fears color coronary CTA guidelines.

Soaring CT-based radiation exposure points at self-referral.

Study blasts agencies for radiation standards.

Organizers expand scope of Image Gently radiation reduction program.
PHILADELPHIA, PA (July 22, 2010) -- Patients going from one radiology facility or one doctor to another, or indeed moving from one country to another, can leave a confusing trail of documentation about radiation exposure in radiological examinations. M. Rehani, who works at the International Atomic Energy Agency (IAEA) in Vienna, Austria, will report today at the 52nd meeting of the American Association of Physicists in Medicine (AAPM) on efforts to develop an international system for tracking patient exposures. The idea was first broached in 2001 but became an active program only around 2008.

Called a Smart Card/SmartRadTrack, the system ultimately may be something like an ATM card. It does not contain money on it but allows one to use the card to access money and account details. For the patient, radiation exposure history is sufficient whereas for health authorities radiation dose information is needed. Aggregate data obtained through the eHealth system would enable countries to establish radiation and exposure standards and help in future epidemiological studies. This would require manufacturers to develop equipment and software for tracking procedures and doses.

The presentation "IAEA Smart Card Initiative for Patient Exposure" by M Rehani will be at 8:30 a.m. on Thursday, July 22, 2010 in Room 202 of the Pennsylvania Convention Center.

‘Smart Card’ project aims to better protect patients from radiation, say UN experts

29 April 2009 – A Smart Card project to log how much radiation a person receives in the course of a lifetime is among the latest efforts by the United Nations International Atomic Energy Agency (IAEA) and its partners to ensure better protection of patients from any unnecessary exposure.

Radiation safety experts from the IAEA have lauded advances in imaging technology that enable doctors to detect hidden diseases and make better diagnoses. At the same time, they caution that overuse of high-tech scanning procedures may unnecessarily expose patients to increased radiation levels.

Of particular concern are procedures such as computed tomography (CT) scans because they deliver higher doses of radiation to patients in comparison to conventional X-rays (radiographs), according to a news release issued by the agency.
IAEA Calls for Enhanced Radiation Protection of Patients
From: Suzanne H. Reuben [mailto:progressive_hlth@msn.com]
Sent: Thursday, 04 June 2009 20:28
To: HANSEN, Kirstie
Subject: IAEA YouTube Video -- Enhanced Radiation Protection of Patients Needed

Dear Ms. Hansen:

I am Chief Writer for the U.S. President's Cancer Panel, and am currently working on the Panel's 2008-2009 report to President Obama.

A longtime friend at IAEA, Laura Rockwood, forwarded to me the Agency's YouTube video on excess medical radiation exposure, a topic that will be part of the Panel's report on environmental factors in cancer.

Two statistics included in the video caught my attention and I am hoping you can provide or refer me to the literature references for them:

Thank you for any information you can provide.
Tracking radiation exposure of patients

As recently as only 6 years ago, it was not possible to come across a radiation-induced skin injury (erythema such as a burn, or hair loss) to a patient resulting from CT. However, in 2009–10, overexposure of about 400 patients undergoing brain-perfusion CT protocols, resulting in hair loss or skin redness in some patients, was brought to the attention of the US Food and Drug Administration and in media reports. 20 years ago, it was not possible to come across a patient who had undergone scores of CT scans in a few years, especially the patient without cancer. Did we see this coming? The answer is largely “no” for visible radiation effects and “probably yes” for usage. In view of these recent events, what might be the scenario in a few years? There are no indications that the increase in CT use will decrease. On the contrary, CT might replace some traditional fluoroscopy-based angiographic procedures. The medical profession has a responsibility to account for radiation exposure from medical imaging. What are the risks and are the risks real? Essentially there are two types of radiation effects. Ones that are visible, documented, and confirmed (deterministic effects: the radiology facility has a major role to optimise the technique to do the examination with the minimum possible radiation dose without hampering the diagnostic purpose. The approach towards justification so far has been to promote use of appropriateness criteria developed by professional societies. Obviously the current situation with arguably unjustified CT scans ranging from 3% to 77% for certain indications and patients subjected to multiple radiological examinations shows that this approach is insufficient. A compelling answer is to track lifetime radiation exposure (radiation history, which should work efficiently to improve justification).

There are currently no successful examples of pro-younger individual, one should aim at recording either doses or factors that can give a reasonable dose estimate within, say, ± 50%. At younger ages (20–40 years), if the number of examinations is low (say below five CT scans), tracking the number of examinations might suffice. But above five CT scans during this period, tracking of doses might be warranted.

Madan Rehani, Donald Frush
International Atomic Energy Agency, Vienna 1400, Austria (MR); and Duke Radiology, Durham, NC, USA (DF)
rehani@iaea.org

MR works on the SmartCard project. DF received travel assistance for project meetings.
How?
Foremost necessity

Patient Identifier
Informe Ecografía

Nombre: [nombre]  Nro. Usuario: 0123467892
Matricula: 261391  C.I.: 1170447-9
Edad: 54
Fecha Ejecución: 19/12/2007  Hora Ejecución: 08:25
Médico solicitante: [nombre]
Tipo de ecografía: APARATO URINARIO

Riñón derecho:
De 110 mm, liso, con un seudocáncer intraluminal de 10 mm.

INFORME DE ECOGRAFÍA

DOMICILIO: SORIANO 1064  BIS/101
NUMERO DE HISTORIA: 1170447
Countries who responded to IAEA survey

Algeria, Argentina, Armenia, Bosnia and Herzegovina, Bulgaria, Colombia, Costa Rica, Czech Republic, Egypt, Estonia, Finland, Greece, Honduras, Hong Kong (China), Ireland, Kenya, Lithuania, Malaysia, Macedonia, Malta, Mexico, Moldova, Montenegro, Portugal, Nicaragua, Romania, Russian Federation, Serbia, Singapore, Slovakia, Slovenia, Spain, Sri Lanka, Sudan, Tajikistan, Tanzania, Uruguay
Is there a unique permanent identification number for every person in the country valid for life?

YES 81%

NO 19%

Total=36
Is this permanent number used for X ray examinations whenever a person visits a hospital?

Total = 36

YES 44%

NO 56%
If this number is NOT used, it is because of:

- Lack of technology: 92%
- Confidentiality issue of patient: 8%

Percentages out of 20 answers!!
Most basic: paper card

Like Vaccination card

Merits:

• Helps tracking of individual exposure history
• Can serve a great deal of purpose
• Is very good so long as it is maintained and used

Demerits:

• Record is only with patient, not with health care system
• Is highly dependent upon patient and health care provider
### IAEA X-ray record card

**Radiation Imaging Record**

- **Your name:**
- **Unique personal ID number:**
- **Date of Birth:** day, month, year
- **Address:**

**Important information**

- This individual card is designed to keep record of all radiation imaging procedures utilizing either X-rays or radioactive substances.

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<tr>
<th>Date</th>
<th>Hospital/room where procedure was carried out</th>
<th>Type of procedure (mark the appropriate)</th>
<th>Body part examined</th>
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</tbody>
</table>

Actions on Patient ID

Actions on data collection on repeated examination
Where are we now?
Unique Card Number

- World Population 6.7 billion
- Credit Cards have already 16 digits. That can cover all people in world
- BUT health system unfortunately has not been as sexy to global service providers as financial
Issues nearly Resolved

• Use of reference dose quantities (e.g. DLP & CTDI in CT; KAP & CAK in fluoroscopy …)
• CT & fluoroscopy have dose displays & records
• DICOM - communication of images
• IHE - REM communication of dose
Nuclear Medicine

Paper under Communication

The Need for an Integrated Approach to Tracking Radiation Exposure: Challenges with Nuclear Medicine

M Mercuri, M Rehani, A Einstein
Unresolved issues & practicability

- Use of patient identifiers
- Off line studies
- Nuclear Medicine
MoU US & Europe for health care data exchange
PATIENT EXPOSURE TRACKING: THE IAEA SMART CARD PROJECT

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Recommendations from Meeting of the IAEA

Smart Card/SmartRadTrack Project
25-27 January, 2010


- Action for manufacturers
- Government
- Appropriate groups, professional societies and organizations, and regulatory bodies
Joint Position Statement

- Meeting on 30th Jan- 1st Feb. 2012
- WHO, EC, IHE, ISR, ISRRT, IOMP, Referring physician
What do referring physicians think?
## Referring physicians

<table>
<thead>
<tr>
<th>Country</th>
<th>Resp.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Czech Republic</td>
<td>175</td>
<td>28.14%</td>
</tr>
<tr>
<td>Finland</td>
<td>90</td>
<td>14.47%</td>
</tr>
<tr>
<td>India</td>
<td>51</td>
<td>8.20%</td>
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<tr>
<td>Pakistan</td>
<td>43</td>
<td>6.91%</td>
</tr>
<tr>
<td>Croatia</td>
<td>37</td>
<td>5.95%</td>
</tr>
<tr>
<td>FYR Macedonia</td>
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<td>5.47%</td>
</tr>
<tr>
<td>Brazil</td>
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<td>4.18%</td>
</tr>
<tr>
<td>Indonesia</td>
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<td>3.86%</td>
</tr>
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<td>Philippines</td>
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<td>3.38%</td>
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<tr>
<td></td>
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<tr>
<td>Iran</td>
<td>16</td>
<td>2.57%</td>
</tr>
<tr>
<td>Kazakhstan</td>
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<td>2.41%</td>
</tr>
<tr>
<td>Hungary</td>
<td>14</td>
<td>2.25%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>14</td>
<td>2.25%</td>
</tr>
<tr>
<td>Lebanon</td>
<td>12</td>
<td>1.93%</td>
</tr>
<tr>
<td>USA</td>
<td>12</td>
<td>1.93%</td>
</tr>
<tr>
<td>Sri Lanka</td>
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<td>P.R. China</td>
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<td>0.80%</td>
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<tr>
<td>Republic of Moldova</td>
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<td>0.64%</td>
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<tr>
<td>Slovenia</td>
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<tr>
<td>Cyprus</td>
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<td>Armenia</td>
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<tr>
<td>Georgia</td>
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<tr>
<td>Lithuania</td>
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<tr>
<td>Australia</td>
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<tr>
<td>Ireland</td>
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<tr>
<td>Spain</td>
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<td>0.16%</td>
</tr>
<tr>
<td>UK</td>
<td>1</td>
<td>0.16%</td>
</tr>
</tbody>
</table>

622 physicians from 28 countries
How often in your clinical practice do you think knowing history of previous CT scans will help in making a better decision?

- Always: 23.0%
- Mostly: 49.0%
- Occasionally: 21.1%
- Rarely: 6.9%
Do you think having a system by which you have quick information about patients dose history will be helpful?

- Yes: 60.6%
- Maybe: 31.4%
- Not really: 7.9%
- No answer: 0.2%
Most difficult aspect is to drive Industry

First major driver
ICRP Publication 87 (2001)

• Editorial in Br Med J in March 2000

BMJ 2000;320:593-594 (4 March)

Editorials

Radiation doses in computed tomography

The increasing doses of radiation need to be controlled
CT radiation dose questions draw international attention

Radiation dosage from CT scans could become a matter of debate if international calls for reduced radiation levels move forward.

Writing last month in the British Medical Journal, Dr. Madan Rehani, chairperson of an international task force on safer dosage standards for CT scans, made the case for a closer look at CT radiation levels.

"The increasing doses of radiation need to be controlled worldwide," he said.

The task force was established by the International Commission on Radiological Protection (ICRP). The organization meets in Zurich this month to discuss safer dosage recommendations.

While the ICRP believes that there is cause for concern about high radiation dosage in CT scans, some physicians claim that there is no basis for alarm.

"The FDA approves a technology only after due research. Radiation is used discerningly in our country. America is one of the most conscious medical communities when it comes to radiation safety, and radiation is used wisely by physicians only after weighing cost and benefit, keeping in mind safety of the patients," said Dr. Jonathan Goldin, an assistant professor of radiology at the University of California, Los Angeles, who studies radiation safety, a member of ICRP's Radiation Research Section.
CT scans in children linked to cancer later

By Steve Sternberg
USA TODAY

Each year, about 1.6 million children in the USA get CT scans to the head and abdomen — and about 1,500 of those will die later in life of radiation-induced cancer, according to research out today.

What's more, CT or computed tomo-
graphy scans given to kids are typi-
cally calibrated for adults, so children absorb two to six times the radiation needed to produce clear images, a sec-
ond study shows. These doses are “way bigger than the sorts of doses that peo-
ple at Three Mile Island were getting.”

David Brenner of Columbia University says, “Most people got a tenth or a hun-
dredth of the dose of a CT.”

Both studies appear in February’s 
American Journal of Roentgenology, the 
nation’s leading radiology journal. The 
first, by Brenner and colleagues, is the 
1st to estimate the risks of “radiation-
induced fatal cancer” from pediatric CT 
scans. Until a decade ago, CT scans took 
too long to perform on children without 
giving them anesthesia to keep them 
still. Today’s scanners spiral around the 
patient in seconds, providing cross sec-
tions, or “slices,” of anatomy.

Doctors use CT scans on children to 
search for cancers and ailments such as 
appendicitis and kidney stones.

“THERE’S A huge number of people 
who don’t just receive one scan,” says 
Fred Mettler of the University of New 
Mexico, noting that CT scans are used 
for diagnosis and to plan and evaluate 
treatment. “The breast dose from a CT 
scan of the chest is somewhere be-

tween 10 and 20 mrem. It’s really only 
six times higher than necessary. Cutting 
the adult dose in half would yield a clear 
image and cut the risk a little amount, 
Brenner says. “Radiologists genuinely 
believe the risks are small,” he says. “I 
suspect they’ve never been confronted 
with numbers like this.”

Brenner, Lee Rogers, Paterson, Donolly, Nickoloff, Haaga
Second major driver

- IAEA Smart Card/SmartRadTrack project
- Difficult to imagine what we have today in PACS would have come of its own
  - Our call for action
Third major driver

THE RADIATION BOOM

After Stroke Scans, Patients Face Serious Health Risks

By WALT BOGDANICH
Published: July 31, 2010

When Alain Reyes’s hair suddenly fell out in a freakish band circling his head, he was not the only one worried about his health. His coworkers at a shipping company avoided him, and his boss sent him home, fearing he had a contagious disease.

Only later would Mr. Reyes learn what had caused him so much physical and emotional grief: he had received a radiation overdose during a test for a stroke at a hospital in Glendale, Calif.

Other patients getting the procedure, called a CT brain perfusion scan, were being overdosed, too — 37 of them just up the freeway at Providence Saint Joseph Medical Center in Burbank, 269 more at the renowned Cedars-Sinai Medical Center in Los Angeles and dozens more at a hospital in Huntsville, Ala.

The overdoses, which began to emerge late last summer, set off an investigation by the Food and Drug Administration into why patients tested with this complex yet lightly regulated technology were bombarded with

Hair loss in patients who received radiation overdoses.
We are in a situation where turning back is Not possible
IAEA

The Nobel Peace Prize 2005
“for their efforts to prevent nuclear energy from being used for military purposes and to ensure that nuclear energy for peaceful purposes is used in the safest possible way”

IAEA
Atoms for Peace: The First Half Century
1957–2007

Rehan, Beebe Symp Tracking National Academies USA
Thank You

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